The State of Our Indigenous Birds

Although New Zealand's birds are a well-researched group, it is not possible to say with precision how many species and sub-species have lived and died here. New genetic studies and newly discovered bones continually revise our count of existing and extinct species. Such revisions improve our knowledge of the birds' story but, unfortunately, they do not make it read any better. Each newly identified species merely adds to the extinction list or the currently threatened list.

Apart from taxonomic revisions, the statistics on New Zealand birds can be confusing for other reasons. Many species are divided into several subspecies, or geographically isolated populations, some of which have their own distinctive characteristics. These populations are often treated as separate taxonomic units (or taxa) thus adding to the overall bird count. Further sources of confusion arise when whole groups of birds are excluded from the statistics, such as seabirds, or introduced birds, or non-endemic native birds (i.e. those native to both New Zealand and Australia).

If all New Zealand's bird taxa (species plus additional subspecies) are counted, including seabirds, non-endemics and introduced species, the total number of bird taxa currently in New Zealand comes to 231, comprising 33 alien species, 126 native land species and subspecies, and 72 native seabird species and subspecies. The threat of extinction is not spread evenly among them, however. The taxa most at risk are those which happen to be the most unique—the endemics. All our extinct species and nearly all our threatened species are endemic.

In contrast, the introduced and non-endemic birds tend to be mobile and adaptable. Most of the introduced birds were brought from Europe or Australia within the past 150 years and are well-adapted to the open landscape humans have created here. Most of the non-endemic natives are also open-space birds. Some are migratory species, for whom New Zealand is a necessary part of their international range. Others are accidental tourists that flew or blew here within the last few thousand years from Australia or the Antarctic. They include such successful species as the harrier hawk, the pukeko and the black-backed gull. As if their success in modern New Zealand were not enough, the introduced and non-endemic species are also buffered from extinction by having secure populations overseas. In contrast, the endemic birds are on their own.

Most of the following discussion is concerned with the state of our endemic birds. Land and sea-going species are discussed separately. Where relevant, statistics are given for both species and taxa (i.e. species plus additional subspecies). The species classification generally follows the Ornithological Society's 1990 checklist (Turbott, 1990), but also includes four extinct seabirds yet to be formally described and named.

Ignoring subspecies, it appears that, when humans reached New Zealand, they found at least 131 full species of land birds (that is birds whose primary habitat is on land, freshwater or the coast) and 65 species of seabirds (e.g. gulls, albatrosses, petrels and penguins). More than two-thirds of the land birds (93 species) and one-third of the seabirds (22 species, including the four unnamed ones) were endemic or unique to New Zealand (see Tables 9.28 and 9.29).

Today, 43 of the endemic land species (46 percent) are extinct, and 4 of the endemic seabirds (18 percent). A further 7 subspecies of land birds are also extinct. In the towns and farmland of New Zealand it is hard to imagine the scale of the country's bird losses because birds still seem plentiful. Sparrows, starlings, blackbirds, chaffinches, song thrushes and magpies are everywhere. Asian mynas dominate the road verges in the upper North Island. Introduced pigeons form dense clusters in city centres. Rooks have become closely watched agricultural pests in Canterbury and the Wairarapa. But all these birds, 33 species in total, are interlopers brought here in the past 150 years. They bear little resemblance to the giants they have replaced—the great Haast's eagle, the giant swan, the pelican, the rails and, of course, the moas.

Endemic land birds (i.e. land, freshwater and coastal birds)

By the time Europeans arrived, 34 species and 1 subspecies (35 taxa) of endemic land birds had gone. Following European settlement 9 more species and their constituent subspecies (13 taxa in all) were wiped out and a further 6 subspecies were lost. This leaves 50 surviving endemic

species (comprising 102 taxa), of which 37 (comprising 66 taxa) are now listed as threatened (Department of Conservation, 1994b).

Overall, then, 84 percent of New Zealand's endemic land bird species have become extinct or threatened since human occupation. Of today's 50 surviving species, 74 percent are threatened (see Figure 9.7). These statistics are only likely to worsen in the foreseeable future as palaeontologists and archaeologists bring more evidence of extinct species to light, and as pests and habitat degradation push more birds onto the threatened list or into oblivion.

The irony of this is that the thing which makes the endemic birds unique and globally important—their evolutionary isolation—is also what has rendered them so vulnerable (Holdaway, 1989; Anderson and McGlone, 1992). They evolved no defences against humans and other hungry mammals (see Table 9.28). For the first time they faced predators that could hunt by smell at night and that could follow them into their tunnels and hollows. Many had little or no ability to fly, so they could not escape forest fires and hunters, nor emigrate to safer habitats.

