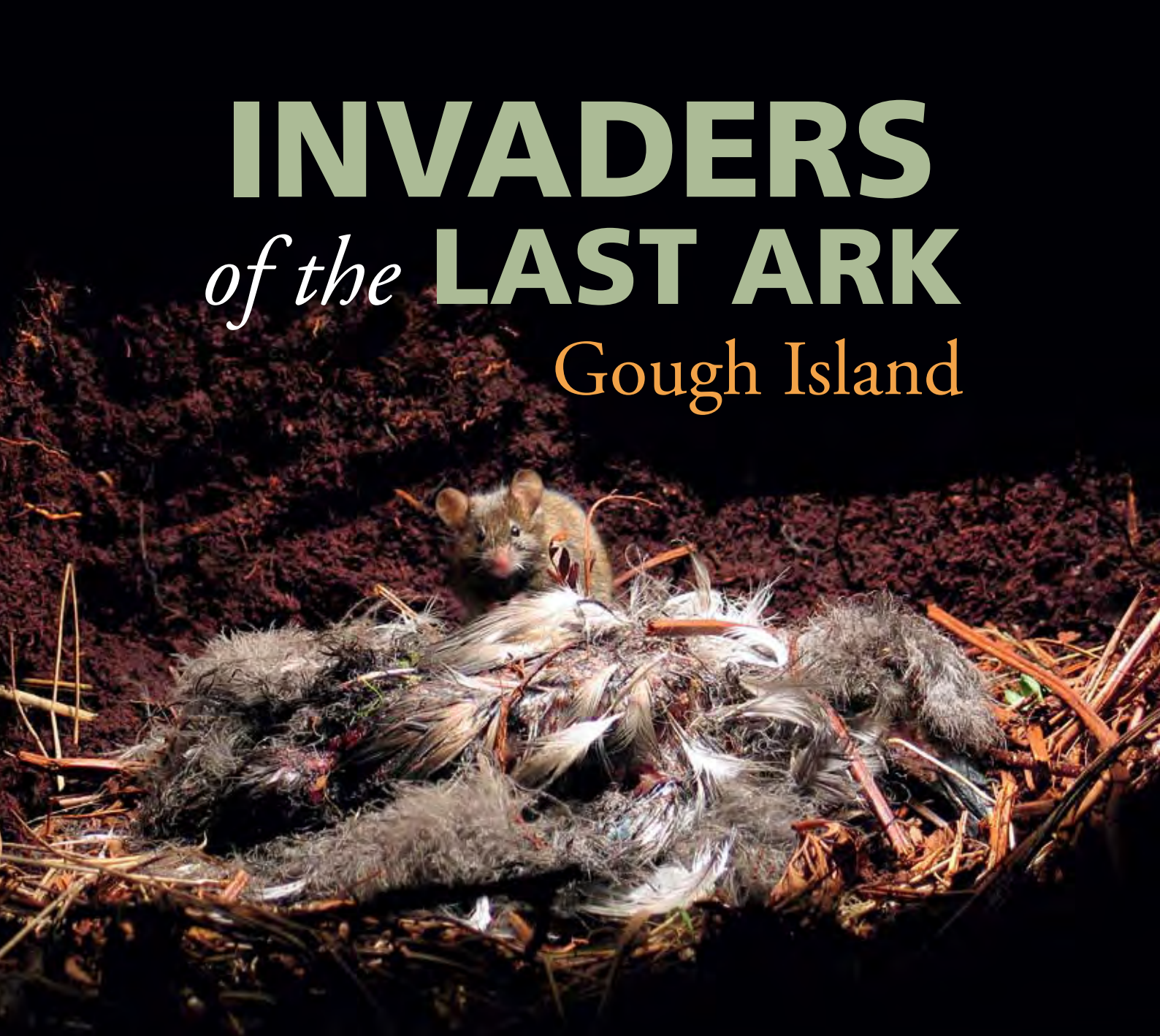
INVADERS *of the* LAST ARK

Gough Island



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It is only after the noise of the helicopter engines fades into the distance that the bizarre wails and staccato honking of courting Sooty and Atlantic Yellow-nosed albatrosses become audible. This is the greeting that the privileged few who get to visit Gough Island will invariably experience. Positioned as it is, roughly midway between the southern tip of Africa and South America, Gough is one of the least disturbed and most stunningly beautiful islands in the world and teems with spectacular seabirds. Its impressive isolation means that visitors are few and stays are generally short. For biologists, an opportunity to spend a year in such a pristine wilderness is the chance of a lifetime and, when it came, my wife Andrea and I grabbed it. Our mission was to discover what was causing large-scale nesting failure among the island's seabirds, but we were taken aback at what we found. ▶

Procellariiform seabirds (albatrosses, petrels and allies) come to Gough for one purpose: to lay a single egg and raise their single chick. And some do so in phenomenal numbers. At dusk each day, millions of petrels, shearwaters, prions and storm-petrels form loosely woven, shape-shifting carpets over the water and great swirling clouds of life as they wait for nightfall before coming ashore. This is one of nature's grandest spectacles, on a par with the migrating wildebeest of the Serengeti. After dark, the air fills with a mad cacophony as the birds call while in flight or from within their myriad burrows. A tumultuous abundance of life dominates the senses.

