

# Eradication of Feral Cats (*Felis catus*) from Gabo Island, south-east Victoria

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The authors are all formerly technical field officers of the Orbst Region of the Victorian Department of Natural Resources and Environment. This paper is based on work undertaken by them while working on a range of pest species and wildlife conservation programmes on Gabo Island in far eastern Victoria, one of Australia's most significant seabird islands. The current address of the coordinating author (Keith Twyford) is National Parks and Wildlife South Australia, P.O. Box 39, Kingscote, Kangaroo Island, SA 5223, Australia. Email: ktwyford@dehaa.sa.gov.au

**Summary** Concerns about the effects of predation by Feral Cats (*Felis catus*) on native fauna, particularly breeding seabirds, precipitated a decision in 1987 to control and eventually eradicate cats from Gabo Island. The size of the population prior to control was at least 30 animals. A control programme, undertaken between 1987 and 1991, centred on shooting, trapping and an extensive 1080 poison-baiting programme. Trapping and shooting were ineffectual. Poisoning was the most successful and effective technique for the rapid and widespread reduction in the Feral Cat population on Gabo Island. The effectiveness of dead 1-day-old chickens as a poison carrier was demonstrated. Effective poison baiting was attributed to bait selection and strategic timing of baiting to periods when prey was at low levels. Outcomes from the trapping programme and post-control monitoring strongly suggested that the cat population had been reduced to only two or three animals, possibly of the same sex. Monitoring between 1992 and 1998 failed to record any evidence of cats, indicating that the cats remaining after poison baiting had been unable to sustain a viable population. On the basis of the available evidence, Feral Cats appear to have been successfully eradicated from Gabo Island.

**Key words** 1080 poison, feral animal control, seabirds.

## Introduction

### *Feral Cats and Island biota*

Feral Cats (*Felis catus* L.) are widely distributed across Australia where they occupy a diversity of habitats. Cats are adaptable and opportunistic predators of native wildlife and are thought to have contributed to the decline and extinction of a range of native birds and small mammals in Australia, although much of the evidence for this is either indirect or anecdotal (Jones 1989; Dickman 1996). Island wildlife populations, however, are recognized as being particularly vulnerable to Feral Cats, and Moors and Atkinson (1984) have suggested that no other alien predator has had such a universally detrimental effect on island seabirds. Ground-nesting and ground-feeding birds are particularly susceptible as they are often a major dietary item of cats and the effects of this predation can lead to serious population decline or extinction (Jones 1977; van Aarde 1980; Veitch 1982, 1985; Brothers *et al.* 1985; Fitzgerald & Veitch 1985; Rauzon 1985;

Bloomer & Bester 1992). In New Zealand, cats have been implicated in the extinction of at least six endemic birds and the localized extinction of a further 70 species (Merton 1978). A similar situation is reported for many Australian offshore islands (Dickman 1996).

### *Gabo Island: A Snapshot*

Gabo Island (154 ha) has been classified as a site of zoological significance in Victoria because of its importance for seabird conservation (Norris & Mansergh 1981). Recent systematic surveys have confirmed that between 15 000 and 20 000 breeding pairs of Little Penguin (*Eudyptula minor*) are present on Gabo Island, representing the largest colony of this species in Australia and possibly the world (Fullagar *et al.* 1995). Fullagar and Heyligers (1996) estimated the Short-tailed Shearwater (*Puffinus tenuirostris*) population at more than 6000 breeding pairs.

Gabo Island has a long history of human occupation and use. Archaeological surveys indicate that Aboriginal people made exten-

sive use of the marine life around Gabo Island for food. Prior to 1846, the island was used as a whaling station and, possibly, as a sealing base. From 1853 to 1995 the island was permanently inhabited and managed by the Commonwealth Government as a lighthouse reserve. The Victorian Department of Natural Resources and Environment received management responsibility for Gabo Island in 1995. Parks Victoria now manages the island to conserve natural and cultural resources and to provide opportunities for nature-based tourism.

### *Feral Cats on Gabo Island*

Cats were first recorded on Gabo Island in 1846 and probably originated from domestic animals owned by sealers and whalers who occupied the island in the early 1800s. The population was likely to have been supplemented by animals brought onto the island by lighthouse keepers who have resided there since 1853.