Table 9.28

The state of New Zealand's indigenous land, freshwater and coastal birds.

Description of status	Indigenous species			Indigenous taxa (including subspecies)		
	Endemic	Non-endemic	All	Endemic	Non-endemic	All
Number of 'original ' land birds (i.e. those described from subfossils or living specimens)	*93*	*38*	*131*	*156*	*24*	*180*
Land bird extinctions that occurred prior to European settlement.	*34**	*0*	*34*	*35*	*0*	*35*
Land birds remaining when Europeans settled in New Zealand.	*59*	*38*	*97*	*121*	*24*	*145*
Land bird extinctions that occurred after the arrival of Europeans.	*9*	*0*	*9*	*19*	*0*	*19*
Total number of known land bird extinctions.	*43*	*0*	*43*	*54*	*0*	*54*
Percentage of 'original' land birds now extinct.	*46%*	*0%*	*33%*	*35%*	*0%*	*30%*
Land birds surviving in 1994 (with probable extinctions included as extinct).	*50*	*38*	*88*	*102*	*24*	*126*
Land birds threatened with extinction (i.e. those in categories A, B, and C in Department of Conservation Threatened Species publication: DOC 1994b).	*37*	*0*	*37*	*66*	*0*	*66*
Percentage of remaining land birds that are threatened with extinction.	*74%*	*0%*	*42%*	*65%*	*0%*	*52%*

Source: Department of Conservation
** All but 9 of these species have been found in middens.*

Box 9.19

The plight of the takahe

The takahe (*Porphyrio mantelli*) is a flightless blue bird belonging to the rail family. It looks like a heavier version of its close cousin, the pukeko, or Purple Swamphen. In fact, the takahe is a descendant of stray pukekos which landed here from Australia several million years ago. In the placid New Zealand environment they lost the power of flight, put on weight, and prospered. Now they are in danger of dying out. The takahe were already rare when Europeans arrived and, for the first half of this century, were thought to be extinct. In 1948, however, about 500 survivors were found in the rugged and remote Murchison Mountains in Fiordland. Several pairs have been transferred to predator-free islands and have had some breeding success. But in the wild their plight is worsening. The Fiordland population is down to about 115 birds.

For a long time it was believed that the takahe's preferred habitat was the high tussock country where the survivors were found (Mills *et al.*, 1984). Although takahe bones have been dug up in many parts of New Zealand, these were assumed to date from Ice Age times when tussock grasslands were more extensive. Today, however, the bones are believed to be more recent. Far from being tussock dwellers, it now seems that the takahe were most at home stepping and pecking their way along the edges of lowland streams and forests. The Murchison Mountains are merely their last inhospitable refuge from the onslaught of humans, rats and fire (Bunin and Jamieson, 1995).

Until recently, red deer (*Cervus elephus*) were blamed for steadily reducing takahe numbers by competing for what was assumed to be the birds' favorite food, snow tussock. However, after an intense deer eradication programme, the snow tussock has recovered, but not the takahe. The latest research suggests that the birds face the same problems as other small populations trapped in ecological 'islands'. The takahe are not prolific breeders and, faced with stoats and the harsh and changeable weather of the Murchison Mountains, the species is on a knife edge.

Having adapted to an environment free of mammalian predators, the takahe are not 'street wise' like their pukeko cousins. They appear to lack the know-how to recognise and avoid enemies. In contrast, the pukeko, which arrived here from Australia about 1,000 years ago, is one of our most common native birds, in spite of the best efforts of human hunters, rats, stoats and other predators. The pukeko has the advantage of being able to fly, albeit reluctantly and briefly, but another flightless New Zealand bird, the weka, has proved that you don't have to fly to survive. The knack may simply be in knowing when to run and what to run from.

Researchers recently tested this theory in a cross-fostering experiment with pukeko. Takahe eggs were slipped into a pukeko nest to find out whether the pukeko would be effective foster parents (thus freeing the takahe parents to produce more chicks) and also to see whether the takahe chicks may pick up a few survival skills from their foster family (Bunin and Jamieson, in press). The research was limited by a shortage of viable eggs. Over two breeding seasons, only 12 takahe eggs could be given to the pukeko, of which only eight hatched and only two produced chicks that survived. One of these chicks was used in a predator defence experiment with a model stoat. The chick appeared to respond more to the stoat than did another takahe chick reared by takahe parents. It was also more likely to leave the danger area.