Gough is home to two endemic landbirds: a flightless, heavy-footed moorhen and a bunting with South American affinities. But Gough's seabird legacy is impressive – at least 20 species breed there. The Tristan Albatross *Diomedea dabbenena*, a close cousin of the Wandering Albatross *D. exulans*, is virtually confined to Gough, having been preyed upon and over-harvested to virtual extinction on the nearby Tristan da Cunha island group. A similar situation has rendered the Atlantic Petrel *Pterodroma incerta* essentially endemic to Gough. No other single island in the world has two endemic seabirds.

Gough's only human presence is at a meteorological station. This fact, plus a bit of luck, has kept Gough as one of relatively few islands in the world with no recorded avian extinctions. Also, with no ecology-transforming invasive plants (yet), it looks and feels much as we believe it should. But all that is changing. Something insidious has come, like a thief in the night, and it is devastating the island's natural heritage.

'Andy! It's happening!' I yelled as I slogged over the rise towards her. She already knew. Just five minutes earlier, as we sat down on the seaward flanks of Green Hill, looking out across the infinite horizon of the south Atlantic, we had marvelled again at the breathtaking beauty and grace of the overhead flight of the gigantic Tristan Albatrosses. As we scanned the 60-odd albatross study nests with our binoculars, we realised something was amiss, because since our previous visit a week before, close to 10 per cent of the nests were now mysteriously empty. This was a disturbing rate of failure for such long-lived, slow-reproducing birds, and the season had only just begun.

We split up to check on the remaining nests, most of which still had adults brooding their white, downy chicks. Suddenly our paradigm shifted from wonder to horror and despair. Gaping wounds darkly pierced the fluff of some chicks, rusty smears stained the white breasts of brooding parents. There could be no more doubt about what was causing the failures. The chicks were being eaten alive. After three years of waiting and careful planning, our worst fears had been realised. A vicious predator, alien to this environment and brought by thoughtless humans, had invaded this insular haven. It was running amok and doing untold damage to the defenceless chicks.

The culprit? Mice. 'Mice?', you ask. Surely I mean rats?

As we continued to check nests, the full extent of our discovery was graphically illustrated. A female guarding on Nest No.32 climbed off her chick as we approached. Closer inspection revealed the chick had been severely attacked by mice. Its entrails were hanging out from a huge hole in its lower belly, a congealed mess of dirt, blood and guts already replete with flies. It was barely moving, unresponsive to its parent or to us. While we watched, life ebbed from the hapless chick. Then something quite unexpected happened: the male parent returned. He'd probably departed the nest four or five days previously, leaving his mate to assume the brooding and guarding of their precious offspring while he flew trackless thousands of miles in search of food for the youngster. All would have been well when he left.

He landed next to the female and they interacted briefly – touching bills, giving gentle pecks and making the muted calls of pair bonding. But he had crop full of squid, and instincts and hormones were telling him that his growing chick was desperately hungry. As he headed for the nest, the female followed him. Subdued, we watched the male discover that his baby was dead. He lovingly nuzzled the pathetic little corpse, seemingly trying to wake it up. But his sense of smell – unparalleled in the bird world – was indicating to him that things were not right. Scavenging Southern Giant-Petrels *Macronectes giganteus* and Subantarctic Skuas *Catharacta antarctica* could also smell death and were beginning to gather. For nearly half an hour, the parents sat alongside their dead chick, constantly touching it with their bills, then touching each other while making low, crooning noises. These magnificent birds seemed to love their chick so much and to mourn their loss so keenly. It was, and remains, the saddest and most moving event of animal behaviour I have ever witnessed.

Why is this happening to these birds? How come an animal as small as a mouse, weighing just 25 grams, can walk up to a bird 300 times its size and kill it? Why doesn't the chick or the parent sitting on top of it do *something*? Even the chicks are well endowed with weaponry easily sufficient to kill a mouse. They have large, hooked bills with a razor-sharp cutting edge. One bite would do it. After all, they defend themselves against far more impressive dangers – the skuas and giant-petrels.

This story and the answers to these questions have many beginnings. It started a million years ago, when albatrosses colonised Gough Island as it rose, steaming and smoking, from the middle of the Atlantic Ocean. It began with a sealing ship in the 1800s, landing at Gough and carelessly bringing ashore some stowaway mice. It also got under way in 2001, at the end of the first year-long ornithological visit to Gough Island, when colleagues discovered that albatross ▷

Below *Andrea Angel examines a severely attacked Tristan Albatross chick.*

Opposite *Gough's wide-open landscapes and formidable weather make for truly wild natural beauty.*

Previous spread *In the nest-chamber of a burrow, a house mouse is caught in the act of eating the half-grown Atlantic Petrel chick it has killed.*

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chicks were dying in droves. It was then that Geoff Hilton of the Royal Society for the Protection of Birds and Peter Ryan of the Percy FitzPatrick Institute decided that more research was needed, and Andrea and I were available.