Historical estimates of the Feral Cat population on Gabo Island vary. Lighthouse keepers estimated a population of 19 animals

in 1976 (Fisheries and Wildlife Division (FWD), unpubl. data). Spotlight transects undertaken in 1978 suggested a relatively stable population of 12 animals with little potential for further increase due to the limited capacity for young animals to establish new territories and shortages in food availability in late winter (E. Jones, unpubl. data, 1978). A preliminary trapping and shooting programme undertaken by FWD officers in 1978–79 resulted in 20 Feral Cats being destroyed with evidence of Feral Cats still common 9 months later (FWD, unpubl. data).

Population size was estimated at approximately 30 animals from 1982 to 1984 on the basis of capture-release studies and extensive observations (I. Gray, pers. comm., 1993). This assessment is considered to most accurately reflect the population of Feral Cats on Gabo Island at the start of the 1987 control programme due to the extensive period over which data were collected (approximately 40 weeks of survey over 2.5 years; I. Gray, pers. comm., 1993).

#### *Cat population density*

The estimated population of 30 animals on Gabo Island equates to a density of 20 cats per km<sup>2</sup> which is broadly comparable to recorded densities on part of Marion Island (5–14 cats per km<sup>2</sup>; van Aarde 1979). Density is low in comparison to off-shore islands such as Tasman Island (40 cats per km<sup>2</sup>; Brothers 1982), Cousin Island (220 cats per km<sup>2</sup>; Veitch 1985), Herekopare Island (118 cats per km<sup>2</sup>; Fitzgerald & Veitch 1985) and North-west Island (more than 100 cats per km<sup>2</sup>; Domm & Messersmith 1990).

High densities of cats are only possible where large numbers of nesting seabirds provide an abundant year-round food supply (Veitch 1985). On Gabo Island, such a food supply is not available. Adult and newly fledged young Short-tailed Shearwaters migrate from breeding colonies in April–May and do not reappear until late September (Rogers 1990). Little Penguin breeding is generally confined to the period July to April with most eggs laid between August and November (Reilly & Balmford 1975). At the end of the breeding season, young birds disperse rapidly from natal colonies while adults appear to remain

centred on their breeding colony throughout the year, although they may leave it for 2 or 3 months in the non-breeding season (May–July; Reilly & Cullen 1982). Although adult Little Penguins are present on Gabo Island throughout the year, thereby providing a potential food resource for Feral Cats, populations of larger seabirds, such as penguins, may be little affected by cat predation (Jones 1977; van Aarde 1980; Moors & Atkinson 1984), although possible instances of predation on their chicks have been reported (Berruti 1981).

It appears likely that a major consequence of the breeding pattern of seabirds on Gabo Island is that food availability for cats is relatively low over winter, possibly resulting in high kitten mortality. This regulatory effect on cat population levels is also evident on other islands with seasonal food supply (Jones 1977).

#### *Previous control programmes*

Concerns about the effects of Feral Cats on the Island's seabirds were first raised by Gillham (1962) who reported that former large populations of Short-tailed Shearwater had been greatly reduced by cat predation. The first recorded control efforts against Feral Cats were undertaken by lighthouse staff in 1975. Shooting and trapping programmes were carried out by FWD in 1978. Despite this control programme, cat numbers still appeared to be high in mid-1979 (FWD, unpubl. data). In subsequent years, concern about the effect of cat predation on seabird populations continued to be expressed by bird banders and biologists that visited the island (Norris & Mansergh 1981).

Fisheries and Wildlife officers captured 14 animals over a 7-week period in mid- to late-1979 (FWD, unpubl. data, 1979) amounting to a trap success of approximately 1%. Similarly, cage trapping undertaken between 1982 and 1984 indicated that cats were trap-shy, with only five animals captured in approximately 200 trap nights (trap success of approximately 2.5%; I. Gray, pers. comm., 1993).

#### *Purpose of this study*

This paper reports on a control programme for Feral Cats on Gabo Island undertaken from January 1987 to August 1991 and the

outcome of ongoing monitoring to October 1998.

