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Eradicating introduced mammals from a forested tropical island

Cristina Rodríguez, Roxana Torres, Hugh Drummond*

Instituto de Ecologia, Universidad Nacional Autonoma de Mexico, Department of Ecology and Evolution, Ciudad Universitaria, s/n, AP 70-275, 04510 Mexico City, DF, Mexico

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ABSTRACT

Methodologies developed in New Zealand for eradication of exotic mammals from temperate oceanic islands were adapted for use on a topographically complex, 194-ha, densely forested, tropical island off the Pacific coast of Mexico. Isla Isabel is a National Park and a nesting refuge for nine species of marine birds, but the island's extraordinarily dense population of cats (113/k^2) was annually killing 23–33% of nesting sooty terns. We provide quantitative descriptions of the implementation and outcome of the methodologies over a period of three years, culminating in successful eradication of cats, but not rats. We also provide quantification of the effects of cat eradication on sooty tern mortality over a period of 11 years.

1. Introduction

Marine islands are especially vulnerable to disturbance and their faunas have suffered degradation worldwide due to human activities (Diamond, 1985; Vitousek, 1988; Rauzon, 1992), particularly the accidental or deliberate introduction of mammals (Coblentz, 1990; Bester et al., 2002; Smith and Bester, 2004). Because they often nest exclusively on small islands where native mammals are absent, marine bird populations tend to lack effective defences against exotic mammals and introductions commonly result in their depletion or local extinction (van Aarde, 1980; Moors, 1985; Bloomer and Bester, 1990, 1992; Rauzon, 1992). This problem affects many of the world's islands, 82% of which are inhabited by exotic rodents (Atkinson, 1985; Brockie et al., 1988). Introduced rats (*Rattus* spp.) and domestic cats (*Felis catus*) are often present together (cats are introduced to control rodents), and in combination these two species can be especially harmful to island ecosystems, affecting birds, reptiles, and native mammals (Moors, 1985; Atkinson, 1985; Diamond, 1985; Fitzgerald, 1988; Fitzgerald et al., 1991).

Wildlife managers have endeavored to eradicate populations of exotic mammals that are degrading island ecosystems, including goats (*Capra hircu*), pigs (*Sus domesticus*), rabbits (*Oryctolagus cuniculu*) and hedgehogs (*Erinaceus europaeus*) that were harming plants and invertebrates (Calvopina, 1985; Atkinson and Bell, 1973; Schofield, 1989; Bullock et al., 2004; Burbidge and Morris, 2004; Diger et al., 2004; Jones et al., 2005). Managers in New Zealand have developed techniques for eradication of rodents and cats from marine islands (Veitch, 1983, 1985, 2001, 2002a; Donlan et al., 2003; Veitch and Clout, 2002), and the techniques have been successfully applied in Mexico to 10 islands in the Gulf of California and 12 islands off the Pacific coast, all desertic (Tershy et al., 2002; Donlan et al., 2003; Wood et al., 2002). In 1995–1998 we adapted the techniques for use in the sensitive and challenging ecosystem of Isla Isabel, a densely forested tropical oceanic island.

* *Corresponding author:* Tel.: +52 55 5622 9007; fax: +52 55 5616 1976.
E-mail address: cjuarez@miranda.ecologia.unam.mx (C. Rodríguez).
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Here we report the successful eradication of cats and the unsuccessful attempt at eradicating rats from Isla Isabel, so that managers of similar ecosystems can benefit from our experience. Published documentation of unsuccessful and successful eradication attempts and their outcomes is rare and the absence of quantitative reports limits the development of eradication as a conservation tool (Donlan et al., 2003). In addition, we provide qualitative and (rarely available) quantitative information on how eradication of cats affected populations of the native species they preyed on.