Gough is truly oceanic, isolated from continental land by thousands of miles of sea. Seabirds come to places like this to lay their eggs with impunity from predators. Albatrosses have evolved in a world without mammalian nest predators. For them, there is no need to hide their nests the way most landbirds do. They lay their eggs out in the open, on large pedestal nests made of mud and vegetation. Skuas and giant-petrels don't attack chicks because the youngsters keep a crop full of vile, fishy oil which they projectile-vomit at aggressors with surprising accuracy. It is virtually impossible for birds to clean oil off their feathers, and oiled feathers lose their waterproofing. This is especially bad news if you are a seabird living in the icy cold Subantarctic. So the predatory seabirds steer clear of healthy albatross chicks. Because there is no need for chicks to know how to use their bills to defend themselves, they have lost that behaviour (if they ever had it). It is one of the saddest, but most glaringly obvious truths about insular species: they cannot cope with novel predators. This is why the vast majority of bird extinctions have occurred on islands.

The common house mouse *Mus musculus* is an inveterate hitchhiking species, having sneaked onto islands around the globe. Until now, most ornithologists have been largely unconcerned about the threat of mice, compared to that of cats, rats and pigs. And with good reason, as these others are the kinds of invasive species that tend to lay waste to island bird populations in a very short space of time. Before we got to Gough, there was no concrete evidence that mice could have significant impacts on seabirds. But the Gough mice have grown big. Freed from their natural predators and competitors, the mice have multiplied to prodigious densities and become a plague of biblical proportions. They swarm in their millions across the island, each night devouring anything they can find: earthworms, flightless moths, seeds. They have also learned to eat seabird chicks alive.

To obtain the unequivocal proof that the mice were causing the wounds in the chicks, we had to film an attack. So, a week after our grizzly discovery, armed with a video camera, we set off for the highlands. Doing the nest rounds that day was depressing because so few chicks were surviving. Finally, we found a chick that had two large, fresh wounds. We trekked back to our tent and loaded up with camera gear for the recording, and protective gear for the weather. Because mice are nocturnal, we had to film at night, using infrared.

Shortly before nightfall, the first mouse appeared. It knew where to go and wasted no time in getting there. Even we could smell the wounds. Within an hour there were at least 10 mice crawling all over the chick, eating almost at will from holes through to its abdominal cavity. The severely weakened chick could only manage the occasional whimper or shuffled change in position. While the attacks continued relentlessly, we got the gruesome evidence we needed, and then some. The following morning the chick was dead, its carcass already picked clean by the scavenging birds.

During the course of the year, almost 1 000 chicks succumbed, with a mere 27 per cent of eggs resulting in a fledged albatross. Albatross populations cannot withstand such low breeding success indefinitely. Unless we intervene, population decreases are not only probable but, in the case of the Tristan Albatross, could contribute to their extinction within 50 years.

Some 20 years ago, and with little evidence to the contrary, biologists dismissed mice as a conservation concern to seabirds. The results from Gough have changed that. But what is so special about Gough, besides its unspoiled beauty and endemic birds? Intriguingly, it is one of fewer than 10 islands with sensitive bird populations where mice are the only introduced mammal. It seems likely that, elsewhere, mice are kept in check by other invasive aliens, such as rats and cats, which prey on them and/or compete for food resources. Around the world, island conservation actions are clearing more and more islands of rats and cats, often in order to protect threatened seabird populations. But, until now, mice have not been widely targeted for eradication because of the perception that they are relatively harmless. Results from Gough prove that to be a misperception, and we may well find that where mice are the only mammals, such as when left behind after cat or rat eradications, they too may evolve the rat-like behaviour that we discovered on Gough.

Oceanic islands are more than vaguely reminiscent of the biblical Noah's Ark, seemingly adrift in the middle of the sea, with their odd assemblages of species often found nowhere else. Invasive mammals wreak havoc in these vulnerable ecosystems. Technologies are being developed to tackle the problems of invasive species, giving some hope. The tragic attempts of yesteryear at biological control, such as using cats to 'keep mouse numbers down', were based on farmyard understanding of ecology. Nowadays, high-tech interventions use helicopters, differential GPS devices, digitised spatial images and highly specific poisons to great effect. But although some people no longer consider island size an obstacle to eradicating rats, Gough, at 6 500 hectares, is an order of magnitude larger than the biggest successful mouse eradication to date. Gough is the last ark for the Tristian Albatross, but restoration biologists have never even attempted to clear mice from an island the size of Gough.

Not yet. Watch this space. □

Far left *A downy Tristan Albatross chick peers from under its parent's warm belly.*

Above, left *Imposing cliffs dominate the rugged coastline, and lobster-fishing boats indicate the only occasional human presence, besides the weather station on Gough.*

Above *This albatross chick died just hours after it was filmed being attacked by mice. Ironically, scavenging birds ate most of the flesh, while mice benefited relatively little from the chick's death.*