## Methods

### *Study area*

Gabo Island (37°34'S, 149°54'E) is 154 ha in area and located approximately 12 km east of Mallacoota and 5 km south of the Victorian/New South Wales border (Fig. 1). The island is separated from the mainland by a channel 500 m wide. Topography is low and gently undulating with vegetated sand dunes overlying granite on most of the island. An extensive rock platform surrounds the entire island. At its highest point, Gabo Island is 50 m a.s.l.

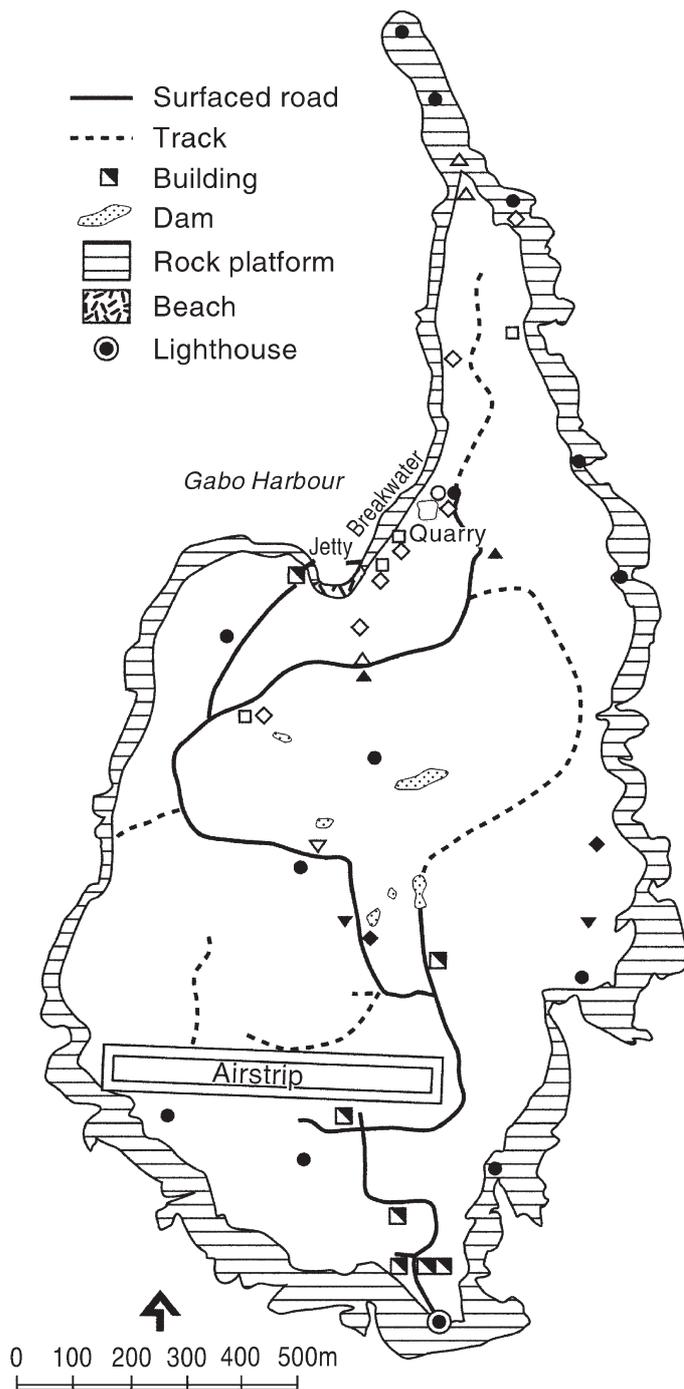
The central part of the island comprises dense coastal scrub. Dense infestations of Blackberry (*Rubus fruticosus*) are present, particularly along drainage lines. Small areas of scrub associated with rocky outcrops occur on the southern part of the island. Open scrub vegetation prevails on consolidated dunes in the northern and south-western areas of the island. Open sedgeland covers the southern-most parts of the island. Pastures heavily grazed by cattle predominate around the lighthouse and in the northern, eastern and south-western peripheral zones. Thickets of African Boxthorn (*Lycium ferocissimum*) are present within the coastal fringe, particularly in more sheltered areas.