2. Methods

2.1. Study area

Isla Isabel (21°52′N, 105°54′W), an uninhabited 194-ha Pacific island whose steep and rocky slopes are clothed with relatively dense tropical forest, was declared a National Park in 1981 because it is a nesting refuge for nine species of marine birds and six species of reptiles. The three zones of the island and their major habitat types are: I. Central forested zone, with two species of trees: *Crataeva tapia* and *Euphorbia schelechandalii*, beaches and tidepools and a hypersaline crater lake; II. Northeastern forest, grassland, rock slabs, introduced plants (sugar cane and bananas), boulderfields and tide pools; and III. Southern grassland, forest, introduced plants (sugar cane, bananas, pineapples and limes), fishermen's camp and beaches.

In 1930, ship rats (*R. rattus*) and domestic cats (*Felis catus*) were introduced on Isla Isabel by fishermen and by 1991 Isla Isabel had one of the densest insular populations of feral cats in the world (113/k^2, Osorio and Torres, 1991; cf. Fitzgerald and Veitch, 1985). The feral domestic cats were annually killing 23–33% of nesting sooty terns, and the tern population declined over 13 years from 150,000 to roughly 1000 individuals, probably because cat predation depleted the population and discouraged nesting (Gaviño and Uribe, 1978; Osorio and Torres, 1991). In 1995 a cat killed 1–3 chicks per nest in nine of 61 monitored nests of Heermann's gulls (*Larus heermanni*, Drummond, unpublished data). A study carried out in 5 months of 1990 and 1991 (December, March, May, June and July), which included the sooty tern nesting season, showed that the island's cats subsisted on marine birds, fish scraps scavenged from a seasonal fishermen's camp, native reptiles and rats (50%, 25%, 24% and 1%, respectively, of food items in 327 scats; Osorio and Torres, 1991).

2.2. Preparation

The program began on October 21 1995, the start of a 5-week seasonal window of opportunity when we could work without substantially disturbing the island's vertebrate fauna, and when cats were least likely to shun our baits in favor of their habitual foods. During that period, there was (1) a lull in nesting by marine birds, (2) minimal availability of foods for cats to prey on or scavenge and (3) minimal human presence (and fish scraps) in the fishermen's camp. The disadvantage of working at this time, 1 month before the end of the 5 month rainy season, was that the island's trees and grasses were dense and in many places nearly impassable.

During 9 days, 15 people worked 10 h/d to establish 94 trails over the whole walkable surface of the island (only cliffs were excluded), by cutting back vegetation with machetes just enough to allow passage (Veitch, 2001). The trails mostly ran parallel to each other, at 20 m intervals, and along each one we marked bait stations every 20 m using conspicuous nylon tapes (total = 1227 stations, Fig. 1).

First we started to eradicate rats, and 3 days later we started to eradicate cats. We began with rats so that cats would have the opportunity consume poisoned rats and die through secondary poisoning, and also to reduce the availability of rats as a food for cats, leaving cats to scavenge our poisoned baits.

2.3. Eradication of rats

A single technique was used to kill rats: poison baiting with brodifacoum, 50 ppm in 2.5 cm^3 scented wax and cereal cubes weighing 5 g (Talon-Klerat) (Kaukeinen, 1982, 1984). At every bait station one cube was offered every day, either in a bait tube (N = 247, roughly every fifth station) or resting on the ground (N = 980, all other stations). Every morning between 06:00 and 12:00 h we registered whether each cube was intact, chewed or missing, and replaced chewed and missing cubes with fresh ones. Bait tubes were 30-cm long white PVC tubes of 10 cm diameter (Taylor and Thomas, 1989, 1993), sealed at

