live Fast, die young and kill to survive

the menace of stoats

written and photographed by Marty Taylor
Stoats

YOU could say that Selena kept herself warm in the most exotic sleeping bag in New Zealand. Researchers John Dowding and Elaine Murphy uncovered her dwelling while working in Fiordland’s Eglinton valley. “When we looked inside,” recalls John, “we found a bowl of feathers from some of the most endangered native forest birds in the country, including New Zealand robin, kakariki, kereru, mohua (yellowhead) and kaka.” Selena wasn’t some crazed eco-terrorist; she was a stoat the two biologists were tracking.

In a 1997 report to the Department of Conservation (DOC), Elaine identified several endangered species at risk from stoat predation, including the Haast tokoeka (one of the rarer South Island kiwi), North Island brown kiwi, Okarito brown kiwi, orange-fronted parakeet, black stilt, takahē and fairy tern. “Stoats are widely regarded as the most significant predator of a number of New Zealand’s most threatened and endangered native bird species,” she explains. “Stoat control will have to be ongoing if some endemic species, such as kiwi and kaka, are to survive on the mainland.”

In response to mounting evidence of the stoat threat, the Labour-led government allocated $6.6 million in the 1999 budget to the problem. A group, under Elaine’s leadership, was set the task of conducting research on stoats so that they would no longer pose such a danger to indigenous animals.

Stoats belong to the mustelid family (Mustelidae), a group of mostly small carnivorous mammals allied to dogs that includes wolverines, otters, mink, badgers, skunks and—also introduced to New Zealand—ferrets and weasels. Of the grim immigrant trio, the most versatile, widespread and deadly is the stoat. Stoats infest every terrestrial habitat—including areas above the tree line—and will eat birds, lizards, rats, mice, possums, insects and even koura (freshwater crayfish).

Native birds have been particularly hard hit by rats and stoats: since human settlement, 40 per cent of species have become extinct, and the proportion of those surviving classed as threatened is higher in New Zealand than in any other country.

Stoats were introduced from Britain in the 1880s in a misguided attempt to control rabbits, and until 1936 they even enjoyed legal protection as a “natural enemy of rabbits”. Yet they were soon implicated in the decline of native species, although, despite much anecdotal and circumstantial evidence, it is only recently that scientists have proven the causal link between stoats and species decline. Even now, the full extent of their influence on indigenous wildlife is poorly understood.

In the austere low-alpine tussock of the Tasman valley, John Dowding is catching and radio-tracking stoats in an attempt to learn more about their habits. His eyes pick up even the smallest of details. He stops abruptly, crouches and points. The grey boulders, pebbles and silt merge and I can’t make out what he’s pointing at. “There, 15 metres ahead—a wrybill.” Crouched statue-still on her eggs, a female dotterel with distinctive right-curving beak is practising the only defences she knows—immobility, silence and camouflage. These work with me but not with stoats. John has found wrybill remains—egg, chick and adult—in and around stoat dens.

Few people appreciate the extent of stoat predation on lesser-known endemic species. “People have largely been unaware of the threat to shorebirds, for instance,” explains John, “but these appear to have suffered at least as much as other birds.” According to The World List of Threatened Birds, published by the Smithsonian Institute, six of New Zealand’s most endangered species are shorebirds. “The New Zealand region currently has 155 species of endemic or native bird. Forty-five are threatened and a further 12 are near-threatened. We have no fewer than five of the world’s rarest shorebirds, with total populations of 110 individuals or less, and predation has been the main agent of this decline.”

We leave the wrybill to her fate and move on to check John’s traps. Peering through a slight gap round one trap door, John confirms there’s a stoat inside. Back at the
Stoats don’t make their own dens (opposite), but take over those of their prey, often using the fur or feathers of a victim—here a nesting female kaka—to upholster the interior. Ranging from beaches to the snow line, stoats are everywhere—even if their low-slung bodies, small size, and inconspicuous colour mean we are generally unaware of them. Those acute eyes and sharp ears—so vital in locating food—also mean they can stay out of the way of humans.

Hilux, he determines it’s a female, fits a radio collar, records details of the animal’s condition and names her. I’m surprised to see she’s almost entirely white. “She’s in her winter coat. White is ideal camouflage in snow.”

After releasing this latest catch, we start searching for stoats John has collared earlier. Pacing every couple of hundred metres, he hoists a tracking antenna above his head and listens as he changes its orientation. With each adjustment it emits a different pattern and intensity of clicks, indicating the direction and distance of radio-tagged stoats. The collar affixed to each stoat transmits at its own frequency, so tracing a particular animal is a straightforward matter of tuning in to the appropriate wavelength.