### *Control and monitoring programmes*

The programme was implemented in two phases. The first, involving control and intensive monitoring, was undertaken between January 1987 and August 1991. It included free feed and poison baiting, trapping, shooting and monitoring of control outcomes. The second phase from February 1992 to October 1998 involved periodic monitoring of the Feral Cat population.

### *Poison baiting*

Baiting was first undertaken between 4 August and 1 September 1988 as part of the initial knock-down of the cat population. A second baiting programme was undertaken between 6 and 14 August 1990.



**Figure 1.** Gabo Island, showing locations of Feral Cat presence detected by spotlighting, shooting, trapping, free feeding and poison baiting. Location where cats were (○) shot and (●) observed during spotlighting in 1987. Positive indication of cats from trapping in (△) 1988, (▲) 1989 and (▼) 1990. (▽) Cat captured in trap in 1990. Positive indications of cats from (□) free feeding, 1988; and from poison baiting in (◇) 1988 and (◆) 1990.

Free feeding with unpoisoned baits commenced at 13 sites on 4 August 1988 (Table 1). Sites were located to coincide with areas known to have been frequented by cats in the past and where recent signs

and activity (scats, tracks, prey remains) were evident. At each bait site, between two and 12 baits were laid. Baits were strategically placed in rock crevices and beneath shrubs to avoid detection and consumption

by raptors, the main non-target species likely to consume baits. Apart from a small number of sites inspected regularly, bait sites were not inspected during the first 7 days of free feeding to allow cats to become accustomed to the alternative food source without interference. All bait sites were inspected on 12 and 15 August 1988. The number and location of baits taken were recorded and those baits replaced. Positive bait take by cats was assessed by the presence of cat signs (tracks, scats) at bait station sites.

A total of 153 unpoisoned baits were laid over a period of 13 days. Each bait site was left in place for 11-13 nights resulting in a total of 153 free-feed bait site nights (where one free-feed night was equivalent to the operation of a bait site for one night). At the conclusion of free feeding, baits had been taken from 11 of 13 sites. Uneaten baits were collected and removed.

Poison baiting involved the use of dead, 1-day-old chickens as baits that were head-injected with 4.5 mg sodium monofluoroacetate (1080 poison) per bait. This bait has been successfully used as a poison carrier against Feral Cats on Tasman Island (Brothers 1982). As Feral Cats have a LD<sub>50</sub> of 0.4 mg per kg for 1080 (McIlroy 1981), a volume of 4.5 mg 1080 per bait was considered adequate to kill any cat eating a single bait.

Poison baits were laid at 11 of the original free-feed sites and 20 new sites. Bait sites were inspected daily between 17 and 19, 22 and 25 August and 29 August and 1 September. Baits taken were replaced with poisoned fresh chickens. Bait sites were left in place for between seven and 16 nights.

In August 1990, poison baiting was repeated (using the methods described above) because the continued presence of cats had been confirmed through a sighting and observation of tracks and scats. Preliminary free feeding was not undertaken due to time limitations. Sites were inspected, and baits replaced daily, between 7 and 10 August and on 14 August.

*Trapping*

Large treadle cage traps were set at sites showing evidence of recent cat activity. Traps were baited with either 1-day-old chickens, cooked oxen liver, fresh rabbit,

**Table 1.** Free-feed and poison-baiting effort and rate of bait uptake

Baiting effort and bait uptake	August 1988		August 1990	
	Sites 1-13	Sites 14-33	Total	
Free feeding*				
No. bait sites	13	–	13	–
No. nights per site	11–13	–	–	–
No. bait site nights	153	–	153	–
No. baits laid	153	–	153	–
No. baits taken	146	–	146	–
Mean bait take (%)	96	–	96	–
Bait take range (%)	94–100	–	94–100	–
Bait take by cats (no. sites)				
Positive†	4	–	–	–
Negative‡	7	–	–	–
Poison baiting*				
No. bait sites	11	20	31	15
No. nights per site	16	7–9	–	8
No. bait site nights	176	154	330	112
No. baits laid	292	166	458	154
No. baits taken	244	100	344	132
Mean bait take (%)	81	56	65	91
Bait take range (%)	38–100	20–100	20–100	69–100
Bait take by cats (no. sites)				
Positive†	6	1	7	2
Negative‡	5	18	23	12

