

Feral Chicken Management Plan for Bermuda



BERMUDA GOVERNMENT
Department of Environment & Natural Resources

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



Director
Department of Environment & Natural Resources

24th Feb 2025

Date

Executive Summary

The feral chicken (*Gallus domesticus*) is a major source of noise nuisance, destruction of habitat, damage to crops and gardens, competition to native and endemic species and potential disease vectors impacting human health.

Chickens have a very high reproductive rate and with no natural predators their population will continue to grow exponentially.

A latent issue throughout the 20th century, it is hypothesized that a major milestone was reached when many residential chicken coops were destroyed in Hurricane Emily (1987). Since then the feral chicken population has grown significantly and can be found in all major open spaces, golf courses, agricultural fields, residential areas, hotel and commercial properties.

Until such time as the private sector finds a suitable use that meets the need of eradicating feral chickens, the priority for management must be euthanasia.

While the private sector can provide assistance to specific incidents of pest control, the strategic management of feral chickens is currently the responsibility of the government.

The aim of the management plan is to provide a framework for government led action to minimize the economic, environmental and human harm caused by feral chickens through coordination, prevention, rapid response, research, and education.

The plan will seek to control chicken infestations within priority areas, to limit

their spread and reduce impacts in all other areas until such a time as island-wide eradication is possible.

Key components of the plan include:

- The creation of a government led working group coordinated by the Department of Environment & Natural Resources (DENR).
- Improved legislation to stop the release and feeding of invasive species into the wild.
- Implementation of an integrated pest management strategy customized to suit the conditions of each individual site and designed to be efficient and humane.
- The use of effective means of control that includes the use of traps, nets, licensed shooting, baiting using the pest control product alpha-chloralose, snatching, and any other methods approved by the Minister responsible for Bermuda's environment.
- Development of a public relation and awareness campaign.

The plan will be implemented using existing government personnel, as well as registered volunteers and contractors.

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1.0. Introduction and purpose of the plan

1.1. Purpose of the plan

The purpose of the Feral Chicken Management plan is to provide a framework for government led action to minimize the economic, environmental and human harm caused by the feral chicken (*Gallus domesticus*) through activities that include coordination of resources, prevention of infestations, rapid response to public control requests, control strategies, research and education.

The plan is an evolving document which will be revised periodically. Ongoing accomplishments and new information will guide the refinement and revisions of goals and strategies in future versions of the plan.

1.2. The need for control

For centuries humans have introduced plants and animals around the world, both intentionally and unintentionally.

Only a small percentage of introduced species cause serious problems in their new environments, and these are collectively known as "invasive species".

An "invasive species" can be defined as a species that is 1) *non-native (or alien) to the ecosystem under consideration* and 2) *whose introduction causes or is likely to cause economic or environmental harm or harm to human health*¹.



Figure 1: A flock of feral chickens in Bermuda

Invasive species typically have high reproductive rates, disperse easily, and can tolerate a wide range of environmental conditions. Often, they lack predators in their new environments. As a result, invasive species may out-compete native species for prey or other resource needs (e.g. breeding sites). They may also prey upon native species, spread pathogens and parasites, or alter the genetic makeup of closely related species.

Feral animals are domesticated animals that have, for one reason or another, found their way into an un-managed state and become self-sustaining in the wild. Feral goats are considered invasive in various regions throughout the world, and feral chickens are considered to be invasive in Bermuda.

While uncommon, Bermuda is not alone in that feral chickens have become major nuisances in places such as Hawaii, New Orleans (after Hurricane Katrina), Key West, Los Angeles, downtown Miami and Pitcairn Island².

¹ International Union for Conservation of Nature

² Google internet search 2012

1.3. Why do we care?

The problems caused by feral chickens in Bermuda were highlighted during a stake holder driven Invasive Species workshop held by the Department of Conservation Services in 2003. These included:

1. Crop losses- representing loss of locally grown food and income to the agriculture sector.
2. Destruction of private and community gardens.
3. Crowing roosters causing significant noise nuisance at night.
4. Potential human health risk as a reservoir for avian and zoonotic diseases (most notably Avian Influenza, Salmonella and Toxoplasmosis).
5. Rooster attacks on members of the public.
6. Protection of native and endemic species from predation and competition.
7. Reservoir of fowl mite which can



Figure 2: Example of crop damage caused by feral chickens

have a damaging effect on protected bird species (e.g. Eastern Bluebird and Bermuda's endemic vireo).

8. Scavenging on domestic refuse, contributing to the island's trash problem.
9. Risk to road users.

1.4. Management goal

The aim of the plan is to control chicken infestations within priority areas by using various population suppression methods to limit their spread and reduce impacts in all other areas, until such time as eradication is possible.

1.5. Management objectives

The plan seeks to achieve this through:

1. **Coordination** - strengthen the coordination between government and non-government agencies.
2. **Early detection** - strengthen and support early detection mechanisms capable of identifying and reporting the appearance of feral chickens before they become established and control becomes less feasible.
3. **Rapid response** - develop a rapid response capability to implement containment procedures.
4. **Control & management** - provide control of an established population through abatement and other management strategies to minimize environmental, economic and human health issues.
5. **Research and risk assessment** - support or conduct research and risk assessment necessary to assess, prioritize and control feral chickens.

6. **Education and outreach** - provide information about feral chickens, their negative impacts as well as methods of prevention and control to the general public and special interest groups.

2.0 Background

2.1. Historical context

Chickens along with cattle, goats, sheep and rabbits were introduced early in Bermuda's settlement for food and were kept by large segments of the population (c.1620)³. Historically a common sight on every homestead was a flock of half-wild chickens scratching around the house and fields hunting insects, seeds and berries, plus whatever feed grain they could scavenge. Many artists' depictions of Bermuda in the 19th century show chickens running through the scenes.

However the advent of refrigeration, modern shipping and increased U.S. competition led to the decline in local agriculture during the 20th century, which in turn led to a significant reduction in the reliance of chicken as a locally produced staple.

In today's society, purchasing processed chicken at the grocery store is now the norm. As such the half-wild chickens that were accepted in the past, as part of everyday life, are now subsisting and reproducing without a use to modern residents causing much damage and nuisance.

It is believed that the recent infestation came to prominence after Hurricane

Emily (1987) and subsequent hurricanes, which destroyed many residential and commercial coops, thereby releasing chickens into the wild. Compounding this are the birds that have also been deliberately released from captivity by their owners who no longer wish to keep them. Bermuda's feral chickens are supported (through feeding) by sympathetic members of the public who view these birds as 'natural' wildlife.

While no formal estimates of abundance have been made, there is anecdotal evidence suggesting there has been a significant increase in population since the 1990s.

Today the problem is island wide with large congregations of chickens in areas where supporting conditions are particularly good. These fowl now occupy open spaces, wooded areas, golf courses, farmlands, parks, nature reserves, restaurants, residential areas, hotel and commercial properties.

2.2. Chicken biology

The domesticated chicken is a descendent of the Red Jungle Fowl (*Gallus gallus*). Domesticated by man as early as the 7th century, the chicken has become one of our most important food staples. Today more than 50 billion chickens are reared annually as a source of food for both their meat and their eggs⁴. Most are raised using intensive farming techniques. Chickens are also raised using various free range techniques which allow chickens to roam freely on a farm. Other similar

³ R.E. Verrill, 1902

⁴ Foer, Jonathan Safran (2009). "Eating Animals" Little, Brown and Company, USA.

practices include *Yarding*, or the use of floorless portable chicken pens. More commonly in the case of Bermuda, flocks involving relatively small numbers of chickens are kept in suburban or urban residential areas for eggs and meat and/or as pets.

Male chickens over the age of 12 months are known as roosters, whereas males under 12 months are referred to as cockerels. Castrated roosters are called capons. Correspondingly, female chickens under 12 months of age are known as pullets and those over this age are called hens. A pullet becomes a hen when she begins to lay eggs between 15-20 weeks. Roosters are not needed for hens to lay eggs but are needed for egg fertilization to produce chicks.

Chickens tend to live 5-10 years, depending on the breed. Chickens are gregarious birds and live together in flocks; they have a communal approach to the incubation of eggs and raising of young.