With such a small sample, the behavioural experiment was far from conclusive, but the exercise did show that pukeko will hatch and raise takahe chicks, and that takahe will lay more eggs if the first clutch is removed. At the same time, it also confirmed that takahe eggs often fail to hatch, and that takahe chicks are often frail. Until scientists can find ways to solve these problems, the takahe will struggle to survive.

In the face of such pressures and limitations, the survival to date of some species is nothing short of remarkable. Among the threatened land birds are most of our flightless species, such as the takahe (see Box 9.19), the kiwi (see Box 9.20), the weka, the Auckland Island and Campbell Island teals, and the desperately endangered kakapo.

Kakapo

The kakapo (*Strigops habroptilus)* is a large flightless ground-dwelling parrot that managed to stay abundant in areas far away from Maori hunters and fires but declined dramatically after night-hunting mammals, such as cats, were introduced (Holdaway, 1989). A mere 50 survivors are known today. As part of the effort to save them from extinction, they have all been shifted from Stewart Island, where they were clinging to existence, onto three stoat- and cat-free island sanctuaries.

Figure 9.7

The declining state of New Zealand's endemic land, freshwater and coastal birds.

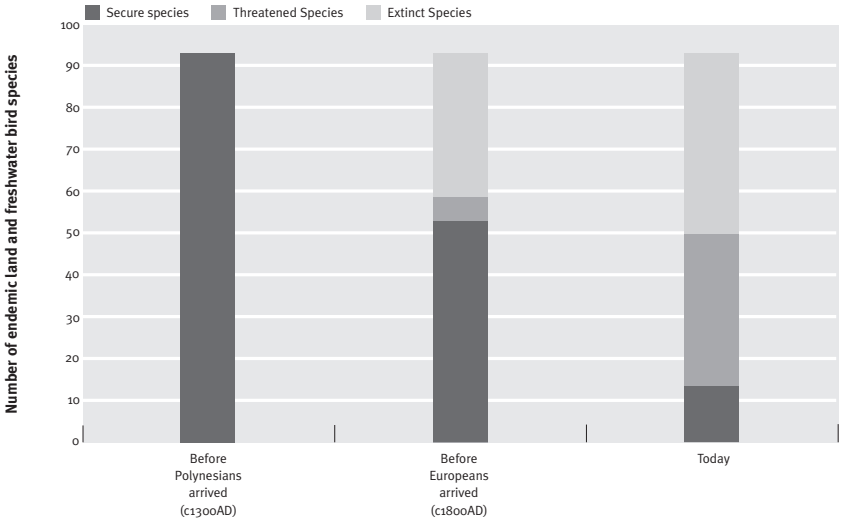


Table 9.29
Some of New Zealand's extinct birds and the probable causes of their extinction.

	Vulnerable traits						Agents of extinction		
	Flightless	Poor fliers	Ground-nesting	Small bodied	Small population	Rat	Dog	Human	Loss of habitat or prey
Moas	X		X				?	X	X h
Pelican			X		X			X	
Swan	?	?	X		X		X	X	
Geese	X		X		X		X	X	X h
Finsch's duck	?	X	X			X			X h
Blue-billed duck			X		X	X			
Musk duck			X		X	X			
Chatham Is. duck		X	X					X	
Haast's Eagle					X				X p
Goshawk					X?				X h,p
Snipe-rail	X		X	X		X			
Giant coot	X		X			X	X	X	
Hodgen's waterhen			X	X		X			
Chatham Is. Giant rail	X		X					X	
Adzebill	X		X			X	X	X	X h,p
Snipe	X		X	X		X			
Giant owlet nightjar		X	X	X		X			X h,p
NZ wrens	X	X	X	X		X			
NZ raven								X	X h,p

h = habitat loss
p = prey or carrion loss
Source: Anderson and McGlone (1992)

Box 9.20

Beleaguered kiwis

To Californians, a 'kiwi' is the fat brown Chinese gooseberry now marketed around the world as 'kiwifruit'. To Australians, it is the national nickname and marketing symbol of their New Zealand neighbours. To New Zealanders, it is both of these things but it is still, first and foremost, a bird. The question is, for how much longer? Introduced predators, loss of habitat and a measure of public complacency have reduced once flourishing populations to remnants. It is a strange way of repaying the bird that has helped put us and our products 'on the map'.