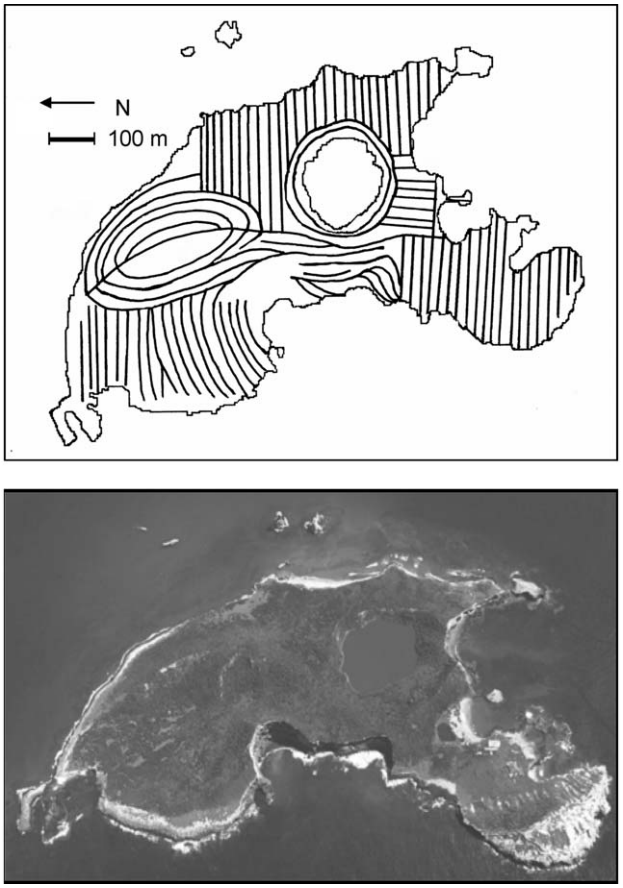

Fig. 1 – Isla Isabel, showing crater lake (bottom), islets and temporary baiting trails.

one end with a plastic cap and propped up at 45° by two wire legs, with the open end 15 cm above the substrate. Cliff terraces, slopes too steep for walking and islets were seeded daily with cubes by tossing them down individually from above or from boats, attempting to equal or exceed the density of cubes on the trails.

Starting October 30, 1995 poison baiting was carried out daily for 2 weeks (Taylor and Thomas, 1989, 1993; Donlan et al., 2003). We expected consumption to progressively approach zero, signifying that all rats are dead (Taylor and Thomas, 1989, 1993; Donlan et al., 2003). This did not occur, so we extended baiting for a further 4 weeks. Then baiting was terminated on December 8 when we could no longer traverse our trails because thousands of magnificent frigatebirds (*Fregata magnificens*) and blue-footed boobies (*Sula nebouxii*) were beginning to form pairs and defend breeding territories.

Toxic effects of brodifacoum do not start until 2–3 days after ingestion, allowing initially neophobic consumers a few days to acquire a preference for the cubes and accumulate a lethal dose of toxins in their intestines before any aversion to the cubes can develop (Pratt et al., 1977). Bait tubes largely denied access to non-target species such as hermit crabs (*Caenobita compressus*), land crabs (*Gecarcinus* spp.) and black iguanas (*Ctenosaura pectinata*). Although we originally planned to use tubes at all stations, we settled for only partial deployment to avoid the delays involved in transporting their bulk through the forest. Presentation of cubes on the ground (a common practice, e.g., Veitch, 2002a,b) risked some loss of bait to invertebrates but involved only minimal risk to other species because brodifacoum is not toxic to invertebrates or reptiles and is unattractive to marine birds, and the island lacks native mammals and has very few species of terrestrial birds and all are scarce (e.g., White-winged Doves (*Zenaida Asiatica mearnsi*), Pacific-slope Flycatcher (*Empidonaz difficilis difficilis*), Greenish Elaenia (*Myiopagis viridicata minimus*)).

2.4. Eradication of cats

We used three techniques to eradicate cats: poisoning, trapping and hunting with firearms. We poisoned with a 0.05% solution of 1080 (sodium monofluoroacetate, Eason and Frampton, 1991), injecting 4 ml of the (odorless) poison solution into 3 cm^3 (16 g) cubes of raw flesh of diverse species of locally captured marine fish or similar sized lumps of raw chicken flesh or canned tunafish. Each fish cube or chicken lump was suspended 40 cm above the ground from a tree limb using nylon fishing line, and lumps of tuna fish were set on plastic plates on boulders. In treeless areas, all baits were placed on small boulders. Baits were put out between 17:00 and 20:00 h, then unconsumed baits were removed and buried next day between 05:00 and 07:00 h. 1080 is an emetic but we did not use an anti-emetic to prevent cats from regurgitating our baits.