Chickens are susceptible to parasites including lice, mites, fleas and intestinal worms. Chickens can also be affected by viral Highly Pathogenic Avian

Influenza (HPAI), but more commonly by Toxoplasmosis and Salmonella bacterium⁵.



Figure 3: A clutch of feral chicken eggs

Feral chickens are ground dwelling birds that can take flight in short bursts when needed. Chickens establish a pecking order with dominant males asserting rights over food and roosting locations. Hens prefer to lay their eggs in the same locations and will return to areas that have proven successful in the past. Roosters crow to establish territory or to raise an alarm. During the heat of the day chickens tend to keep undercover in a shaded area. At night they will bed

Time (weeks)	Generations	Breeding females (20 week generation time)	Offspring (clutch assumed at 8 eggs)	Less 25% mortality	Females in clutch (assumes 4:1)
0	1	1	8	6	5
20	2	6	46	35	28
40	3	34	269	202	161
60	4	195	1561	1171	937
80	5	1132	9053	6790	5432

Table 1: Summary of chicken fecundity

⁵ Shervon DeLeon, Atlantis Mobile Laboratories – *Environmental sources of Salmonella G in Bermuda*, 2013

down as a group under or in a roosting tree where they will stay until dawn. On windy days chickens will typically stay hidden in sheltered areas. It is a mistaken belief that roosters only crow at dawn; they can be commonly heard vocalizing throughout the night. Chickens are most active during the early morning and late afternoon when they come out to feed.

High reproduction rate. Observations suggest that feral chickens have both a very high reproductive and chick survival rate, which may explain why areas under management seem to repopulate very quickly. For example, within one year a single hen can have 3-4 clutches of eggs, each comprising 8-15 eggs.

One hen can lay 60 eggs in a year (4 clutches x 15 eggs); the surviving chicks grow and lay their own eggs – thus in 1 year up to 195 birds can be created by 1 hen (see Table 1).



Figure 4: A feral hen with very young chicks

Food sources

Chickens are omnivorous in the wild, consuming a wide variety of leafy

greens and scratching the soil for worms, seeds, insects, and animals as large as lizards.

If one food source disappears, the chickens quickly adapt and move to other sources. Conversely, if there is a constant source of food the chickens will claim an area and stay. This is especially relevant when feral chickens are subsidized by humans who frequently feed them.

Predators

There are few predators in Bermuda that consistently prey on feral chickens as a food source.

Cats (domestic and feral) may opportunistically prey on young birds but rarely on a full grown adult. In fact, feral chickens and feral cats co-exist around regular food sources (e.g. at cat feeding stations).

The only year-round resident birds large enough to prey on feral chickens are herons (from a variety of species) and crows. However, these species only opportunistically prey on chicks. Few migratory birds of prey (e.g. northern harriers or bald eagles) remain long enough in Bermuda to make any impact on feral chicken populations.

Dogs, especially terrier breeds, are known predators of feral chickens. However this source of predation is random and opportunistic.

Rats are also opportunistic predators restricted to taking chicks, and perhaps eggs, with limited ability to kill a healthy adult chicken.

2.3. Legal status of feral chickens

There are several pieces of legislation that pertain to the control and care of animals, as well as management of birds, specifically chickens.

Farmyard and domesticated birds (fowl) can be defined to *include birds brought under close control by humans for purposes of communication (e.g. pigeons) clothing and furnishing (e.g. ducks), companionship (e.g. canary and pigeons) and food, (e.g. commercial poultry such as chicken, turkey, duck, goose) which are used for meat and eggs*⁶.



Figure 5: A feral rooster

The Minister responsible for the Environment has the power to approve the destruction of any bird or bird species if found to be causing a problem to agriculture, fisheries, public health or public safety. Furthermore, it is illegal to allow poultry to wander off one's property and/or into the National Park System.

The Protection of Bird Act 1975 has responsibility for the protection of Bermuda's birds. Under the Act six species are named as pest species including, the house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), Great kiskadee (*Pitangus sulphuratus*), the American crow (*Corvus brachyrhynchos*), feral pigeons (*Columba livia domestica*), and feral chickens.

Section (4) if the Minister is satisfied that for the protection of agriculture, fisheries, public health or public security it is expedient to control or destroy any bird or species of bird which is a protected bird, he may authorize the conservation officer or any other officer of the department (i.e. DENR) to take such measures for such control or destruction as the minister may approve.

The Care and Protection of Animals Act 1975 has responsibility to manage offenses of animal cruelty (8) (1) (b) *being the owner of the person having the custody or control of any animal in confinement or captivity or in the course of transport from one place to another, abandons it in distress or willfully neglects or fails to provide suitable and adequate food, water, shelter and care for it.*

(e) Willfully, without reasonable excuse, administers or causes to be administered to any animal any poisonous or injurious drug or substance; Punishment on summary conviction is imprisonment for 6 months or a fine of \$500 or both such imprisonment and fine.

⁶ Online Medical Dictionary

Summary Offenses Act 1926

Offenses against property (19) (i) *being the proprietor of cattle or poultry, permits such cattle or poultry to stray out of any land in his possession or occupation. The punishment of offenders (25) on summary conviction imprisonment for 6 months or a fine of \$2,880 pr both such imprisonment and fine.*

National Parks Act 1986

(25) Power to make regulations
(1) *Subject to this Act, the Minister may make regulations for administering this Act and for giving effect to its objects and intentions, and without prejudice to the generality of the foregoing, may make regulations for—*

d) controlling the taking and use of animals in protected areas for any purpose.

(28) *Punishment of offences: Where a person commits an offence against this Act or any regulations made thereunder:*

(1) *Punishment on summary conviction: in respect of each offence imprisonment for 3 months or a fine of \$1,000 or both such imprisonment and fine and, in the case of a second or subsequent conviction imprisonment for 6 months or a fine of \$2,000 or both such imprisonment and fine; and in the case of a continuing offence a further fine of \$200 for every day during which the offence continues.*

(2) *A person found guilty of an offence against this Act or any regulations made thereunder may, if there has been damage done to a protected area and the court thinks fit, be ordered to pay, in*

addition to any penalty for which he is liable for the offence, a sum not exceeding the cost of the damage done to the protected area, as assessed by the court.

National Parks Regulations 1988

Animals and fowls

(7) *No person shall, being the owner of, or in control of, any animal (including a fowl) -*

(a) cause or permit such animal to graze in a protected area;

(b) cause or permit such animal to stray on to a protected area.

(c) cause or permit such animal to disturb or take another animal (including birds, reptiles, fish or invertebrate animal) in a protected area.

The Agriculture Act 1930

(4) General functions of Minister
The general functions of the Minister shall be the functions hereinafter in this section specified -

(a) the Minister shall exercise a general supervision and control over matters concerning or connected with the practice of agriculture and horticulture in Bermuda; and shall promote the improvement of plants, the improvement of livestock, the prevention and control of animal and plant diseases, and exercise control over poultry and livestock care and management.

Agriculture Act (Control of Animal Diseases) Regulations 1947

(68) Day-old chicks; certificate
All day-old chicks landed in Bermuda must be certified by a competent authority to be not infected with pullorum disease.

(69) Poultry; certificate of vaccination
All half-grown or adult poultry landed in Bermuda must have been vaccinated against both fowl pox and laryngotracheitis before leaving the country of origin and must be accompanied by a certificate to this effect issued by a competent authority.

(70) Poultry; certificate of flock origin
All poultry landed in Bermuda must be accompanied by a certificate to the effect that the birds came from flocks which are not infected with the following diseases, that is to say, coccidiosis, fowl typhoid (Kleins disease) fowl pox, laryngotracheitis, fowl cholera, avian tuberculosis, aspergillosis (pneumonycosis or brooder pneumonia) and avian lice, mites and tapeworms.

(71) Minister may prohibit importation of poultry if an outbreak of any of the diseases mentioned in regulation (70) occurs in an area outside Bermuda the Minister may prohibit the importation of any poultry from that area until the infection has subsided.

Public Health (Milk and Dairy Farm) Regulations 1952

Management of Dairy Farm

(10) With respect to the operation and management of a dairy farm (whether or not the dairy farm is licensed under these regulations) the following provisions shall have effect, that is to say—

(d) no horses, pigs, dogs, cats, poultry or other animals shall be allowed to enter or remain in any part of a cowshed used for milking.