John points to a hole in the ground, obscured by matted tussock and matagouri. He takes a GPS reading, records the time, checks for any evidence of life, collects a few feathers and scats (stoat droppings), and moves on. By analysing scats, he gains clues about stoat diet and behaviour.

Stoats can be active at any time of the day or night. Home range varies significantly depending on habitat, season and abundance of food. Ranges often overlap, especially male with female, but most contain an exclusive core area.

Most animals take a substantial time to reinvade an area from which they have been cleared, but not stoats. As John explains: “It was believed that young females stayed close to where they were born and that they stayed there for most of their life. But Elaine and I identified a female juvenile stoat—probably pregnant—that travelled at least 65 kms in four weeks. Which goes to show that clearing stoats from an area is only effective while trapping continues.”

The carnage wreaked by stoats takes place largely in forest and country areas, out of the public eye. It isn’t easy, either, to pin a crime on the accused. “Stoats are extremely nervous, aggressive, secretive and mostly nocturnal,” says John. “Each of these factors makes it difficult to prove a link between stoats and a particular predation event.”

Nonetheless, over the years John and Elaine have compiled compelling evidence linking stoats with predation. One example concerns northern New Zealand dotterel. After the disappearance of five adult breeding pairs on Waiaua Spit, near Opotiki, Mark Dobbins, of DOC Opotoki, followed stoat tracks from a dotterel nest to a stoat den. “Marks in the sand showed clear indications that eggs had been rolled and bodies dragged to the den,” says John, and the den was found to contain dotterel remains.

Several days later Shane Morris and David Rush, also from DOC Opotoki, excavated a second den three metres from the first, and an adult stoat ran from the entrance and three young were found inside along with more dotterel remains. “One female stoat killed at least 11 dotterels within two months. The deaths represented one per cent of the breeding adults of the total population of the northern subspecies.”

Findings in the Tasman valley have confirmed the extent of stoat predation. “Remains of eggs, chicks and adults of pied oystercatcher, banded dotterel, spur-winged plover, wrybill and black-fronted tern have all been found in dens,” John comments. But research has also produced findings unrelated to predation. Interactions between stoats may be much more common than previously thought. “Males and females are known to interact during the breeding season, but we have found examples of males using a common den site consecutively in spring, and males and females using them consecutively in autumn outside the breeding season.” If further research confirms that stoats regularly come into contact with each other, and also with ferrets, the use of socially communicated sterilisation or bio-controlled agents may prove effective counters to their devastat-
a break in the cloud. He pushes the chopper’s nose over a windward lip and catches a much-appreciated updraft. Suddenly we break through the cloud and come to a sun-drenched snow tussock in a place with a distinctly other-worldly feel to it. From the top of the Murchison Mountains you can look across Lake Te Anau to the glacially gouged Clinton, Arthur and Eglinton valleys. Every three to five years the beech forests in these valleys experience a seed boom, or masting. In “intermast” years, hardly any seed is produced. Beech employ this cunning strategy either to swamp or to starve seed-eaters, thus ensuring that some of their seed survives. Through New Zealand’s evolutionary history, mast years have been times of plenty, when the animals of the forest have thrived and bred in great numbers. Variations in the birth and death rates of kakariki, kaka and mohua are closely related to the masting cycle. Mice—and sometimes rats—also proliferate in a mast year, and a short time later stout numbers erupt in response. Unfortunately, mouse-feasting stoats retain their taste for birds.

Until recently the Eglinton valley was one of the last strongholds of mohua. Once found throughout the South Island, the little yellow-headed birds have disappeared from more than 75 per cent of their range and are now restricted to just a few small pockets of beech forest. Two features of mohua breeding make them especially vulnerable to predation—their hole-nesting habit and their breeding timetable.

According to DOC’s Peter Dilks, “Mohua nest in knotholes so they are unable to see approaching predators, and when one finds them, they’re cornered.” Stoats and rats eat mohua eggs, chicks and incubating females. The birds begin to breed in November and may not finish until March, when stout numbers are at their highest.