Kiwis are forest dwellers. At night they seek spiders, earthworms, and larger creatures such as frogs, fallen fruits and seeds. Kiwi couples tend to pair for life. Some are known to have been together for more than 30 years. Having evolved in a land without ground-dwelling mammals, the kiwi became a sort of pseudo-mammal. It is flightless and ground-burrowing. It has hair-like feathers and a body temperature closer to mammals than birds. It is the only bird known to have external nostrils at the end of its bill and a keen sense of smell to match. Even laying an egg is more like a mammalian birth. Only one egg is laid and it is an astounding 20 percent of the females' bodyweight—the largest egg-to-bodyweight ratio of any bird. With such a huge investment in just one offspring, both the male and female are devoted egg sitters and parents.

The kiwi genus (*Apteryx* spp.) is New Zealand's most ancient group of living birds, and one of Earth's oldest. The ancestral kiwi evolved shortly after the New Zealand landmass broke away from Gondwana about 80 million years ago. It belonged to the ancient ratite group of birds whose handful of large, flightless, species include Australian emus, Papuan cassowaries, South American rheas and tinamous, African ostriches and New Zealand's extinct moa. During New Zealand's Oligocene drowning, the early kiwi populations evolved into four separate species: the *great spotted*, the *little spotted*, the *northern brown*, and the recently identified *southern brown* or tokoeka.

The Department of Conservation further divides the northern brown into the North Island and the Okarito varieties, and the southern brown into the southern tokoeka (in Stewart Island and Fiordland), and the Haast tokoeka.

About 25,000 great spotted kiwis are thought to exist. Since European settlement their range has diminished by about one-third. They now occupy high rainfall areas in north Westland and Nelson where the surviving population may be stable because stoats are less prevalent in very wet habitats. The much rarer little spotted kiwi is lucky to be here at all. It would almost certainly be extinct were it not for island sanctuaries. Its population is now estimated to be about 1,500 birds, and growing. The most threatened kiwis are probably the northern browns, despite being the most numerous and widespread. Their population is declining at a rate of 5.8 percent per year but could be halted if predation on young kiwis by stoats and cats were cut by a third (McLennan *et al.*, 1996). In Northland the spread of ferrets and possums into the remaining pockets of lowland forest is placing them under extreme threat (Miller and Pierce, 1995). At the other end of the country, the southern browns appear to be holding their own on Stewart Island, probably because there are no stoats there, but the Haast population of about 200–300 birds is regarded as a remnant colony whose habitat is almost confined to the top of one range.

Efforts are being made, as resources permit, to slow the kiwis' decline in key areas and prevent their extinction. The Department of Conservation, the Royal Forest and Bird Protection Society, and the Bank of New Zealand, have joined forces in 'The Kiwi Recovery Programme'. Funds from the programme are being used to educate the public about the kiwis' plight and to support captive breeding programmes in which birds that face extinction in their natural environments are moved to predator-free 'museum environments' on offshore islands.

Since the intensive kakapo conservation programme began in 1989, only 13 chicks had hatched by 1995, and almost all had died as a result of predation or starvation. The Pacific rat, or *kiore*, is now generally accepted to be a major threat to nesting kakapo. Intensive research continues into the parrot's diet and how to improve it. On top of these concerns is the growing fear that the birds' biological clocks may be running out. Of the 50 surviving parrots, only 19 are females and most are more than 30 years old. They may be nearing, or at, the end of their reproductive lives.

The threatened ducks

The flightless Campbell Island teal (*Anas aucklandica nesiotis*) is our most threatened native duck. Only 50 to 100 of these small, almost cocoa-coloured, birds survive. After 10 years of trying to breed in captivity, four ducklings hatched in 1995. They, and any others bred by conservationists, will probably end up on another of New Zealand's island sanctuaries. Plans are under way to clear the rats from Centre Island in Foveaux Strait to make a teal refuge. The Campbell Island teal is a close relative of another highly threatened duck, the Auckland Island teal (*Anas aucklandica*). It, too, has lost the ability to fly and uses its small wings mainly to help it scramble out of the seaweed kelp forests where it feeds. It lives on coastal rocks in sheltered bays.

Not all our threatened ducks are flightless. The attractive blue duck (*Hymenolaimus malacorhynchos*), for instance, can fly but this has not prevented it from being reduced to a few small populations on remote fast-flowing rivers in the North and South Islands. Another teal, the brown teal (*Anas chlorotis*), can also fly but has experienced a similar reduction in numbers and range. Once common on swampy streams and tidal creeks shaded by overhanging trees, they were often killed for food by the early European settlers. As wetlands were turned into farmland, their numbers dropped dramatically. They now survive in the wild mainly in Northland.