2.4. Policy review of feral chickens

The Government has a mandate to manage invasive species.

A. Invasive Alien Species Act (2021)
To safeguard against invasive alien species in the interest of the environment, human and animal health, and the economy.

B. Biodiversity Strategy and Action Plan 2003

B.4.1 *Identify all relevant Government departments and conduct an audit of their activities to identify areas where these interface with biodiversity (including invasive species, land use, pollution and climate change) and explore opportunities to modify practices.*

B.4.3. *Draft guidelines to ensure incorporation of due consideration of biodiversity conservation into departmental planning (including the issues of invasive species, land use, pollution and climate change).*

C. Environment Charter for the UK Overseas Territories

Annex A (7) *To safeguard and restore native species, habitats and landscape features and control or eradicate invasive species.*

Additionally, both the National Parks Commission and the Board of Agriculture (2012) have formally requested the removal of feral chickens from their respective areas of responsibility; specifically the National Park System and all cultivated arable land and dairy farms.

It should be noted that it is not illegal for members of the public to take chickens from parks and nature reserves. However as there is no quality control or health assessments of these animals the government cannot encourage such activity.

2.5. Responsible government organizations

In addition to the general public and farmers, the government of Bermuda has numerous departments that may be involved with the control of feral chickens due to the ecological damage they cause, for health and safety reasons, or as land managers concerned with chicken infestations for a variety of reasons.

Ministry of Environment and Planning

Department of Environment & Natural Resources (DENR). Responsible for the maintenance of 300 acres of Nature Reserves. It also has the mandate to manage protected species, biodiversity, threatened habitats and manage invasive species.

It is also responsible for agriculture, animal control, and plant protection and is responsible for enforcing *The Care and Protection of Animals Act 1975*

Department of Parks. Responsible for the maintenance of 800 acres of amenity parks, beaches, government buildings, road-side verges and the Railway Trail. This department is additionally responsible for government properties including schools, post offices and roadside verges, all of which can

experience major feral chicken infestations.

Ministry of Health and Seniors

Department of Environmental Health. Manages issues related to humans and the environment, such as mosquitoes and rats. Of special concern is the overall health of the public, health care institutions and ports of entry.

This concern is reflected in a United Nations press release which stated: *"Governments, local authorities and international agencies need to take a greatly increased role in combating the role of factory-farming, commerce in live poultry, and wildlife markets which provide ideal conditions for the (avian Flu) virus to spread and mutate into a more dangerous form..."*⁷

Health Care facilities including the King Edward Memorial VII Hospital, Mid-Atlantic Wellness Center, Summerhaven Rest Home, Sylvia Richardson Rest Home and Lefroy House report continual feral chicken infestations.

Ministry of Public Works

Waste Management.

Responsible for facilities such as the Tynes Bay Waste Treatment Facility and the Marsh Folly composting center. These areas continually have recurring chicken infestations.

⁷ "UN task forces battle misconceptions of avian flu, mount Indonesian campaign". UN News Center. 24 July 2009.



Figure 6: Feral chickens scavenging in garbage

Highways. Responsible for managing Bermuda’s network of roads.

Bermuda Land Development Corporation. Responsible for the 700+ acres of the former U.S. Base Lands including, Tudor Hill, the East End and Naval Annex. There are significant infestations throughout all residential areas and wooded lots.

West End Development Company. Responsible for the management and improvement of lands west of Watford Bridge including the former British Royal Naval Dockyard and Boaz Island Housing Complex. Of particular concern is the Dockyard as a port of entry, the former Sally Port dump and the Lagoon Park area.

Ministry of Tourism Development and Transport

On behalf of the Department of Airport Operations (DAO), Skyport employs several wildlife control officers to manage the grounds and runways of the L.F. Wade International Airport to minimize potential for bird strikes to aircraft.

Government Golf Courses. Responsible for Port Royal and Oceanview golf courses. These areas continually have recurring feral chicken infestations.

Ministry of Community, Culture and Sports

Bermuda Housing Corporation. Responsible for the management of a number of housing complexes. These areas also continue to have problematic chicken infestations.

Bermuda Housing Trust. Responsible for management of senior housing complexes. These areas continually have problematic infestations.

Department of Youth, Sports and Recreation. Responsible for 10 Recreational parks including Bernard’s Park, Port’s Island and portions of Shelly Bay Park. These areas continually have problematic infestations.

Ministry of Home Affairs

Municipalities. Responsible for the City of Hamilton and Town of St George. These areas continually have nuisance infestations in certain residential streets.

2.6. Affiliated non-government organizations

There are several non-government organizations and charities that have chicken infestations on their properties and/or are associated with feral chicken management and animal welfare.

Bermuda National Trust (BNT). One of the largest landowners and managers of privately owned protected spaces, nature reserves and agriculture fields with tenant farmers.

The BNT's properties are being impacted in the same ways as the Government Nature Reserves and Parks.

Bermuda Audubon Society (BAS). The charity whose mandate is to preserve Bermuda's bird species and threatened habitats. The BAS are also the owners of a series of privately owned nature reserves. The BAS's properties are being impacted in the same ways as the government nature reserves and parks.

CATS Ltd. (formerly the Bermuda Feline Assistance Bureau). A charity whose mandate is to provide support and manage the island's feral cat population. There is a strong correlation showing that feral chickens coexist in large numbers around feral cat feeding stations.

Bermuda Farmers Association. The association that advocates for the island's commercial farmers. Farmers are one of the groups worst impacted by feral chickens.

Poultry Fanciers. The charity interested in promoting and supporting different breeds of poultry as a part of their area of interest.

Society for the Protection and Care of Animals (SPCA). The charity whose mandate is to provide care and safeguard the welfare of Bermuda's animals.

2.7. Private sector affiliations

Meat & egg production.

There are two existing commercial businesses currently operating in Bermuda; Windy Bank Farm and Wadson Farm. Both raise chickens for the production of eggs and both businesses have requested assistance for feral chicken management.

Private sector pest control.

Several private companies have provided some service including:

- **Bermuda Pest Control Services.** Contracted by the Department of Environmental Protection to experiment with Avitrol in the early 2000s. This service was discontinued after being considered ineffective.
- **Chickens Plus.** This service used traps and the hand capture of chickens while they roosted at night.

2.8. The Public

Breeders, homesteaders and pet owners. Members of the public are encouraged to raise chickens, so long as they are well cared for as per the *Care and Protection of Animals Act 1975*. These managed flocks are, however, not allowed to wander off the owner's property as per *the Summary Offences Act 1926*.

Historically, chickens were kept by a large majority of households for food. Though this trend has significantly reduced over time there are still many households that keep chickens as pets, for egg production and/or meat.

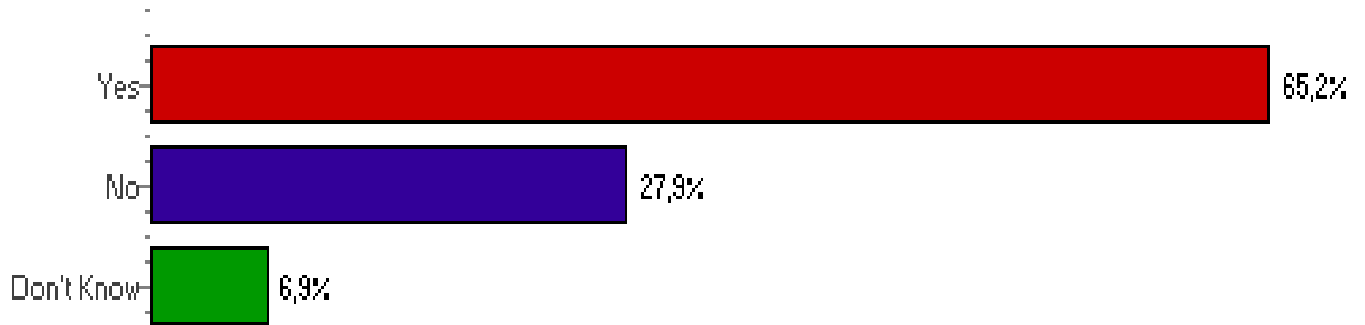


Figure 7. Bermuda Royal Gazette August 2012 Poll Results: Should the Island’s feral chicken population be eradicated?