The relationship between high stout numbers and mohua mortality is not straightforward. During a stoat eruption in the summer of 1999–2000, 60 per cent of nests were lost and 60 per cent of female birds were killed, mostly by stoats. To reduce stout numbers a low-intensity trapping programme was begun in 1997; then, during the summer of 1999–2000, 27 pairs of hatched mohua were intensively monitored, 66 per cent of which produced fledglings. The trapping programme appeared to protect breeding mohua from stoat predation. However, during two consecutive beech masts in the summers of 1999–2000 and 2000–01, numbers of rats sky-rocketed and the Eglinton valley mohua were wiped out. The evidence suggests that rats, not stoats, were the culprits. Further work is under way to see if stoat control allows rat numbers to escalate.

Kaka mortality, on the other hand, seems to be directly linked to stout numbers. In areas without stout control, kaka nesting success rates are usually below 38 per cent, while success doubled in the Eglinton valley after trapping had commenced.

In the Arthur valley, where there is no stout control,
Largely because of their keeping properties, eggs have been the traditional bait in stoat traps. However, a range of more attractive baits, incorporating such delicacies as salted and freeze-dried rabbit, are under development. Trained dogs—such as this pair owned by Scott Theobald of Trounson Kauri Park—are also being used to sniff out stoats, especially the breeding females which are particularly difficult to trap.

DOC has been investigating the impact of stoats on whio (blue duck). In the 2001–02 breeding season, six female whoio were monitored and nine nesting attempts observed. Five nests were destroyed before incubation could begin, and stoats were recorded killing one of the incubating females. The only nest to go undetected by stoats was located among boulders in the middle of a fast-flowing river. Within three days of fledging, however, one of the five ducklings, along with the mother, was killed by a stoat, and the other ducklings didn’t last much longer. Two other females in the valley were found covered in blood and with stoat-inflicted lacerations and puncture injuries to the head and neck, and were lucky to survive. Overall, two females were killed and no chicks survived beyond fledging.

In 2003, the International Union for the Conservation of Nature and Natural Resources (IUCN) raised the risk status of blue duck from vulnerable to endangered. The stoat problem isn’t confined to Fiordland. Through the Kiwi Recovery Programme, DOC has put a mammoth effort into saving the rowi (or Okarito brown kiwi)—one of the most endangered kiwi species—between Okarito and the Waiau River, in Westland National Park. The 11,000 ha rowi sanctuary occupies a corridor between the sea and the Southern Alps, and is clad in dense lowland rimu forest. Project leader Jo Crofton recalls the summer of 2002: “Things went nuts. The juvenile stoats started showing up in mid-November, and by Christmas Day we had only two radio-tagged chicks left. I went out on Boxing Day to check on one of them, and its signal was coming from under the ground. [Stoats store dead prey underground.] By early January, all 14 monitored chicks were dead.” A couple of weeks later, the last two chicks in the sanctuary were recovered and evacuated to Motuara Island, a bird sanctuary in the Marlborough Sounds.

Sid March, an experienced kiwi fieldworker who describes himself as a “frontline kiwi grunt,” has been working with kiwi on and off for the past 12 years, including with the Okarito project. He thinks that most conservation people underestimate the intelligence and adaptability of stoats. “They’re like scaled-down arboreal tigers that work below ground, in cavities, on the forest floor, and right up to the top of the canopy. I’ve watched one moving at high speed over the top of a tawa canopy in kokako country in the Coromandel Range. It moved along horizontal branches 10–15 metres up and jumped from leaf spray to leaf spray.

“On a separate occasion I was manning a kokako mist-net rig, with a speaker emitting tape-recorded kokako song. As I sat absolutely still, I heard a movement close by and was surprised to see a stoat stalking the speaker. With kokako near, I moved, and this scared off the stoat. They’re predators without peer.”

Near Blackball, on the West Coast, I was sitting once with a friend in his garden, surrounded by primal rimu and kahikatea forest. We were chatting beneath the towering trees, and listening to tui and bellbirds, while his delighted daughter chased giant dragonflies. In mid-phrase, my friend suddenly jumped to his feet, sprinted into the house and fetched his gun in feud-ing hillbilly fashion. Then: Crack! Crack! Two shots and two misses. Annoyed, he muttered, “I’ve been trying to shoot that bastard for weeks. They’re bloody hard to kill.” A stoat, of course.

Elaine Murphy agrees. “They have very few chinks in their armour and they’re incredibly adaptable.” However, as she goes on to explain, the news isn’t all bad. “We’ve made some promising progress on a toxin that is fairly predator specific, but we still have a few hoops to jump through. The trouble with PTF [Predator Toxin Formulation] is that although it works well in a lab situation, it’s not so good when delivered in a bait. Conservation, an Auckland company, have come up with some ‘secret herbs and spices’ to make it work better, but more non-target testing needs to be undertaken, especially with birds.”