Just 2 mg of 1080 is sufficient to kill a 5 kg cat, and the poison degrades readily in (rain) water and has been used successfully in 28 mammal eradications in New Zealand and nine cat eradication programs elsewhere, without affecting other species of concern or contaminating ground water (Eason et al., 1993; Bester et al., 2000; Veitch, 2001; Nogales et al., 2004; Smith and Bester, 2004). Earlier pilot trials showed that baits hanging from tree limbs were inaccessible to whiptail lizards, iguanas, hermit crabs and Heermann's gulls. Access by gulls and reptiles was further restricted by offering baits mostly during the night, when those animals were inactive. There was never any sign that buried baits were accessed by iguanas, the only vertebrates that could have dug them up. Initially, there was no evidence that any other species took baits, so we attributed all disappearances to consumption by cats; in the third year, rats began taking the baits and we could not make this attribution (see below).

We trapped by setting leg-hold Victor 1.5 traps (Veitch, 1983, 1985, 2001) where they would be activated by cats that approached any of four attractants: (1) a 5 cm^3 (25 g) cube of raw fish soaked in fish oil was nailed to a tree trunk 40–50 cm above ground; (2) 200 g of "Nine Lives" commercial cat food was smeared over a tree trunk and the accompanying oil was sprinkled around the trap; (3) a 5×5 cm cloth bag of catnip was tied to a tree trunk; or (4) sand impregnated with the urine and faeces of domestic cats of another population, or vaseline containing mountain lion (*Puma concolor*) faeces and commercial mountain lion attractant were smeared or sprinkled around the lower trunks of trees or surfaces of boulders. Traps were located beside paths, in small clearings and outside potential dens such as crevices and small caves, and surroundings were often modified to funnel cats toward them (Veitch, 1985). Traps were checked twice daily, at 07:00–09:00 and 15:00–18:00 h.

Hunting was done by two experienced local game hunters, who together wandered the trails and paths of the island after dark and before dawn (20:00–01:00 and 04:00–06:00 h) looking for cat eyes reflecting the beam of their headlamps. One of the pair carried a .22 rifle or (in 1996 only) a shotgun.

We began on November 2 1995 with 8 days of daily poison baiting with fresh fish, designed to quickly kill as many cats as possible. Baiting was carried out daily at every other rat baiting station along every other trail; that is, at 40 m intervals over the whole island surface. Then we followed up by flexibly applying all three eradication techniques as needed until (four years later) no live cats remained on the island. Throughout the program we applied a diversity of techniques, baits and attractants, frequently varying them for the sake of novelty but also favoring techniques that had recently worked well. We monitored by all means available (sightings, footprints, scats, bait consumption, fishermen's reports) the presence of cats in all parts of the island and selectively deployed eradication techniques in areas with recent evidence for cat presence, areas near human habitations and areas with landscape features attractive to cats (e.g., ridges, caves, sparse vegetation). Because the scheduling and precise application of particular techniques (summarized in Table 1) were continuously modified over the course of the four years in accordance with results, their detailed description is presented in Section 3.

2.5. Ecological consequences of eradications

From 1991 to 2004 we estimated mortality of breeding adults in the part of the sooty tern population that nests every year in March and April in the grassland near the northern tip of the island. Each year, 30 days after the start of nesting, on a

Table 1 – Implementation of cat eradication techniques over 4 years

Technique	1995	1996	1997	1998
Poisoned baits	November Zones I, II, III 2397 baits Fish, chicken, tuna 16 days	March Zones I, II, III 22 baits/day Tuna 7 days	October Zone II 78 baits/day Fish, chicken 10 days	
Traps	November Zones I, II, III 34 traps/day × 6 days	March–May, October, November Zones I, II, III 57 traps/day × 47 days	January, October Zones I, II 56 traps/day × 22 days	January, February Zones I, II, III* 17 traps/day × 10 days
Firearms	November, December Zones I, II, III 7 h/day × 18 days	February–May, October, November Zones I, II, III 7 h/day × 27 days	October Zones I, II, III 7 h/day × 10 days	February Zones I, II, III 5 h/day × 5 days