Feral chickens as a public nuisance.

Many members of the public find feral chickens to be a nuisance either due to noise, physical damage to gardens and/or because of aggressive encounters with roosters.

Two performance surveys of the Department of Conservation Services were conducted in January 2012 and then June 2013. The first survey noted strong public opinion that not enough was being done to control feral chickens. The second survey indicated that feral chickens were still an issue to the public and that their control was the only area of department responsibility that drew significant numbers of complaints (24 of 400 interviews)⁸.

An informal poll run by the Bermuda Royal Gazette in August 2012 illustrated that a large section of the public felt strongly that feral chickens should be eradicated (Figure 7).



Figure 8: Shattered front windscreen of a car after striking a feral chicken on the road



Figure 9: Feral chickens foraging in an agricultural field

⁸ Measures to Improve Survey, Department of E-Government, (June 2013)

3.0. Assessment of existing conditions and management

3.1 Distribution & concentration

Feral Chickens have been observed throughout Bermuda, however they congregate in specific areas where supporting conditions are particularly good. Several flocks can reside in one area, however as they are territorial, the individual flocks can be distinguished from each other.

3.2. Analysis of potential use of feral chickens as a resource

During the development of this plan a common question that frequently arose was “*Why can't humans eat this problem away?*” In order to answer that question the following were considered:

1. Safety and quality of the meat
2. Feasibility of a “capture and consume” campaign
3. Valuing the resource
4. Costs of meat and egg processing
5. Competition to private enterprise
6. Potential for exportation
7. Options for non-commercial use/consumption

Safety and quality of the meat.

The quality of the chicken extracted from the wild is dependent on several factors including:

- The variety of chickens being released by owners.
- Variations in the age and sex of the birds culled.
- Quality of food available to the chicken which ranges from the

equivalent of free ranging on greenfield sites, to contaminated brown field and waste treatment sites.

- Potential meat spoiling during the length of time from field to refrigeration. The culling method can also spoil the meat e.g. shooting has a high probability of spoiling the meat due to internal rupture.
- As a result of their active lifestyle, the meat of local feral chickens is firmer than commercially raised chickens whose meat is sold in local food stores.

As such there can be neither consistency of the product nor surety of quality.

Currently there is limited motivation for catching chickens in the wild for food due to reasons previously noted.

Consideration of a “capture and consume” campaign. Trapping can provide a number of chickens for any enterprise. However it has proven inadequate as the sole method for managing the feral chicken population.

The retail cost for a locally raised roaster chicken that is 3-6lb in weight was calculated in 2013 and ranged from \$24-\$35 (\$8 per pound), compared to an imported organic chicken that retailed for \$5 per pound⁹.

Costs of meat processing for commercial sale. It can be assumed that in order to be commercially competitive, the cost of processing a feral chicken for consumption must be in

⁹ Pettit, retail comparison, 2013

the same range as a locally raised equivalent.

The potential benefit of using the feral chicken population as a food resource must be offset by the estimated costs of:

- Trap capture
- Feeding and housing during cleansing and/or rearing
- Processing
- Packaging

Comparison of imported chicken.

In February 2025, imported non-organic chicken meat could be purchased at local grocery stores for \$4-9 per pound, whereas imported organic chicken sold for \$9-18 per pound.

Other products. Consideration was also given to the use of feral chickens for their feathers and manure. This was found not to be economically viable due to the high capital start up and operating costs associated with a local product, in comparison to commercially available products available from international suppliers. Similar limitations would apply to the local manufacture of manure.

Establishing a market and competition to private enterprise.

In considering the feasibility of developing a market using feral chickens, the following must be taken into account:

- a large portion of the existing population are roosters and not useful as egg layers.
- the majority of feral birds are of bantam descent and are small in size.

This renders a significant portion of feral chickens either unproductive or undesirable in comparison to

commercially available products. Additionally, it provides little incentive to expend significant effort to trap these animals for such a purpose.

An alternative considered would be to start a commercial enterprise using imported chicks, made up of high quality layers of known sex.

The concept of developing a government managed chicken industry was considered but deemed not to be cost effective as well as unfair competition to existing business.

Should global markets change through a breakdown in medium to long term availability, then the local use of feral chickens could become a more realistic enterprise.

Exportation of product. There is no substantial difference from any Bermuda product compared with those found in the U.S, Europe or the Caribbean.

The low cost of production in the United States compared to the high production and transport costs associated with all components of a Bermuda product(s) makes it cost-prohibitive to develop an export market, without subsidy from the government. This would further be in competition with local businesses.

Non-human consumption of feral chickens. Consideration was given to the use of feral chickens as fish and lobster bait. This would also have the additional benefit of reducing their reliance on diminishing local bait-fish stocks. This was trialed using both feathered and plucked chickens and found not to be effective as bait (2009¹⁰).

¹⁰ Board of Agriculture, minutes, 2009

Conclusion. Due to the high costs associated with extraction, processing and packaging, lack of consistency and low quality of meat there is limited commercial use for Bermuda's feral chickens.

There is a lack of legislation or policy to manage the consumption of feral chickens. Without quality control the government cannot encourage this activity. Until such time as the private sector finds a suitable use that meets the need to eradicate feral chickens, the priority for management must be culling.

3.3. Current Management Programs

Historically, the Bermuda Government has made many efforts to address the feral chicken problem with mixed results. In the mid-1990s cage traps were provided to crop farmers who were experiencing significant losses. The strategy was evaluated as not cost effective and as such was discontinued. Another trial was conducted with a private firm in 2004 and again was deemed to not be effective.

The Department of Environmental Protection (DEP). Historically DEP provided service to manage feral chickens, predominantly using cage traps. DEP has in the past also experimented with a variety of culling methods including net guns, traps, shotguns, air rifles and Avitrol (a commercially available chemical used for flock dispersal).

The Department of Conservation Services (DCS). In October 2011 DCS began an experimental program aimed at addressing the problem within

government managed lands and adjacent areas that acted as sources of recruitment for those areas.

This program was expanded to include privately owned areas in order to effectively address point sources of infestations. This was officially announced by the Minister of Public Works (August 2012).

DCS experimented with a wide range of techniques that included cage traps, modified turkey "Snap" traps, drop and cast nets, net guns, air rifles, shotguns, using alcohol-soaked bait and hand capture, as well as the use of an alpha-chloralose pest control product.

The program concentrated its efforts on a broad spectrum of "hot spots" that included:

- Areas surrounding the Airport, including Cooper's Island Nature Reserve and Clearwater Park
- Oceanview golf course, Tynes; Bay and the Bus Depot
- The Botanical Gardens Park
- Spittal Pond Nature Reserve
- Railway Trail/Riveria Crescent area
- Government Quarry/Midocean and Tucker's Point golf courses
- City of Hamilton
- Marsh Folly and Tynes Bay waste management facility
- Residential areas
- Housing complexes such as Fergusson Park, Alexandra Road and Southside
- Various agricultural fields

Between August 2012 and October 2013 approx. 11,500 feral chickens were culled during the DCS programme.

The Department of Environment and Natural Resources (DENR).

In 2016 the culling programme transitioned to DENR. Between 2015 and 2024 over 65,000 feral chickens were culled across Bermuda, mostly via trapping, deploying alpha-chloralose, and targeted shooting. The live captured birds were euthanized via cervical dislocation.

The Royal Gazette
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Feral chickens getting out of control, says Opposition

Shaun Connolly
Created: Apr 10, 2023 07:56 AM
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Please let chickens cross the road

Letters to the Editor
Created: Jul 18, 2024 07:59 AM
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Residents urged not to poison feral chickens

Alva Solomon
Updated: Jun 27, 2024 10:02 PM
30 Comments

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There are polarized views within the community regarding Bermuda’s feral chickens. Some members have taken management into their own hands and have resorted to using poison, which is a contravention to the Care and Protection of Animals Act (1975).

4.0. Comparative effectiveness of control options

Feral chickens are gregarious and territorial ground birds with restricted ability for flight. The following details a comparison of the various control options researched and trialed.

4.1. Mechanical Control

A. Trapping

This involves the live capture of chickens using a baited trap. All trapping methods require humane euthanasia and disposal of the remains after capture.