Landcare Research and DOC have tested a host of substances in pursuit of a bait that will reliably entice stoats into traps and bait stations. As regularly replacing baits can be a lot of work, long-term attractiveness is another desirable quality.
Ian Domigan of Lincoln University has developed two new traps—Hammer and Thumper (see here)—which meet new humane killing standards that require animals to be rendered irreversibly unconscious within no more than three minutes. Freeze-dried mouse has met with some success, but after the first bite, a stoat’s appetite wanes. Softening carcasses by injecting them with gelatine improves their palatability. A French fragrance manufacturer has developed three synthetic scents using frozen samples shipped from New Zealand—rabbit musk, rat musk and rabbit aroma. Most devastating is rabbit meat, but there is still work to be done in integrating it into a suitable carrier. Dried pet foods, it appears, hold no appeal for stoats.

Improvements are also being made to traps. New models promise the swift dispatch of all captives—no escapes, no prolonged suffering.

The reproductive biology of stoats is unusual, and, with time, we may be able to find some way to exploit its idiosyncrasies. As Janine Duckworth, a reproductive biologist at Landcare Research, Lincoln, told me: “Female stoats are almost always pregnant. Males mate with the mother of a litter soon after she has given birth, then turn to the females in the litter. New-born females are normally receptive even before their eyes open. It’s a great survival mechanism for a solitary animal.”

Stoats do not pair bond, and there is a rapid turnover in the population (most die in their first year), so it is unlikely that males mate with their own young. Embryos develop to about 230 cells, then remain at that size until the following spring, when they become implanted in the uterus and complete their development over the next six weeks. Since females are such prolific procreators, it takes only a single mother to infest a new territory—which might be an entire island. And as stoats are capable of covering great distances quickly—particularly evident when young disperse to find their own territories—they can overrun a vast area in short order.

“When we started our work, we didn’t know what controlled pregnancy so we didn’t know how we could disrupt it,” Janine tells me. It is now evident, however, that levels of progesterone—one of the hormones essential for pregnancy—rise considerably when embryos are implanted in October–November. “So if we can disrupt progesterone, we can probably disrupt pregnancy,” another possible target is the embryo itself. Using the animal’s own immune system, it may be possible to attack the embryo while it is in the uterus. “The work that we are doing tricks the immune system into thinking that a protein that is really important for normal pregnancy is a foreign target. This immuno-contraceptive approach may result in effective stoat control—if the problem of delivery to the stoats can be sorted out.”

Stoats’ long skinny shape, agility and electric speed are great assets to a predator, but there is a downside: their fast-twitch muscle fibres need regular refuelling. Winter and early spring are the most energy-sapping time of the year for stoats. Males must eat a quarter of their body weight every day, while lactating females need to devour half to three-quarters of their body weight daily. Once a female starts feeding weaned young, she has to work even harder. Stoats unable to catch sufficient prey starve within 24 hours.

Since bushman Richard Henry’s abortive attempt in the closing years of the 19th century to relocate endangered flightless birds to Resolution Island, in Dusky Sound, many threatened species has become New Zealand’s bread-and-butter method of averting extinction. In the 20th century, translocation steadily grew in popularity, and by 1994 over 392 translocations of 50 species (42 birds, five reptiles and three invertebrates) had taken place.

The most suitable locations are islands out of the swimming range of stoats, but such refuges are in short supply. Murray Williams, from DOC Te Anau, suggests closer islands may still be useful. “A swim of a few hundred metres is possible but it still poses a substantial barrier. After eradicate predators from such an island, we expect reinvasions but we also expect the rate to be very low. It’s a rare stoat that chooses to swim more than a few hundred metres for its next meal. At present we don’t know how rare so we are trying to figure that out. One thing we are pretty confident of is that the speed of re-instatement on the mainland is much greater.” The Te Anau conservancy is undertaking its most ambitious inshore-island clearance—on Secretary Island, in Doubtful Sound.

Despite their obvious value as refuges, islands are no panacea in the war on stoats. They offer only a fraction of the range of mainland habitats. There are, for example, no high dry islands, so greckles, skinks and weta from arid valleys and ranges are unlikely to adapt to island life. As

Fresh dead lab rat, ground freeze-dried rat and synthesised rat-odour molecules have all been added to PVC pellets. The freeze-dried rat proved more attractive than the fresh, and although the odours alone were less potent than either, they still showed potential. Rabbit and sparrow have also been found to be palatable, the former more so than the latter. Freeze-drying or salting to maximise durability marginally reduced the attractiveness of rabbit meat. Stoats spent quite a while chewing salted rabbit—the most durable bait—but ingested relatively little, which suggested it would be suitable for a trap but less so as a carrier of poison.