* Traps were concentrated around the grassland area where sooty terns were nesting.

transect that roughly bisected the tern colony's nesting area through its long axis and a perpendicular transect that traversed the area half way down the first transect, we counted all the nests with eggs or chicks in a series of 5 × 5 m quadrats that were staked out at 10 m intervals (the number of quadrats depended on axis length). Assuming an elliptical shape for the nesting area, we converted this count each year into an estimate of the total number of adults nesting in the area. The death rate was estimated by counting the corpses (mostly just pairs of wings) of terns throughout the nesting area and up to 50 m beyond its borders as soon as the terns had departed the island.

Other, non-quantitative, estimates of impacts on populations of other animal species are based on non-systematic observations during the 5–7 months between December and July during which our team of researchers resided on the island every year between 1991 and 2004.

2.6. *Cost of eradication programs*

The 23 workers in the program included eight fishermen who normally camp on the island, whom we paid; seven students from colleges in San Blas, Tepic and Mexico City, who were unpaid volunteers; four personnel of SEMARNAP (the Ministry for the Environment, Natural Resources and Fisheries), two members of Island Conservation and the two coordinators (CR and HD). The program cost 16,717 US dollars, including a salary for one of the two coordinators, but not including the salaries of the island conservation staff or government officials, or the cost of marine transport, which was provided by the Mexican Navy and fishermen.

3. Results

3.1. *Eradication of rats*

Bait cubes were often found to be partially eaten and frequently bore the marks of two broad rat-like incisors. When baits were gone from a tube, frequently we found rat droppings nearby. The only non-target animals regularly seen in contact with the baits were cockroaches, hermit crabs and ants; as far as we know, the island's birds, reptiles and cats did not attempt to eat baits.

Roughly half of the baits offered each night over the 40 days of baiting were consumed (48% of 9432 baits were chewed or missing). Although low at the start, consumption increased progressively in all three zones, rising immediately in zone I but only after 5–25 days of stable consumption in zones II and III, where there is extensive grassland (Fig. 2). In zones I and III consumption peaked at 26–30 days then declined progressively by 53% and 9%, respectively, over the next 10 days. By contrast, in zone II consumption continued to increase right up to the final 5 days of baiting, when it reached a maximum of 85% with no sign of decline (Fig. 2). Summing across the three zones, consumption peaked at 61% at 25–30 days, then declined to 50% on days 36–40.

Continuing consumption after 6 weeks of baiting showed that the target population had survived the poisoning program. On December 8 we conceded failure and suspended baiting indefinitely because further baiting would disturb nesting by frigatebirds and boobies and because the patterns of recent bait consumption indicated that success was not imminent (consumption was not approaching zero, Fig. 2).

3.2. *Eradication of cats*

Overall, consumption of fresh fish baits was maximal on the first day (35%), declined steeply over the first 3 days and remained low thereafter, with only 7% of cubes consumed on

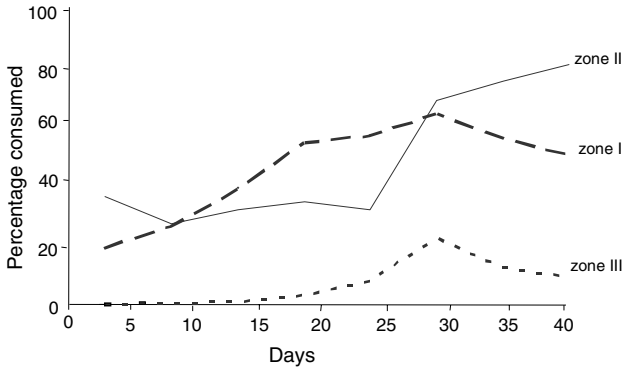

Fig. 2 – Brodifacoum bait cubes partially or completely consumed (or missing) in zones I, II and III (N = 6513, 1345 and 1574 cubes, respectively).

the 8 day (Fig. 3). (Our figures slightly underestimate the magnitude of the decline after the fourth day because of our practice of suspending baiting in areas with zero consumption over 4 days). The pattern of progressive decline varied among the three zones, but not greatly (Fig. 3).