The duration of trapping operations can vary considerably from hours to many weeks, and in some instances trapping attempts can continue for months.

Typically bread or bird Scratch (a blend of grains used by animal breeders and farmers) is used as bait.

Trapping has a relatively high catch per unit effort (CPUE) and low “by catch” rates for non-targeted species.

Some feral chickens eventually learned to stay away from any type of trap and the residual population reproduced and eventually recolonized the treated area.

Three types of traps were trialed:

Cage trap

Once inside the trap they are restricted from leaving. These traps can catch on average 1-3 chickens per trapping session. Some traps can be constructed locally and are relatively inexpensive to make, while others are purchased from commercial sources.



Figure 10: Example of a commercially available live capture trap

Birds should be allowed to forage around and inside a cage trap during the pre-baiting stage (3-7 days). This reduces ‘trap shyness’ and improves the chances of trapping on the day of capture. During pre-baiting the cage trap is fixed open. Traps should be checked regularly when in use.

Advantages:

- Effective on small flocks.
- Humane (when used properly)
- Easy to use.

Challenges:

- Traps are prone to vandalism in public areas.
- Cage traps have been stolen.
- Survivors become trap shy.
- Labour intensive.
- Tend to receive complaints from public regarding cruelty to birds if left in cages too long.

Drop door trap

The drop door trap (figure 11) is based on the well known box supported on a stick trigger that is pulled manually by a string. There are several designs and depending on size, these traps can catch up to 20 chickens each trapping session.

Traps are positioned strategically in a problem area and baited with bread or Scratch. Chickens usually respond more quickly to entering this type of trap versus the cage trap. Drop door traps are typically used in areas where large congregations of chickens are frequently fed by the public. They are less prone to theft and vandalism because they are rarely left unattended by trapping personnel.

Advantages:

- Effective on larger flocks.
- Very effective where chickens are frequently fed by members of the public (e.g. parks).
- Humane (when used properly).
- Easy to use.



Figure 11: Drop door trap

Challenges:

- Traps are bulky and need dedicated transport.
- Labour intensive.
- Survivors become trap shy.

Snap trap

This baited bird trap uses a green nylon net to humanely capture chickens which set it off by feeding on the trigger plate. It typically only catches 1-2 birds but can be easily modified to be closed with a manual trigger on a pull string to increase the capture rate. The greatest number of chickens caught in a single trap was 14 individuals (2012¹¹).

Advantages:

- Closes automatically.
- Effective on birds frequently fed by the public.
- Humane (when used properly).
- Easy to transport and use.
- Can be used to catch both chickens and pigeons.

Challenges:

- Relatively expensive to purchase and import.
- Chickens learn not go into the trap if used too often in one place.

¹¹ Pettit, personal communication, 2012



Figure 12: Snap traps, before (top) and after (bottom) being triggered to close

- Capable of catching non-targeted animals.

B. Shooting

Shooting involves a licensed marksman, using a registered firearm, to target a chicken from a distance.

Use of firearms is strictly controlled on Bermuda to ensure public safety and licensed marksmen must abide by all police regulations. Targeted shooting has proven to be one of the most effective means of controlling unapproachable, individual feral chickens. It is, however, not an efficient control method for large flocks of birds who quickly learn to flee.

Air rifle

When used by an experienced marksman the .22 caliber air rifle is one of the most efficient methods of culling pest birds at a distance. Targeted shooting provides a complimentary method of control, when used in combination with other methods (e.g. trapping).

Advantages:

- No by catch.
- Useful on trap shy and unapproachable birds.

Challenges:

- Equipment is heavily regulated.
- Spare parts and ammunition must be imported.
- Risk of accident.
- Requires training.
- Relatively low catch per unit effort.
- Risk of non-fatal wounding.

C. Netting

Net gun

The Department of Environmental Protection experimented with a hand-held net gun with limited success. It was loud and cumbersome, and the relatively small net was slow to deploy and only useful in open areas¹². A firearms license is required to operate it.

Air powered net launcher

An air-powered net launcher was purchased in 2013. The air reservoir can be filled by a compressor to 125 psi which remotely fires four 5lb weights attached to a net measuring 46 x 30 feet.

¹² Pettit, personal communication, 2012



Figure 13: Air powered net launcher

Birds need to be baited immediately in front of the launcher for the net to successfully capture them. Field use has shown this equipment to be more effective in catching feral pigeons and nuisance ducks than feral chickens.

Advantages:

- No by catch.
- Effective on larger flocks.
- Works better where chickens are frequently fed by members of the public (e.g. parks).
- Humane.

Challenges:

- Equipment is bulky and needs dedicated transport.
- Labour intensive.
- Relatively low catch per unit effort.
- Can only be used in open, grassy areas.
- Netted birds need to be disentangled and euthanized by hand.
- Requires refilling with an air compressor after each shot.

E. Hand capture

Feral chickens have a habit of roosting in trees, often the same one night after night (figure 14). This makes them

relatively easy to catch. Using this method a hunter can either noose or hand catch the chicken and then humanely euthanize it.



Figure 14: Chickens in their roosting tree

Advantages:

- High catch per unit effort.
- No by catch.
- So specialized equipment needed.

Challenges:

- This method relies on knowing where the chickens roost at night, being able to access the area, and being able to physically reach the birds.

4.2. Chemical Control

A. Avicides and anesthetizing agents

Careful consideration was given to the use of avicides for bird control, with specific attention given to:

- Efficacy
- Toxicology
- Animal warfare
- Residue
- Public and operator safety
- Non-target risks

Starlicide (DRC 1339). A pesticide considered but not trialed due to its relatively slow acting nature.

Avitrol (4-aminopyridine). A commercially based chemical specifically made for the control of pest birds. This product was designed as a flock dispersant and is commonly used in the U.S.A. It acts by causing pain to the animal which in turn results in the expression of alarm and panic. This product was trialed in Bermuda during 2006 and discontinued because it did not meet the aim of the program, which is to remove the animals from the environment by the most efficient and humane means possible.

Over proof alcohol. Alcohol-soaked bread acts as a sedative on birds and is used as a traditional method of capture in the Caribbean. Experiments were conducted in Bermuda and found to be ineffective.

Alpha-chloralose (10%) paste. Alpha-chloralose is a commercially available pest control product that has been used in Bermuda to control feral chickens since 2012.

Alpha-chloralose is classified as a soporific or narcotic agent that anaesthetizes birds. It depresses the central nervous system producing a hypnotic and anesthetic effect on birds. Affected birds initially loose coordination but eventually the alpha-chloralose induces hypothermia and the birds die painlessly of respiratory failure. It is considered a humane avicide.

The product used by DENR is a paste that is spread on bread and hand fed to target birds as per the pest control

guidance note (appendix 1). Once ingested, comatose birds can then be collected and humanely euthanized. Non-target species can often be revived.

The culling operation typically lasts for 1 -2 hours per site. It should be noted that extreme care must be taken in bait management to minimize exposure to non-target species.

Advantages:

- High catch per unit effort.
- Ideal for large flocks, especially those frequently fed by the public.
- Simple to use.

Challenges:

- Alpha-chloralose is not authorized for use by the public and is only approved for use by DENR.
- Requires a period of pre-bating to be most effective.
- Subject to public interference.
- Lengthy time delay during warm weather.
- Affects non-targeted species (e.g. sparrows, starlings, pigeons, and kiskadees).
- Concerns over secondary poisoning of non-target species who consume treated birds (e.g. cats).

All of the above concerns can be mitigated by following the guidelines described in the *Pest Guidance Note - Alpha-Chloralose* (Appendix 1).

Alpha-Chloralose treated wheat product. A treated wheat version coated in alpha-chloralose product was trialed in Bermuda (2012). Its use was discontinued due to its greater impact on non-target species (e.g. protected birds) and the difficulty of retrieving any unused bait.

B. Sterilization

Research was undertaken into sterilization methods for Bermuda's feral chicken population. The intent was to allow existing chickens to remain in the wild but stop population expansion through reproduction.

Birth control. Chemically treated feed (e.g. Ovocontrol) is fed daily to the same birds as a mean of continuous birth control.

Advantages:

- Humane.
- Non-lethal.