Endemic seabirds

Of the 22 endemic seabird species (encompassing 39 taxa) which were here when people arrived, 18 survive (Turbott, 1990). Fifteen of the surviving species (83 percent), or 26 of the surviving 35 taxa (74 percent), are now listed as threatened (Department of Conservation, 1994b). These include 5 penguins (among them the world's rarest, the yellow-eyed penguin), 7 mollymawks, 4 albatrosses (including the royal albatross which nests at Taiaroa Head, near Dunedin), and 4 petrels. Threats include predation on nests and eggs by ferrets, stoats, rats, cats and humans, incidental capture by longlines and setnets, long-term changes to feeding grounds as sea temperatures rise, and localised pressures from pollution and toxic algal blooms.

The Chatham Islands are home to six of our most threatened seabirds. Several seabirds became extinct there following human settlement and today 24 seabird species still breed in the islands. Top of the threatened seabird list are the Chatham Islands taiko (*Pterodroma magentae*) and the Chatham petrel (*Pterodroma axillaris*). The other four threatened birds are the Northern royal albatross (*Diomeda epomophora sanfordi*), Northern Buller's albatross (*Diomeda bulleri platei*), Chatham Island albatross (*Diomeda cauta eremita*), and the Chatham Island shag (*Leucocarbo onslowi*) (Bell and Robertson, 1994).

The taiko or magenta petrel is a large bird, with a deep brownish-black head, neck and throat. It is one of the 'gadfly' group of petrels, named for their airy drifting flight punctuated by startlingly abrupt free-falls (Falla *et al.*, 1979). For more than a century the taiko was considered extinct. Breeding in burrows on the main island, it was easy prey for human hunters and the many bones found in middens indicate that it became a major food source for the Moriori people. The spread of predators such as rats and ferrets all but sealed the bird's fate.

The taiko was rediscovered on New Years Day 1978 and the population now has between 50 and 150 birds. Only four burrows are known to harbour breeding pairs, but the discovery of pairs of birds in another two burrows in 1993 has raised hopes that the number of breeding couples may rise to six. In 1994, the best breeding year so far, four known breeding pairs produced a chick each. All four died, however, even though intensive predation control was carried out.

Table 9.30
The state of New Zealand's indigenous seabirds

Description of status	Indigenous species			Indigenous taxa (including subspecies)		
	Endemic	Non-endemic	All	Endemic	Non-endemic	All
Number of 'original' seabirds (i.e. those described from subfossils or living specimens)	*22*	*43*	*65*	*39*	*37*	*76*
Seabird extinctions that occurred before European settlement.	*4**	*0*	*4*	*4*	*0*	*4*
Seabird extinctions that occurred after the arrival of Europeans.	*0*	*0*	*0*	*0*	*0*	*0*
Seabirds surviving in 1994.	*18*	*43*	*61*	*35*	*37*	*72*
Seabirds threatened with extinction (i.e. those in categories A, B, and C in Department of Conservation Threatened Species publication: DOC 1994b).	*15*	*3*	*18*	*26*	*3*	*29*
Percentage of remaining seabirds that are threatened with extinction.	*83%*	*7%*	*30%*	*74%*	*8%*	*40%*

Source: Department of Conservation
** These, as yet unnamed species, have all been found in middens.*

Captive rearing of petrels has rarely been attempted and the rearing of seabirds in general without parental involvement is rare. To determine the requirements for captive rearing of the taiko, a trial is now in its second season at the Mount Bruce Reserve using eggs from the grey-faced petrel. One chick has survived, providing valuable information on such things as incubation temperature and feeding strategies. Predator numbers are still high, and twice-yearly trapping is carried out as part of the taiko conservation effort. The principal threats to the survival of the threatened birds are mammalian predation, destruction of ground nesting habitat by pastoral farming, occasional recreational and customary hunting, and possible climatic and oceanic changes or cycles (Bell and Robertson, 1994).

A significant threat to some seabird species is the risk of getting hooked on tuna longlines. Nearly 20 seabird taxa from 14 different species, 5 of them endemic, have been recorded among the longline bycatch. All these birds are legally protected and, under recent amendments to the Wildlife Act 1953, this protection now extends to the limit of New Zealand's Exclusive Economic Zone (EEZ). Among the victims are the wandering albatross, the snowy albatross, the southern black-browed albatross, the grey petrel and several threatened species, namely: the New Zealand black-browed albatross, the grey-headed albatross, the New Zealand white-capped albatross, the black petrel and the Westland black petrel.