\*Sites where there was no bait removal during free feeding or poison baiting have been excluded from further analysis and results. This accounts for the apparent discrepancy in figures for No. bait sites and Bait take by cats (no. sites). †Positive bait take by cats determined by presence of cat scats and/or footprints at bait sites. ‡Negative bait take by cats determined by absence of cat scats and/or footprints at bait sites.

fresh fish or tinned fish. Trapping was undertaken between 16 August and 1 September 1988, 23 and 26 January 1989, 6 and 14 August 1990 and 7 and 10 August 1991. Cages were checked daily except over weekend periods during the August 1988 programme when cages were closed. Trapping details are provided in Table 2.

### Shooting

Spotlight searches for cats were undertaken in January 1987 (20 spotlight hours), August 1988 (25 h), January 1989 (11 h), August 1990 (27 h) and August 1991 (4 h) in those areas of the island readily accessible by foot. Spotlight searches were undertaken in groups of two people, except in January 1987 when a party of five (two shooters, three spotlighters) was used. Two shooters carried out separate dawn searches for cats in August 1990 (20 observer hours). The number and location of cats seen and hours of observation were recorded. Animals were shot wherever possible and sexed. A total of

87 and 20 observer hours were spent on spotlight and dawn searches, respectively, as part of the control and intensive monitoring phase.

### Monitoring programmes

Intensive monitoring was undertaken throughout and immediately after the control programme (i.e. January 1987 to August 1991). Over this period, the status of the Feral Cat population was assessed by recording cat presence by spotlight and dawn searches, opportunistic daylight sight-

ings and intensive searches for scats and tracks.

Between February 1992 and October 1998, periodic monitoring was undertaken by National Park rangers and involved searching for cat scats and tracks as part of regular visits to Gabo Island. Lighthouse staff permanently based on Gabo Island until 1995 (replaced by National Parks Service staff after 1995) were requested to report any cat sightings or traces.

Hair sample tubes were established and left in place from 18 August to 22 September 1992 (35 nights) in an effort to detect any remaining cats. A large PVC hair tube (after Scotts & Craig 1988) was set at each of 40 sites (1400 sampling nights). Tubes were baited with either cooked meat scraps wrapped in a piece of pantyhose or a mixture of peanut butter, honey and rolled oats. Most tubes were fixed to the ground although a small number were wired to tree limbs. Hairs adhering to the sticky, double-sided tapes placed within the tubes were identified using the techniques described by Brunner and Coman (1974).

## Results

Table 3 details the ongoing status of Feral Cats on Gabo Island between 1987 and 1998 as indicated from the various control and monitoring techniques used. Results from each of the techniques are presented separately below.

### Poison baiting

Table 1 describes free feed and poison bait removal throughout the 1988 and 1990 baiting programmes. Sites where there was no bait removal during the free feed (two sites) and poison stages (one site) have been excluded from data analysis.

In August 1988, positive bait take by cats

**Table 2.** Cage trapping effort and results

Trapping data	Year				Total
	Aug. 1988	Jan. 1989	Aug. 1990	Aug. 1991	
No. trap sites	47	11	20	6	84
Trap nights	288	33	115	18	454
No. cats caught	0	0	1	0	1
Trap success (%)	0	0	0.9	0	0.2
Positive cat presence (no. sites)	3	2	2	0	7

**Table 3.** Indications of feral cat presence on Gabo Island 1987–98

Control/monitoring method	Control/monitoring method			Control and intensive monitoring phase					Periodic monitoring phase		
	Jan 1987	Aug 1988	Oct 1988	Jan 1989	Apr 1990	Aug 1990	Mar 1991	Aug 1991	Feb 1992	Aug 1992	Aug 1992–Oct 1998
Spotlighting (cats shot)	Y	N	–	N	–	N	–	N	–	–	–
Spotlighting (cats seen)	Y	N	–	N	–	N	–	N	–	N	N
Daylight sighting	N	N	Y	N	Y	N	N	N	N	N	N
Poisoning	–	Y	–	–	–	Y	–	–	–	–	–
Trapping (cats captured)	–	N	–	N	–	Y	–	N	–	–	–
Trapping (positive cat presence)	–	Y	–	Y	–	Y	–	N	–	–	–
Tracks/scats observed	Y	Y	Y	Y	Y	Y	Y	N	Y <sup>1</sup>	N	N