Challenges:

- Damage and nuisance are still caused by existing birds.
- Costly, time consuming, and technically difficult to ensure that the adequate dose of chemical is regularly administered to each female bird throughout her reproductive life.
- Concern there may be exposure to native and songbird populations.
- Not a practical solution for the majority of sites.

Rendering eggs non-viable.

Eggs can be coated in paraffin oil or corn oil to suffocate the developing embryo inside, or they can be pierced with a nail and addled.

Advantages:

- Encourages the hen to brood for the normal incubation period, thereby prohibiting her from laying additional eggs.

Challenges:

- Time consuming.

- Labour intensive.
- Great difficulty in finding enough nests to make a discernible difference to the feral chicken population.
- Damage and nuisance are still caused by existing birds.

4.3. Biological Control

Caponizing (testicle removal) of roosters. The testicles are located internally which makes this a relatively complicated and costly procedure to undertake by surgery. This method is also costly as it includes trapping, surgery and recovery (estimated \$200-300 per bird¹³).

Advantages:

- Non-lethal.

Challenges:

- Must capture rooster.
- Labour intensive.
- High cost.
- Needs the services of a licensed veterinarian.
- Rooster still crows and impacts the environment after being released.

Introduction of a pathogen or predator.

This type of control was not considered due to the potentially long term and unknown risks to Bermuda's ecology.

4.4. Technique Summary

Observations from the field trials:

- **Trapping.** The most successful traps used to control feral chickens

¹³ Bermuda Veterinarian Association, meeting discussion, 4th September 2013

in Bermuda are the live capture traps (e.g. HavaHart, large or extra-large).

- **Shooting.** Air rifles are both quiet and accurate. Guns that are .22 caliber were more effective in killing feral chickens than 0.17 caliber, but much depends on the shot placement. The preferred pellet grain sizes are 14.3 and 18.1 which can deliver up to 26 ft/lbs of energy.
- **Chemical control.** The most efficient tool to manage large flocks of feral chickens is the sedative Alpha-chloralose. This plan recognizes the potential negative impacts that it has upon non-target species; however this can be offset by controlled use of the chemical using the pesticide guidance note (Appendix 1).
- **Sterilization** was deemed to have limited and unpredictable effectiveness.

In practice, the most efficient means to address most situations of feral chicken infestations requires the combined use of live trapping, alpha-chloralose, and the air rifle.

5.0. Implementation

Realizing the long term and open-ended nature of the problem this plan recommends a pragmatic control strategy with no finite date for eradication.

It is useful to restate the goal of the plan which is *control within priority areas, coupled with population suppression to*

limit spread and reduce impacts in all other areas, until such time as eradication is possible.

This section outlines accepted methodology, requirements for personnel, equipment, and other resources, anticipated budget and priorities necessary to meet the goals and objectives of the plan.

5.1. Authority

Plan approval

The Plan is approved under Section 4 of Protection of Birds Act 1975 by the Minister of the Environment after consultation with stakeholders, listed below, and consideration by Cabinet.

- The Board of Agriculture
- The National Parks Commission
- Bermuda Audubon Society
- Bermuda Farmers Association
- Poultry Fanciers
- Society for the Protection and Care of Animals (SPCA)
- Bermuda Feline Assistance Bureau (BFAB)
- Bermuda Veterinarian Association
- Bermuda National Trust

Legislation

It is proposed to create or amend legislation to make it illegal to allow invasive species, including chickens to wander, be released, fed and or supported in the wild. Furthermore, it is proposed to make it an offense to interfere with an officer in the course of their duty and/or to interfere with their

equipment. Until such time as this legislation is developed the *Summary Offenses Act (19) (i)* and the Protection of Birds Act 1975 will be the legislative tools used to manage this issue.

Notice and prosecution

In addressing a suspected infestation the first course of action is to investigate whether the chickens are indeed feral and not owned.

Should they be owned, the landowner will be advised that it is an offense to allow poultry to wander from his/her property and that they will be required to coop the chickens within two weeks of official notice.

If after that time the chickens have not been cooped or restrained, the landowner will face prosecution under the ***Summary Offenses Act 1926***. The landowner will be given the option of using a private contractor or the government service, which is free of charge, to remove the birds.

5.2. Management organization

In order to increase efficiency an inter-ministerial working group will be created comprising officers and non-government stakeholders to coordinate the program. This will be coordinated by the Director of DENR.

The primary team will comprise the Biodiversity section of the Department of Environment & Natural Resources using department approved volunteers and specialist contractors as required.

Assistance will be provided as required from the:

Government Organisations

- Department of Parks
- Waste Management
- Bermuda Land Development Company
- West End Development Company
- Department of Environmental Health
- Department of Airport Operations /BAS Serco
- Golf courses
- Corporation of St Georges
- Corporation of Hamilton
- Bermuda Housing Corporation
- Bermuda Housing Trust

Non-Government Organisations

- Bermuda National Trust
- Bermuda Audubon Society

Support can take several forms such as:

- personnel on a case by case basis.
- providing transport such as golf carts or other internal transport.
- informing staff of plans.
- keeping facilities open after hours.
- trapping.
- providing trapping data.
- on site direction.
- providing security during operations.

Advisory stakeholders

Information meetings with selected stakeholders will be held to gain input and address concerns as needed.

1. Bermuda Audubon Society
2. Farmers Association
3. Bermuda Poultry Fanciers
4. Society for the Protection and Care of Animals
5. Bermuda Feline Assistance Bureau
6. Bermuda Veterinarian Association
7. Bermuda National Trust

5.3. Reporting

DENR has developed an internet based reporting form for feral chickens which can be found at www.environment.bm/feral-bird-control as well as via the Bermuda Government portal www.gov.bm/online-services/report-feral-bird-your-property

DENR is also, at the time of writing, developing a new interactive reporting tool. This map-based application will allow technical staff and members of the public to quickly detect new areas where feral chicken populations have become established, as well as monitor areas already under management

All requests for assistance must be submitted via the online form. Information required includes address, contact details, estimated number of feral chickens, confirmation if pets are on the property, and acknowledgement of the methodology used. Upon submittal of the form, the date and time, as well as IP address of the sending computer are captured. An automatic acknowledgement of receipt is sent back to the submitter.

The information from each form automatically populates an excel database which is used by technical staff to track work activities on each site. The system also generates a work order and sends it automatically via email to staff.

Requests are addressed by the date received.

Field teams record locations and cull statistics monthly. This is consolidated

into a single report and sent to the Director of DENR.

Priority

Priority is given to the following areas:

- Agricultural fields
- Ports of entry
- High density residential areas
- Nature reserves and parks
- Health institutions and senior housing
- Dairy farms
- Horse stables
- Golf courses
- Restaurants
- Schools

All other areas will be addressed as soon as possible.

5.4. Control & management

The proposed management methodology recognizes that feral chickens are:

- non-migratory and territorial
- restocked in the wild through local release and/or natural breeding
- omnivorous and have no significant predators in Bermuda
- a pest not protected under legislation
- only active during the day

Understanding the many scenarios in which feral chickens can be found and the nature of these birds, no one single control method has proven completely effective; rather a variety of methods must be employed. All of the methods have been reviewed for effectiveness and are employed to minimize any element of cruelty.

As such an Integrated Management Strategy will be used based on the general strategy outlined below. This

strategy will be amended as necessary to best manage each individual situation.

A. Primary methods

1. Chemical – alpha chloralose paste

Situation - 5+ birds that have been pre-baited

Will be used under strictly controlled conditions and by authorized government employees, only as per the pest guidance notes for alpha-chlorolase (Appendix 1).

2. Air rifle

Situation 1-2 birds and/or dispersed wild populations

Will be used under strictly controlled conditions and by authorized government employees. All proper precautions will be taken with landowner's permissions given and police notified of action.

3. Combined use of chemical control & air rifle

It is recommended that the most effective combination of methods is the use of alpha-chlorolase paste to reduce chicken numbers and the air rifle to remove any residual individuals from an area.

B. Secondary methods

The methods detailed below will be employed when necessary and in combination, depending on the specific situation.

Traps

Snap traps

Situation – 1-4 birds that have been pre-baited in areas where the approved chemical, cage trapping or shooting is problematic. (E.g. a small number in a public space).