Government observers on foreign tuna boats have recorded seabird bycatch since the late 1980s. However, the quality of the observer data is uneven, with marked fluctuations in some years (e.g. 16 observed captures in 1992 and 215 observed captures the following year). The observed catch rate per hundred sets has varied from 7 to 196 in the northern tuna fishery and from 4 to 80 in the southern fishery. While most of these fluctuations reflect uneven observer coverage, they may also reflect variations in fishing effort (e.g. the number of lines and hooks set in a given year); the use of mitigation measures by the boats carrying observers (e.g. the percentage of properly deployed tori lines); the choice of areas for setting longlines; and the degree of visibility during night sets (Duckworth, 1995).

Most seabirds are caught in the brief period between the longline being thrown overboard (setting) and it sinking out of diving reach (soaking). The baited longline provides a tempting meal and, once a bird has become hooked or entangled, it is dragged under and drowned. Observers are generally sleeping during this part of the operation, their main role being to record fish species during the 10–17 hour hauling-in phase. Most seabird deaths are therefore recorded hours after they occur, when the lines are pulled in, by which time an unknown number may have been eaten by sharks, become detached from the line, or died elsewhere from injuries sustained in tearing free (Brothers, 1991).

Table 9.31

New Zealand seabird captures by Japanese tuna boats, 1988–95.

	Observed captures[1]	Estimated captures[2]	Best estimate	Total number of longline sets	Percentage of sets observed
1988[3]	*15*	*234–1,406*	*820*	*2,231*	*2%*
1989	*123*	*1,697–6,261*	*3,979*	*3,310*	*3%*
1990	*129*	*1,197–3,595*	*2,396*	*2,918*	*5%*
1991	*37*	*266–1,092*	*629*	*4,452*	*3%*
1992	*16*	*16–371*	*185*	*3,148*	*8%*
1993	*215*	*310–1,146*	*728*	*1,499*	*28%*
1994	*108*	*108–176*	*132*	*320*	*76%*
1995	*90*	*90–252*	*167*	*463*	*54%*
Yearly average 1989–95	*103*	*526*	*1,174*	*2,301*	*10%*

[1] *Seabird captures include live and dead birds recorded by MAF Fisheries observers.*
[2] *Estimates are based on observer data extrapolated over the whole fleet and have a 95% confidence interval.*
[3] *1988 data are for the northern tuna fishery only. All other years combine northern and southern tuna fisheries.*

Adapted from Baird (1996)

The scale of the seabird bycatch has been hotly debated. Estimates refer only to the Japanese tuna boats operating in New Zealand waters. Information from the domestic tuna fleet has been too limited to make estimates. In 1990, when the Japanese fleet was four or five times larger than it is today, one unofficial estimate put the seabird toll at 5,000–25,000 deaths (Tennyson, 1990). Official estimates for the same year, based on Government observer data, have ranged from more than 9,000 captures, with perhaps 5,000 deaths (Murray *et al.*, 1992, 1993) to 1,200–3,600 captures (Baird, 1996). The official estimate for 1995 is 90–252 seabird captures by Japanese longliners in New Zealand waters (Baird, 1996).

Bycatch estimates are dependent on both the level and quality of observer coverage and the level of fishing effort. Betweeen 1987 and 1992, Government observers witnessed only 1–7 percent of the Japanese longline sets. The percentage increased dramatically after 1992 as the Japanese tuna fleet was severely reduced. In New Zealand's southern bluefin tuna fishery, for example, the Japanese fishing effort fell from about 12 million hooks in 1990 to less than 3 million hooks by 1995, and the estimated number of seabird captures has declined accordingly (see Table 9.31). Conversely, the unrecorded bycatch of 10–15 years ago must have been much greater than it is today. In the period 1979–1983, nearly 22 million hooks were set each year in the southern bluefin fishery. This may have been a crucial factor in driving some species onto the threatened list.

As late as 1990, the 32 Japanese boats catching southern bluefin were accompanied by only 2 New Zealand longliners. By 1995, however, the number of Japanese vessels had declined to 9, while New Zealand longliners had multiplied to 25. The bycatch from these domestic vessels is not known, but conscientious efforts are being made by the local industry to reduce the problem. However, beyond New Zealand waters, other longline tuna fisheries encircle the Antarctic, both on the high seas and in other countries' exclusive economic zones. Together, these longline fleets may catch as many as 40,000 or more seabirds each year, including many New Zealand birds whose flight paths are not limited to New Zealand waters (Tennyson, 1990; Brothers, 1991; Close, 1994b).