Y, positive indication of cats; N, negative indication of cats; –, not assessed or method not attempted; Y<sup>1</sup>, decomposed scats at least 6 months old.

was recorded at four free-feed sites located south of the harbour to the northern part of the island (Fig. 1). Uptake of free-feed baits was highly variable across sites. Seven sites recorded positive indications of poison bait take by Feral Cats and were concentrated in the vicinity of the harbour to the northern-most tip of the island (Fig. 1). Cat carcasses were not found, although a strong odour of decaying animals was detected in the vicinity of five sites following poison bait removal. Bait take from the remaining 23 sites could not be positively attributed to cats.

In the August 1990 programme, poison bait uptake was relatively high and consistent across all sites. Two sites situated in the centre and east coast of the island showed positive indications of bait take by cats. Bait take from the other 12 sites could not be attributed to cats. Cat carcasses were not found.

Bait take by rats, as indicated by footprints and scats, was evident at a large number of bait sites during the 1988 and 1990 programmes. It is highly probable that the introduced Brown Rat (*Rattus norvegicus*) was responsible for non-target bait take as this is the only mammal which occurs in high numbers across Gabo Island (K. Twyford, unpubl. data, 1995). There was no indication of bait take by any other non-target species.

### Trapping

Table 2 summarizes results from trapping programmes undertaken from 1988 to 1991. Despite a trapping effort of more than 450 trap nights, only a single cat was captured, this occurring in August 1990 when an adult

female cat was captured toward the centre of the island (Fig. 1). The trap was baited with a 1-day-old chicken and had fresh shark placed under the trap to act as a lure. Upon autopsy, it was apparent that the animal had not lactated and was not pregnant.

Positive indications of cat presence were evident at trap sites located in the northern parts of the island in 1988 and 1989, and in 1990 in the central woodland and the east coast (Fig. 1). There was no evidence of cat presence around traps in 1991 (Table 2).

Non-target species captured in cage traps were Brown Rats, Little Penguins and an unidentified skink. Evidence of rats (*Rattus* sp.) was found in a number of traps although few individuals were captured due to the heavy trip setting used.

### Shooting and sightings

A 4 h spotlight search on 27 January 1987 involving a party of five personnel recorded 28 cat sightings, including 16 individuals in the vicinity of the quarry, north-east of Gabo Harbour (Fig. 1). Apart from the quarry, spotlight observation of cats was most successful on the relatively open rock platform surrounding the Island where visibility was best. Of the 16 cats observed in the quarry area, three (two females, one male) were shot. The other 12 sightings were widely dispersed across the island and, in most cases, are likely to represent separate individuals. These sightings support the estimate that at least 30 animals, and probably more, were resident on the island at the commencement of the control programme.

After the January 1987 baiting programme, no spotlight or dawn search

yielded any further sightings of cats. Lighthouse staff made incidental sightings of single cats in October 1988 and April 1990 (Table 3). These sightings, along with other evidence of continued cat presence (scats and tracks), precipitated additional control programmes in January 1989 (trapping and shooting) and August 1990 (poisoning, trapping and shooting).

There have been no sightings of Feral Cats since April 1990 despite the permanent presence of lighthouse staff, and more recently National Park staff, on Gabo Island throughout this time (Table 3).

### Monitoring programmes: Sparse but useful results

Analysis of mammal hair from hair tubes retrieved in September 1992 failed to yield a positive indication of cat presence. Brown Rat and House Mouse (*Mus musculus*) were positively identified through hair tube analysis.

The presence of fresh scats, tracks and scratchings was recorded during all trips to Gabo Island between January 1987 and March 1991 (Table 3). Three fresh cat scats were collected in March 1991. Subsequent analysis suggested that two of these scats may have been deposited by the same animal due to the similarity in colour of grooming hair in the scats (B. Triggs, pers. comm., 1991). In February 1992, three cat scats were collected but were assessed as being at least 6 months old, probably more, based on their advanced state of decomposition (B. Triggs, pers. comm., 1992). There have been no further sightings of Feral Cat scats or tracks since February 1992.