Cage traps

Situation – 5+ birds in rural or private areas with limited public accessibility to reduce vandalism (e.g. farmer's fields).

Cage traps are a longer-term solution than the above methods and require daily supervision of each trap.

Drop door traps will be built and stored at DENR. These will be signed out as needed.

Traps could also be issued to each stakeholder group from DENR. That member will report back catch statistics on a monthly basis.

Air powered net launcher

Situation – 5+ birds in level and open rural or private areas (e.g. farmer's fields, gardens or parks).

All proper precautions will be taken with landowner's permissions gained and police notified of action. The use of the air powered net launcher will be employed as needed for large groups in situations where there is a possibility of high by-catch of non-target species.

Hand capture will be used as and when needed.

5.6. Disposal

Retrieved carcasses will be disposed of at no cost at the Tynes Bay Waste Treatment facility for incineration, or taken to the Marsh Folley Composting center for burial.

5.7. Hours of operation & fees

In order to encourage the public to support the management of feral birds the government will provide a full complement of service, as noted in Section 5.5. *Control and Management*, with no fee for service.

This service will be provided, during normal business hours - Monday to Friday 8:30am to 5pm excluding public holidays, unless otherwise approved. Users of the government service must use the approved application system, agree to the terms and conditions of the service and on the understanding that the service is provided on a first come/first serve basis - unless in a noted priority area.

Should members of the public require service outside of the above parameters the government will encourage the use of private pest control services to undertake management of feral birds, using unlicensed methods, that do not contravene the Care and Protection of Animals Act 1975 (e.g. trapping and hand capture) using humane euthanasia practices. Members of the public who chose this service will be charged at market rates directly by the contracted company.

5.8. Monitoring

DENR will monitor its outputs against the plan's objectives and protocols in order to monitor effectiveness.

Tracking and Mapping. DENR will compile request sites and statistics into a single database which in turn will be linked to a GIS generated map. The map will be issued in conjunction with the monthly report.

Follow up visits. Sites will be revisited the day after any baiting has been used and monitored every two weeks for residual populations or secondary populations that claim territory from the removed primary group.

5.9. Research & risk assessment

The plan will provide guidance on research monitoring and assessment tools. This will support statistically sound and repeatable standard techniques that can be applied to multiple habitats.

5.10. Education & outreach

Education and outreach is vital to the success of this plan especially with gaining understanding of the public, special interest groups, pet owners, as well as provide any other relevant information about feral chickens, their impacts, and methods of control.

Training. Mandatory training will be given to all new employees including techniques to catch, euthanize and monitor feral chickens.

Public relations and education campaign. Press statements will be released as needed to update the public.

Signage will be developed and placed in feeding hot spots to advise the public not to feed feral chickens.

A handbook, pamphlet and poster will be developed to promote responsible chicken ownership; require persons owning chickens to keep them cooped or otherwise controlled. These will be distributed to pet stores, stakeholders and will also be made available electronically on the DENR website.

5.11. Budget

The plan will use existing government personnel, as well as registered volunteers and contractors, to deliver the program.

The expected budget for this plan, excluding costs associated with government staff is \$30,000 per annum. This operating budget will cover the fees for firearm licenses, security alarm costs, materials for traps, chemicals and contractor wages. This level of budget is accounted for in the forecasted operating budget of the Department of Environment & Natural Resources.

5.12. Action plan priorities

Action items will be updated regularly:

1. Creation of working group expanding on the existing program.
2. Approval of recommended management methods, service request system, data tracking and mapping system.
3. Manufacture and importation of traps by DENR.

4. Supply approved traps to farmers/team members and the public.
5. Create an improved feral chicken reporting web-based application
6. Amendment/creation of legislation to address release of and feeding of invasive species, including feral chickens.
7. Public education campaign promoting good ownership practices, the damage invasive species do to Bermuda's habitats and wildlife, fines etc.

APPENDIX 1

ALPHA-CHLORALOSE PESTICIDE GUIDANCE NOTES

Alpha-chloralose for Feral Chicken Control

Pesticide Guidance Note

Introduction

This product is used as part of an integrated pest management program to manage Bermuda's feral chicken population.

This guidance noted includes a description of alpha-chloralose, pharmacology, toxicity, recommendations for safe preparation, use and disposal. It describes its health effects, first aid, treatment of non-target species, limited environmental concerns, and symptoms of poisoning. Observations have been included from trials conducted by the Department of Conservation Services in August 2012.

These notes are issued as guidance only. Always READ THE PRODUCT LABEL and comply with all handling instructions before using and understand symptoms of poisoning and the recommended first aid treatment.

What Is Alpha-chloralose?

Alpha-chloralose is classified as a soporific or narcotic that anaesthetizes/immobilizes birds. It acts on the central nervous system, depressing central nervous activity, slowing heart and respiration rates and eliminating the sense of pain. It is generally considered the most humane of the available avicides (Tracey et al. 2004). After ingestion, comatose birds can be collected and humanely euthanized. Non-target species can often be revived by placing them in a warm dark place for a few hours.

Alpha-chloralose was developed in the 1940s by the USDA APHIS Wildlife Research Centre in the United States to meet the need for an effective, safe, slow-acting toxicant to allow control of bird pests including starlings and blackbirds. Today it is used under specialized license in the U.K and is one of the main control methods used in New Zealand for nuisance bird control.

Alpha-chloralose is a white crystalline powder, with a melting point 187°C and low solubility in cold water. It can be dissolved in hot water and is soluble in alcohol. It is converted by acids and alkalis into glucose and chloral. Baits trialed for use on Bermuda include alpha-chloralose treated wheat (supplied in 10 kg pails) and alpha-chloralose paste (500g tubes). Active ingredient: 10% alpha-chloralose powder.

Pharmacology - How does it work?

Following ingestion alpha-chloralose is metabolised in the body to chloral, which in turn is largely converted to trichloroethanol. The latter compound is a CNS depressant, which combines with glucouronic acid in the liver to form a pharmacologically inactive urochloralic acid. This derivative is readily excreted in urine. (Segec et al. 2006).

Studies of the effects of alpha-chloralose on birds report alpha-chloralose-induced sedation did not appear to cause stress. Untreated birds showed no negative response to birds in the same cage undergoing alpha-chloralose-induced sedation (Woronecki

et al. 1990). Affected birds in this study displayed torticollis (lateral flexion contracture of the cervical spine musculature so that the head is tilted to one side), fluid in the oral cavity, respiratory irregularities and shivering. Tonic convulsions such as those induced by strychnine poisoning were not observed, but convulsion-like behavior observed when birds in mid- to deep sedation were disturbed or startled by other affected birds staggering in near proximity (Woronecki et al. 1990). The latter observation is suggestive of hypersensitivity, and was also reported with alpha-chloralose use on gulls (Woronecki et al. 1990).

The main advantage of alpha-chloralose is that it does not induce pain and therefore panic in the birds as some other avicides do. It has selective oral toxicity to birds, with mammals apparently less susceptible.

Typically, active concentrations of 2.5% alpha-chloralose in cold climates is suitable to stupefy birds that ingest it, allowing them to be collected and either recovered and released, or killed humanely. Concentrations in bait greater than 6% are necessary in warmer climates due to the limited effects of alpha-chloralose on thermoregulation. Feral chickens have greater body mass, therefore 10% concentration is used on Bermuda. Krieger (2001) summarizes the comparative values of alpha-chloralose across a range of species.

Acute oral LD50 for rats 400mg/kg, mice 32 mg/kg, cats 100 mg/kg, dogs 600 to 1000 mg/kg (Cornwell 1969). The compound is often more toxic to birds than most mammals. Oral LD50 for

starling 75 mg/kg, pigeon 178 mg/kg, house sparrow 42 mg/kg, chicken 42 mg/kg, mourning dove 42 mg/kg (Schafer 1972).

Fatal secondary poisoning as a result of eating a bird that has ingested alpha-chloralose must be considered during field operations, however it is highly unlikely for domestic animals to receive a fatal dose in this manner, as the quantity consumed is too small.

It is probable that hypothermia always accompanies anesthesia with alpha-chloralose in all species of animals. The deeper the level of anesthesia the greater the fall in body temperature. This explains why lethal toxicity is more likely when ambient temperature is below 15°C (59°F). This temperature range is limited in Bermuda to only the coldest winter months. However it is noted that the optimum time to use Alpha-chloralose is during the cooler months of the year.