Rabbit meat has also proven effective combined with wax and tallow, with gelatine, wax and bran, and with a dairy-product matrix. With polymer it was less toothsome.
While stoat predation stops many chicks even making it to hatching, the carcases of adult birds often bear the marks of stoat teeth. Here, Mike Elliot examines the remains of a bird killed by stoats in the Tasman valley, close to a site where the highly endangered black stilt occurs. Ground dwelling birds are not the only ones at risk since stoats are nimble climbers.

A partial response to this problem, an attempt was made in the mid-1990s to provide safe havens on the mainland. Known as mainland islands, there are now six of these dotted around the country.

Natasha Coad is a ranger in one of them—Trounson Kauri Park, near Dargaville. “We’re trying to restore the ecosystem by controlling pests,” she explains. “Traps ring the outer margin of the park with the intention of developing a protective boundary, a little like an island.”

In areas without stoat control, kiwi-chick survival sits at around five per cent. At Trounson the figure hovers around 38 per cent. “Our best year we had 86 per cent chick survival,” says Natasha. “We didn’t do anything different that year. It seems that some years you just get stoats that have a taste for kiwi.” A sustainable recruitment of chicks into the population requires a survival rate of at least 20 per cent. “We’re pretty close to capacity at Trounson, because we’re finding juvenile kiwi beginning to disperse.”

A promising initiative that has come out of Trounson is the training of dogs to track and locate predators. Lead trainer Scott Theobald is an advocate of the canine control of stoats. “Before I had the dogs I only caught three lactating females out of more than 300 stoats. It’s relatively easy to catch the juveniles after they leave their mother’s care because they’re young and dumb. The males are also easy to catch, but what we really want are the females in their dens with their kits.”

Mick, Scott’s first stoat dog, discovered a den with five kits and a mangled kiwi chick. “It’s important we catch these stoats that have eaten kiwi because young stoats brought up on kiwi will probably develop a taste for it and pass it on to the next generation of stoats.”

The dogs have four main roles: to locate stoats, to aid the investigation of sightings on supposedly stoat-free islands, to help ascertain islands are stoat-free, and to aid the setting-up of trap lines. Scott and his dog(s) are often rushed out to islands such as Great Barrier after members of the public report stoat sightings. Their contribution has enabled Murray Williams in Fiordland to declare islands free of predators, and Des South in the Murchison Mountains Special Takahe Area to identify the best places to set up stoat trap lines.

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Natasha Coad believes she has a responsibility to educate the public about the impact of stoats. Following a talk she gave at Kaipara College, all the students wanted her to answer a single question: “What can we do?”

“If you can feel something for a species,” she explained, “if you can feel something for what is around you, then that is a start. If you have pets, get them de-sexed so you aren’t contributing to the numbers of unwanted predators. Control your pets, especially if you take them hunting or live close to bush or natural habitats like beach dunes or bush. Stoats are everywhere, so you can volunteer to trap with your local council.”

Eden McLean, 11, is the youngest volunteer I’ve come across. I met him at Kuaotunu, on the Coromandel Peninsula, where he shyly extends his hand, welcomes me to Project Kiwi and introduces me to his dad, Victor, project...
Zealand Lotteries Commission, The Warehouse—the list
Then there are the financial supporters, DOC, the New
guides, farmers, committee members and many more.
As do particular students, the Whitianga Hotel, local tour
Helen’s business savvy.” Local schools get a mention too,
says Sharon. The generally high survival rate is due mainly
last year we had our worst year ever, with only 20 per cent,
Our best year we had 86 per cent survival, and on average we have 50 per cent, but
history, The statistics roll easily off her tongue, but the real
VICTOR McLEAN, Project Kiwi’s head trapper, explains
vulnerable stage until they reach a kilogram in weight. If a
It usually takes four to six months. You give them a good
Sharon reckons Project Kiwi saves 40–50 kiwi chicks
each season. “Our average survival rate means the popula
It is hungry or not.” Cradling the young kiwi, he beams.
It is a master of gliding flight, the royal albatross. But as Lyndon Perrimen,
New Zealand Geographic