## Discussion

### *Poison baiting: Rapid knock-down*

Eradication of Feral Cats from off-shore islands has previously been achieved through the combined and persistent use of several methods. Veitch (1985) considered that a quick initial population reduction by poisoning or biological control was required, followed by an extensive and persistent effort to remove the remaining animals.

Previous programmes involving successful poisoning of cat populations on islands used a variety of baits. Fresh fish and seabird flesh have been effectively used as poison carriers in major operational programmes against Feral Cats on islands (Rauzon 1985; Veitch 1985; Domm & Messersmith 1990). On Gabo Island, 1-day-old chickens were a highly attractive bait for Feral Cats on the basis of bait-take data and are probably most effective in island situations where 'natural' prey are often birds (D. Paton, pers. comm., 1998). From an operational perspective, chickens are an attractive bait to use in poisoning programmes because of their ready commercial availability and ease of handling. Brothers (1982) similarly found a number of advantages in using 1-day-old chicks in poisoning Feral Cats on Tasman Island.

Eradication of Feral Cats from Gabo Island has relied heavily on the use of 1080 poison baits to achieve substantial 'knock-down' of the population. Poison baiting was undertaken in August when prey was at its lowest level. During this period, Short-tailed Shearwaters were absent, having migrated from the island in April-May, while nestling Little Penguins do not generally appear until September onwards. Experiences from Gabo Island demonstrate that the timing of poison baiting is important for Feral Cats and must coincide with periods when natural food supplies are low. Similar results have been reported for baiting of Feral Cats on the Australian mainland (Short *et al.* 1997).

Post-control monitoring indicated that poisoning resulted in the near elimination of the Feral Cat population on Gabo Island. Positive indications of bait removal by cats suggest that ingestion of poison baits resulted in the mortality of at least nine

animals. Based on the low frequency of cat traces observed after poisoning, it is highly probable that a large number of cats were also responsible for bait removal from a number of the other bait stations where bait take could not be positively attributed to cats. Secondary poisoning through ingestion of poisoned rats is also likely.

The use of poison baits to control or eradicate cats has had limited application in previous control programmes in Australia and overseas. Successful overseas cat eradication programmes using poisoning have been undertaken on Little Barrier Island (Veitch 1982, 1985), Jarvis Island (Rauzon 1985) and Matakoho Island (Clapperton *et al.* 1992). Baiting programmes against Feral Cats in Australia have neither been widely attempted nor particularly successful because of inherent methodological problems, particularly the selection of an attractive bait medium delivered in a target-specific manner. Exceptions include the work of Brothers (1982) who significantly reduced the numbers of cats on Tasman Island to a few individuals. Poison baiting has been used as a follow up to other control methods on North-west Island (Domm & Messersmith 1990) and Macquarie Island (Binns 1992). Conventional baiting on mainland Australia has generally given poor results against cats (Coman 1992; Risbey *et al.* 1997), although recent trials into alternative bait types show some promise (Dredge 1993; Short *et al.* 1997).

### *Cage trapping: Time consuming and ineffectual*

Control of cats using treadle-type wire cage traps was ineffective, consistent with previous efforts to capture cats in cage traps on the island. On the basis of signs observed in the vicinity of traps throughout the 1987-1991 control programme, it appeared that cats were not predisposed to enter cage traps. This apparent trap-shyness may have been attributable to individual cats being naturally cautious and thereby deterred from entering the confined spaces of the trap or due to factors associated with the availability of natural food resources.

Past experiences with the use of cage traps to capture Feral Cats on islands have met with mixed success. Trap successes of between 15 and 20% have been recorded

(e.g. Brothers *et al.* 1985; Rauzon 1985; Domm & Messersmith 1990) although this capture rate appears to be atypical. Most control programmes and ecological studies have demonstrated that cage trapping of cats is generally ineffective and impractical, with trapping successes less than 5% being characteristic (e.g. Jones 1977; Berruti 1986; Bloomer & Bester 1992). Cage traps are generally not recommended for broadacre Feral Cat control because of the logistical problems of deploying and maintaining enough traps to ensure that every cat encounters a trap (Coman 1991), combined with the apparent reluctance of some cats to enter the enclosed spaces of cage traps (Veitch 1985).