Table 9.32
New Zealand's threatened birds

Category X: Not seen for several years and possibly extinct	
South Is. kokako (Callaeas cinerea cinerea)	
Category A: Birds nearing extinction and having the highest conservation priority	
Campbell Is. teal (Anas aucklandica nesiotis)	*Black stilt (Himantopus novaezealandiae)*
Haast tokoeka (Apteryx 'Haast tokoeka')	*Black robin (Petroica traversi)*
North Is. brown kiwi (Apteryx 'North Is')	*Takahe (Porphyrio mantelli hochstetteri)*
Okarito brown kiwi (Apteryx 'Okarito brown')	*Chatham Is. tui (Prosthemadera novaeseelandiae chathamensis)*
NZ dotterel (southern) (Charadrius obscurus 'southern')	*Chatham petrel (Pterodroma axillaris)*
Orange-fronted parakeet (Cyanoramphus malherbi)	*Taiko (Pterodroma magentae)*
Chatham Is. oystercatcher (Haematopus chathamensis)	*Fairy tern (Sterna nereis davisae)*
Chatham Is. pigeon (Hemiphaga novaezeelandiae chathamensis)	*Kakapo (Strigops habroptilus)*
Category B: Seriously threatened birds with the second highest conservation priority	
Wrybill (Anarhynchus frontalis)	*North Is. weka (Gallirallus australis greyi)*
Great spotted kiwi (Apteryx haastii)	*Stewart Is. weka (Gallirallus australis scotti)*
Little spotted kiwi (Apteryx owenii)	*NZ pigeon (Hemiphaga novaeseelandiae novaeseelandiae)*
Southern tokoeka (Apteryx 'southern tokoeka')	*Blue duck (Hymenolaimus malacorhynchos)*
Stewart Is. fernbird (Bowdleria punctata stewartiana)	*NZ king shag (Leucocarbo carunculatus)*
Codfish Is. fernbird (Bowdleria punctata wilsoni)	*Chatham Is. shag (Leucocarbo onslowi)*
North Is. kokako (Callaeas cinerea wilsoni)	*Yellow-eyed penguin (Megadyptes antipodes)*
NZ dotterel (northern) (Charadrius obscurus 'northern')	*Yellowhead (Mohoua ochrocephala)*
Snares Is. snipe (Coenocorypha aucklandica huegeli)	*South Is. kaka (Nestor meridionalis meridionalis)*
Forbes' parakeet (Cyanoramphus auriceps forbesi)	*North Is. kaka (Nestor meridionalis septentrionalis)*
Chatham Is. red-crowned kakariki (Cyanoramphus novaezelandiae chathamensis)	*Kea (Nestor notablis)*
Stitchbird (Notiomystis cincta)	*Northern Buller's mollymawk (Diomedea bulleri platei)*
Chatham fulmar prion (Pachyptila crassirostris pyramidalis)	*Chatham Is. mollymawk (Diomedea cauta eremita)*
Kermadec white-faced storm petrel	*Grey-headed mollymawk (Diomedea chrysostoma)*
(Pelagodroma marina albiclunis)	*Southern royal albatross (Diomedea epomophora epomophora)*
South Georgian diving petrel (Codfish Is. population) (Pelecanoides georgicus 'Codfish Is')	
Northern royal albatross (Diomedea epomophora sanfordi)	*Gibson's albatross (Diomedea exulans gibsoni)*
South Is. saddleback (Philesturnus carunculatus carunculatus)	*NZ black-browed mollymawk (Diomedea melanophrys impavida)*
Black petrel (Procellaria parkinsoni)	*Fiordland crested penguin (Eudyptes pachyrhynchus)*
Westland petrel (Procellaria westlandica)	*Erect-crested penguin (Eudyptes sclateri)*
Buller's shearwater (Puffinus bulleri)	*White-flippered penguin (Eudyptula minor albosignata)*
Hutton's shearwater (Puffonis huttoni)	*NZ falcon (Falco novaeseelandiae)*
Black-fronted tern (Sterna albostriata)	*Western weka (Gallirallus australis australis)*
NZ shore plover (Thinornis novaeseelandiae)	*Buff weka (Gallirallus australis hectori)*