From the steep decline in consumption of baits over the first 8 days we inferred that most of the island's cats had died through poisoning. Cats were still being detected in some areas so we carried out 6 days of trapping and 18 days of hunting in all cat-suitable habitats during November and December, and immediately baited with chicken and tuna during an additional 8 days block in areas where cats were detected (Table 1). We switched from fish to chicken and tuna to tempt individuals that declined to eat fresh fish, including any that may have acquired a dislike for fresh fish baits through partial poisoning and aversive conditioning. When all the baits in any area went unconsumed during four consecutive days, we suspended baiting there permanently. Over the 16 days of baiting in the first year, cats consumed 13% of fresh fish baits, 11% of chicken lumps and 66% of tuna lumps ($N = 2342$, 46 and 9 items, respectively); that is, 315 baits in total. In addition, in the first year two cats were captured by traps and eight cats were killed by hunters.

In the first 2 months of the second year (1996), although the island's cats were far less in evidence than usual, there were signs of continued cat presence in the forest of zone I, the grassland of zone II and the fishermen's camp and areas of introduced vegetation of zone III. In response, we deployed in those areas the techniques that were working best at the end of the first year. During seven nights in mid March we set 22 tuna baits/night; on 47 days during March, April, May, October and November we had 57 traps in operation; and the two hunters patrolled the island on 27 nights during February, March, April, May, October and November (Table 1). Overall, 6% of 154 baits were consumed, nine cats were captured by traps and the hunters killed a single cat, showing particular efficacy of poison baits and traps when the population of cats was at a low ebb.

In the third year (1997), we responded to the presence of footprints and a sighting on a beach in zone I, and occasional sightings in the introduced vegetation and fishermen's camp of zone III by briefly deploying our three techniques in all three zones. Thus, 56 traps were set on 22 days in January and October, hunters patrolled on 10 nights in October, and during 10 days in October we baited with fresh fish cubes and chicken lumps on alternate nights along 22 trails that were reopened for the purpose. The traps and hunters were largely unsuccessful (just one cat was trapped and the hunters never saw a cat), but 37% of 778 baits were consumed. However, we eventually concluded that trapping and hunting were largely unproductive not because they were ineffective at this stage but because there were virtually no cats still alive on the island; and that the extraordinarily high consumption of baits was carried out by rats, which for the first time were seen (often) feeding on baits. It was in October of the third year that the program clinched its aim, when the island's last cat was trapped in zone II.

In the fourth year (1998) there were no signs of cats anywhere on the island. Even so, to be sure of success, hunters patrolled on five nights and 17 traps were set on 10 days, with half of them around the colony of sooty terns that had always suffered heavy cat predation. Poisoning was not used because we expected that rats would usurp the baits. No cats were trapped or detected by the hunters and we concluded that all of the island's cats were dead.

The 30 recovered carcasses, which we buried on the island, included 19 adult females with a snout–vent length of 360–585 mm (510 + 72.1 mm, X ± s.e.) and weighing 750–4000 g (2479 ± 943.7 g); and 11 adult males with a snout–vent length of 480–665 mm (576 ± 56.7 mm) and weighing 2700–4700 g (3731 ± 723.6 g).

3.3. *Ecological consequences of eradications*

The eradication programs wrought several conspicuous changes in abundance of the island's vertebrate fauna, although only the release of sooty terns from cat predation was documented by quantification.