Effects of alpha-chloralose

Symptoms of narcosis in birds proceed through the following stages:

- a) After ingestion normal activity will continue (1-15 minutes).
- b) Some reduced activity and affected birds will begin to stagger 'drunkenly' but still be interested in bait. Eyes remain open and affected birds cannot readily be captured (15-25 minutes).
- c) Affected birds still interested in bait but stand with difficulty or in a hunched position with eyes closed or flickering. They will not move if approached quietly but will elude capture if disturbed. (25-35 minutes).

- d) Affected birds become recumbent with head drooping and eyes closed. They remain still, apart from occasional wing and tail flapping, but will move when touched or handled. Birds can be captured with a hand net (35-45 minutes).
- e) Affected birds remain motionless even when touched and may die from hypothermia if left undisturbed (45+ minutes).

General procedure

The following lays out the general steps for successful application:

1. Pre-baiting
2. Preparation of bait
3. Laying of bait
4. Euthanasia & collection of carcasses and bait
5. Disposal and decontamination
6. Monitoring

Pre-baiting (feeding)

The key to success for toxic feed is food acceptance. Pre-feeding with untreated feed before using treated feed is essential. This may take a few days or as long as two to three weeks for some individuals. Any change in routine will be noticed by the birds, adversely affecting the result.

Pre-feeding for 3-5 days will usually be sufficient, but it may be necessary to feed for up to 10 days where chickens are naive to hand feeding. If using grain baits, lay in bait trays or on smooth surfaces (this allows for the recovery of any uneaten bait). Observe birds feeding to ensure that the target species (rather than non-target species) are eating the bait.

Consistency is important. Always lay baits at the same time each day and wear similar coloured clothing.

Approach and depart from the operation area in the same direction each day and avoid any unnecessary disturbance of the operation area.

Prior to laying alpha-chloralose bait ensure that all pre-feed bait has been eaten or removed.

The day before you use it, half the pre-feed to ensure that no un-eaten non-toxic bait is left and that the birds will be hungry and readily eat the treated bait.

Preparation of bait

Pre- Treated Pest Off Wheat

Use pre-treated pest off wheat according to the manufacturer's instructions. Keep wheat in a sealed container until immediate use.

Keep all body parts covered, in particular use surgical plastic gloves at all times, and pour into plastic dish/plate.

Pest Off Paste on bread bait

Note chickens have limited ability to bite or chew off pieces of food and rely on side to side shaking of their head and beak to break up bread pieces that are too large to swallow whole.

Select thinly sliced white sandwich bread at least one day old but not too stale. Before applying the paste, massage the tube well to mix the bait thoroughly. Spread the paste onto each piece of bread 1mm thick, like butter and make into sandwiches. Flatten "sandwich" to reduce thickness using heel of hand. Cut each "sandwich" in

about 10mm squares to give about 25 small baits. If the baits are larger, the chickens may have difficulty swallowing them easily.

To increase the amount of alpha-chloralose paste on bread, warm it in a pot of water after applying the first layer of paste (have a dedicated pot that is not used to prepare human meals). This will melt the paste into the bread allowing another layer of paste to be applied.

Health and Safety precautions

All persons handling alpha-chloralose in pure form or as a treated feed must use all the protective clothing and equipment listed in the material safety data sheet. All products must be handled in a well-ventilated area. Avoid contact with skin and eyes. When preparing treated feed wear long pants, long sleeves (or equivalent coveralls) a washable hat, elbow-length PVC gloves, effective eye protection and a respirator fitted with dust particle cartridge. Place prepared bait in a sealed plastic container.

Place all unused materials in separate plastic containers including bread, cutting board, knife, and paste. After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water. After each day's use, wash clothing, gloves and safety equipment.

All alpha-chloralose and treated feed should be safely stored in a dry locked container and be clearly labeled.

Laying of bait

Baits can be laid at any time during the day, however early morning and dusk are the most active periods for feral

chickens. For maximum control, more than one day's baiting will be necessary, but allow at least two days between successive baitings. Baiting should continue for consecutive days for best results.

Alpha-chloralose works quickly. Hand feed or lay treated bait out when you can be sure that the birds will not be disturbed for at least 30 minutes. Ideally allow 30-40 minutes to pass before entering the area again, by then the birds should have had enough and will be narcotised.

For treated bread bait best results are obtained by throwing bait piece by piece to single feral chickens. Bait in the open where possible to make it easier to retrieve target birds. Field trials show 4-5 pieces of bait for each bird are effective for full sedation.

For treated feed lay at the same time of day as the untreated feed was being put out. Feed should be placed in protected areas where wind will not blow it away and where remains may be collected up and removed. Feed should be spread in several bands rather than a single heap, to maximise the number of birds feeding at one time.

Precautions to follow:

- Prior to the operation warn anyone who has access to the area not to touch bait or carcasses. Gain permission, name and contact details from the landowner. Ensure that all pets are restrained or housed, as they are attracted to flapping (semi-comatose) birds and will scare other birds from the bait area. Ideally the general public

should be excluded from the operation area and close surrounds.

- Never leave bait unattended. Maintain supervision while feed placement is underway, monitoring any non-target birds or animals taking the feed and following up on their fate.
- Do not drop treated feed in water or allow it to fall into water.
- Do not place treated feed if significant numbers of non-target species are present and likely to take feed.
- If possible place the treated feed on days when no rain is expected and the temperature low.

Euthanasia & collection of carcasses and bait

All chickens must be quickly and humanely euthanized by cervical dislocation or gassed with carbon dioxide. Bodies must be placed immediately in a heavy-duty trash bag.

People collecting and disposing of narcotized chickens must wear appropriate equipment such as coveralls, rubber gloves and dust mask. All equipment should be thoroughly washed after each operation.

After the treated feed has been placed, watch the area from an appropriate location in a calm manner. Note number of chickens feeding and the direction that any wander too.

To ensure success collect comatose birds with a hand net at 40-60 minute intervals. This can be done carefully during the operation without panicking the target birds. Birds will remain comatose for 2-3 hours.

- Ensure that no birds are removed for human or animal consumption.
- Ensure that there is no interference from other people or dogs.

Disposal & Decontamination

All carcasses should be disposed at the Tynes Bay incinerator to limit secondary poisoning. Once all birds have been retrieved, all surplus bait must be collected, stored for immediate re-use or incinerated.

Make a final search for affected birds 45 minutes after all alpha-chloralose bait has been picked up.

After use all chemicals and/or treated bait to be placed in an approved chemical storage.

Monitoring

Reintroductions of chickens are likely to occur. As such monitoring will be required, even if eradication of the resident population is successful.

Continued monitoring and a combination of shooting and targeted poisoning using alpha-chloralose is recommended to remove the last individuals. Allow at least two days between successive placements of treated feed.

Environmental concerns

Alpha-chloralose is very stable in sunlight and treated feed can remain toxic for several weeks. Treated feed left out may dry and harden and appear unpalatable to birds but will readily re-soften when exposed to dew or light rainfall.

Treatment for non-target animals

If bait is consumed by non-target animals the following treatments are recommended to maximise the chance of a full recovery. As the hypothermic action of the drug contributes to its toxicity, sufficient warmth should be applied to keep the animal close to normal temperature level (25-28°C).

The animal should be gently restrained in a towel to prevent self-injury. Place the animal in a well-padded cage or box and placed in a warm dark and quiet place.

Affected animals will need to be kept under the above conditions until fully recovered and released.

Alpha-chlorolase should only be use on feral chickens and not purposefully used to target other pest species such as feral pigeons without further study.

Human Health effects

- Swallowed: poisonous if swallowed
- Eye: avoid contact with eyes
- Skin: avoid contact with skin
- Inhaled: harmful if inhaled, use a respirator.

First aid

If poisoning occurs call 911 immediately and get to a doctor or hospital quickly.

If swallowed: induce vomiting if patient is conscious.

Eye: immediately flush with plenty of water for 15 minutes.

Skin: wash skin thoroughly with soap and water.

If inhaled: remove to fresh air. If not breathing give artificial respiration. If breathing is difficult give oxygen.

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