Despite the low trap success experienced in this control programme, the August 1990 capture of a female cat provided valuable information on the likely status of the cat population after the 1988 poisoning programme. The female cat captured was sexually mature yet had not produced a litter and was neither lactating nor pregnant. Female Feral Cats are known to reach sexual maturity at 10-12 months and to produce up to two litters each year (Jones 1989). That the female captured had not dropped a litter despite being sexually mature is strongly indicative that the population of Feral Cats had been significantly reduced to a level whereby mating had not occurred.

### *Shooting: Complicated by dense vegetation*

Only three cats were shot throughout the control programme, and few animals were observed except during the initial 1987 spotlighting session. The inability to observe cats after 1987 can be attributed to a combination of increased wariness among the remaining animals, the majority of cats having been successfully killed during poisoning operations in August 1988 and August 1990, and the general poor visibility over much of the island.

Although shooting has played a major role in the control of cats from a number of islands in Australia (Jones 1977; Brothers *et al.* 1985; Domm & Messersmith 1990) and overseas (Rauzon 1985; Berruti 1986; Bloomer & Bester 1992), these programmes have inevitably occurred on islands with flat

topography and open vegetation. Efforts to control cats by shooting on densely vegetated islands in New Zealand have failed (Veitch 1982; Fitzgerald & Veitch 1985). On the Australian mainland, Coman (1991) considered night shooting of cats to be 'virtually useless' in areas with any degree of ground cover.

#### *Success: Eradication achieved*

The August 1988 poison-baiting programme reduced the Feral Cat population to very low numbers. Based on the distribution and abundance of cat scats and tracks identified through intensive searching between October 1988 and April 1990, it appeared that only two or three cats remained on Gabo Island. Although it is not possible to categorically state why the number of cats appeared to be at such a low level in April 1990, the apparent inability of the cat population to increase over the 18 months since the August 1988 poison baiting may have been due to the remaining animals being all female. These indications were supported by the capture in August 1990 of a healthy, adult female cat which, although being of breeding age, was neither pregnant nor showed any signs of having reared kittens in the past. Such a low number of animals is consistent with the findings of Coman (1992) who reported that a Feral Cat population in mainland Victoria had not recovered from a control programme undertaken 4 years previously.

The most compelling evidence that poisoning significantly reduced the cat population is the scarcity of fresh signs (scats, prints) and absence of opportunistic or spotlight sightings. Since the August 1990 control programme, the only positive indications of the continued presence of cats on Gabo Island have been the observation of decomposed scats (6+ months old) in February 1992. Further recordings of fresh signs have not been made despite intensive searches in areas known to have been frequented by cats in the past and general searches across the remainder of the island. Additionally, sightings of cats have not been made since April 1990 despite the continued presence of lighthouse staff and, more recently, National Park rangers, on the island and the many hours of daylight and spotlight searches undertaken as part of this programme.

Trapping outcomes and post-control monitoring pointed towards a critically small population of Feral Cats remaining after the 1988 and 1990 poisoning programmes. In the period between 1991 and 1998, ongoing monitoring has allowed us to confidently state that the remaining cats have been unable to sustain a viable population and are no longer extant on Gabo Island.

Eradication of Feral Cats from Gabo Island can be attributed to a highly successful poison-baiting programme which has not been demonstrated elsewhere on Australian islands. One-day-old chickens were an attractive bait for cats, probably due to their similar appearance and palatability to seabird nestlings, upon which cats were known to prey. Additionally, baiting was strategically timed to be undertaken throughout August when the food supply for cats was at its lowest level.

Prior to the present study, the only known cases of successful eradication of Feral Cats from Australia's offshore islands were Reevesby Island (Pedler 1991) and North-west Island (Domm & Messersmith 1990). The Feral Cat eradication programme on Gabo Island has identified a successful operational poison-baiting technique that may have application in cat eradication programmes on other islands.

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