Before the eradication program, the number of terns found dead at the end of the nesting season equated to 23–33% of the nesting population, but after cat eradication the figure dropped to 5% then remained below 2% through the year 2004 (Fig. 4).

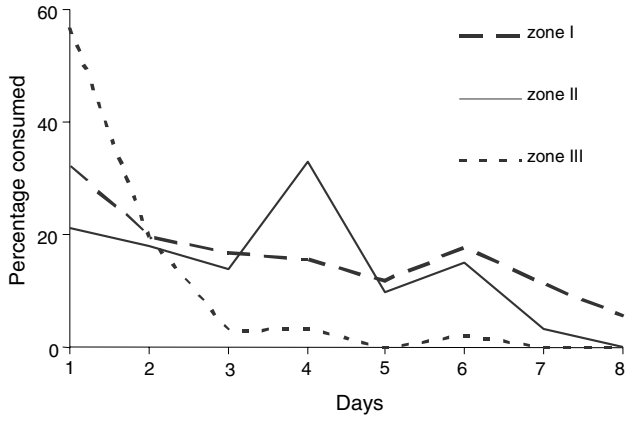

Fig. 3 – Fish baits consumed by cats (or missing) in zones I, II and III ($N = 1935$, 243 and 204 baits, respectively) in the first 8 days of baiting.

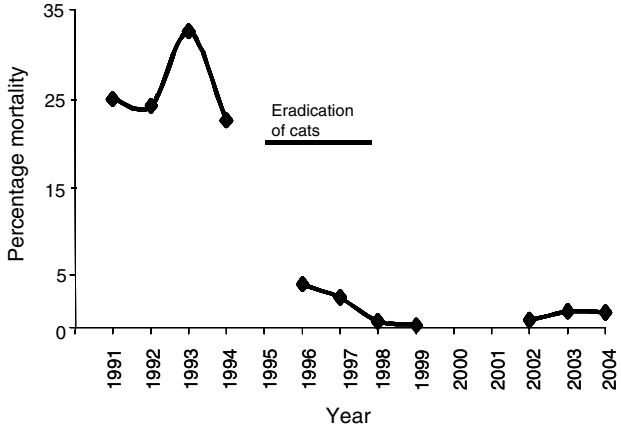

Fig. 4 – Mortality of nesting sooty terns before and after cat eradication. No tern data were recorded in 1995 and 2000–2001.

The proportion of reproductive terns that died was significantly lower in the 7-year block after cat eradication than in the 4-year block preceding eradication (0.018 vs. 0.230, $G = 1253$; df = 1; $P < 0.0001$; Fig. 4). Isla Isabel terns are preyed upon by peregrine falcons (*Falco peregrinus*, unpublished data, Drummond, H. Rodríguez, C. and Tobon, E.) and possibly also by rats and land crabs (we have seen both eating dead terns at night but we did not see whether they scavenged or killed the terns) and black iguanas. We cannot tell what proportion of deaths in any year were due to different causes (including illness and senescence), but our data suggest that eradication of cats resulted in mortality of terns falling permanently by more than 80%. The fact that after cat eradication tern mortality decreased by more than 80% at a time when the rat population apparently increased suggests that rat predation of adult terns was always low.

Thirteen months after the unsuccessful rat eradication program, the abundance of rats in many parts of the island appeared to have increased considerably, but numbers seem to have declined since then. From November 1996 to the present day, we have maintained a program of sporadic control of rat numbers in the island's two seasonal human camps (fishermen's and biologists'), successfully using poisoned baits (flocoumafen, diphacinone and brodifacoum).

Since 1995, the abundance of black iguanas seems to have doubled or quadrupled, and the arboreal and previously rare Clark's spiny lizard (*Sceloporus clarkii*) has frequently been observed in zones I and II.

4. Discussion

Failure to eradicate ship rats using techniques that have successfully been used on numerous temperate islands in New Zealand and arid islands in Mexico, may have been due to hasty implementation without first studying the behavior and ecology of the target population. Elimination of the island's cats was urgently required to avert the imminent local extinction of the island's sooty terns, and the cat eradication program required that we seriously deplete and preferably extinguish the population of rats so that (1) cats would eat our baits rather than eating rats and (2) the rat population released from cat predation would not expand and threaten the ecosystem. With hindsight, the rat program may have been doomed to fail because we did not confirm the palatability of brodifacoum-laced wax block bait to Isla Isabel rats or study the seasonal availability of their normal foods. We attempted to eradicate rats at a time (the end of the 5 month rainy season) when seeds and fruits from the island's grasses and trees were abundantly available to the rats. Alternatively, access of rats to our baits may have been overly limited by placing some baits in elevated tubes or by offering only a single cube at each station (Tershy, personal communication). And baits may have been consumed by terrestrial hermit crabs (*Coenobita compressus*). We saw some hermit crabs feeding on baits but have no way of estimating how many they consumed. Studies of behavior and ecology would have enabled us to address the problems of rats finding the candidate bait distasteful, ignoring it because familiar alternative foods are plentiful, or failing to encounter it because tubes deny access. As it turned out, the continued survival of rats on the island, initially at low densities, did not prevent us eliminating the population of cats, and expansion of the rat population has not, to our knowledge, prejudiced the island ecosystem.

Successful eradication of Isla Isabel's cats vindicates use of a methodology developed on temperate islands on a small and rocky tropical island with steep relief and varied habitats including extensive and relatively dense deciduous forest and inhabited by tens of thousands of marine birds belonging to nine species (and an otherwise limited native fauna). Brief intensive use of poisoned baits (in a novel hanging presentation) over the whole island eliminated the majority of the island's numerous cats, then poisoning, trapping and hunting using varied attractants over three years were needed to kill the last individuals. Importantly, cats readily consumed baits that were unfamiliar foods (chicken and tunafish) or familiar foods in unfamiliar presentations (fish scraps hanging from branches), showing that novel baits can be used with feral cats despite their reputed neophobia (see also Algar et al., 2004). Deployment of particular techniques in particular zones was guided by intermittent monitoring of all island habitats for signs of surviving cats and selective use of techniques, baits and attractants which had recently functioned well or were novel. Systematic record keeping of bait consumption and other cat signs provided important feedback on changes in the size of the cat population, guided the choice of baits and helped us attribute the accelerating consumption of suspended cat baits in the third year to rats. The rat population may have progressively incorporated suspended cat baits into its diet through processes of social learning (Heyes and Galef, 1996), but this shift in diet did not happen nearly fast enough to prejudice the critical cat poisoning campaign at the start of the program.

Involvement of several members of the local community of hundreds of fishermen from several villages on the mainland coast was critical to our initial success and to subsequently maintaining the cat-free status of the island. The program provided some fishermen with off-season paid work, and by participating they came to assimilate the aims of the program and promote those aims in the wider community. For instance, much monitoring of the continued existence of cats on the island consisted of collating the informal reports from fishermen who visited different parts of the island as they went about their own business. In addition, we followed up our work with a 2.5-year education program (February 1997 to July 1999) aimed at modifying the fishermen's attitudes and practices in relation to conservation of the island ecosystem, and improving the quality of life in the fishermen's camp (Ibarra Contreras, 2002). The fishermen have consistently been our allies and they have declined to reintroduce cats despite infering that the increased abundance of rats in their camp is due to eradication of the cats.

Importantly, an extraordinarily dense population of cats was eradicated at modest cost, resulting in probable long-term protection of the thousands of marine birds that inhabit the island. This is the first eradication of cats from a tropical island in Mexico and it resulted in immediate conservation benefits for three native populations, evident in the case of black iguanas and Clark's spiny lizards and proven in the case of sooty terns. This result is similar to what has been found in

cat eradications elsewhere (Bester et al., 2000; Keitt and Tershy, 2003). It remains to be seen whether a rat eradication program customized to the behavior and ecology of the target population can be similarly successful in the complex ecosystem of Isla Isabel.

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