Group C: Threatened birds with the third highest conservation priority	
Brown teal (Anas aucklandica chlorotis)	*Chatham Is. warbler (Gerygone albofrontata)*
Three Kings bellbird (Anthornis melanura obscura)	*Variable oystercatcher (Haematopus unicolor)*
Poor Knights bellbird (Anthornis melanura oneho)	*Campbell Is. shag (Leucocarbo campbelli)*
Snares Is. fernbird (Bowdleria punctata caudata)	*Stewart Is. shag (Leucarbo chalconotus)*
Banded dotterel (Charadrius bicinctus bicinctus)	*Auckland Is. shag (Leucocarbo colensoi)*
Auckland Is. banded dotterel (Charadrius bicinctus exilis)	*Bounty Is. shag (Leucocarbo ranfurlyi)*
Auckland Is. snipe (Coenocorypha aucklandica aucklandica)	*Northern giant petrel (Macronectes halli)*
Antipodes Is. snipe (Coenocorypha aucklandica meinertzhagenae)	*Stewart Is. robin (Petroica australis rakiura)*
Chatham Is. tit (Petroica macrocephala chathamensis)	*Chatham Is. snipe (Coenocorypha pusilla)*
Snares Is. tit (Petroica macrocephala dannefaerdi)	*Yellow-crowned parakeet (Cyanoramphus auriceps auriceps)*
Auckland Is. tit (Petroica macrocephala marrineri)	*Reischek's parakeet (Cyanoramphus novaezelandeae hochstetteri)*
North Is. saddleback (Philesturnus carunculatus rufusater)	*NZ dabchick (Poliocephalus rufopectus)*
Antipodes Is. parakeet (Cyanoramphus unicolor)	*White-naped petrel (Pterodroma cervicalis cervicalis)*
Antipodes albatross (Diomedea exulans antipodensis)	*Cook's petrel (Pterodroma cookii)*
Southern Buller's mollymawk (Diomedea bulleri bulleri)	*Chatham Is. fantail (Rhipidura fuliginosa penita)*
Salvin's mollymawk (Diomedea cauta salvini)	*White-fronted tern (Sterna striata)*
NZ white-capped (shy) mollymawk (Diomedea cauta steadi)	*Pitt Is. shag (Stictocarbo featherstoni)*
Snares crested penguin (Eudyptes robustus)	*Rock wren (Xenicus gilviventris)*

Category O: Species which are threatened in New Zealand, but secure in other parts of their range outside New Zealand	
Common noddy (Anous stolidus pileatus)	*White tern (gygus alba royana)*
Australasian bittern (Botaurus poiciloptilus)	*Royal spoonbill (Platalea regia)*
White heron (Egretta alba modesdta)	*Crested grebe (Podiceps cristatus australis)*
Reef heron (Egretta sacra sacra)	*Grey petrel (Procellaria cinerea)*
Eastern rockhopper penguin (Eudyptes chrysocome filholi)	*Caspian tern (Sterna caspia)*
White-bellied storm petrel (Fregetta grallaria grallaria)	

Source: Department of Conservation (1994b)

The State of Our Mammals

New Zealand has no native ground-dwelling mammals. Our few native mammals either fly or swim. The early ancestors of the mammals had not reached New Zealand when it split off from Gondwana about 80 million years ago. Before the ocean gap had become too wide, however, some bats flew or blew here and evolved into endemic species. The only other mammals to discover New Zealand without the aid of boats were marine ones—seals, sea lions, whales and dolphins.

The flying mammals

Our native bats belong to two very different families. The comparatively normal long-tailed bat (*Chalinolobus tuberculatus*) is part of a worldwide family called the Vespertilionidae. It has close relatives in Australia. The short-tailed bat (*Mystacina tuberculata*) is so different from other bats that it belongs to a family of its own, the Mystacinidae, which exists only in New Zealand. The short-tailed bats are believed to have arrived here more than 35 million years ago, whereas long-tailed bats arrived about 3 million years ago.

In their isolation the short-tailed bats evolved some rather unbat-like ways. They rummage around on the ground for food, climb trees and have even been seen walking nimbly over boulders near the sea, wings tucked under forearms, hunting for insects and small marine invertebrates. They also eat fruit and nectar and are important pollinators of the

threatened plant, *Dactylanthus taylorii* (Ecroyd, 1996).

Two species of short-tailed bat lived here but the larger of these was wiped out 30 years ago when rats invaded its last island refuge. The remaining species, the lesser short-tailed bat is listed as a 'high priority' threatened species. It is divided into northern, volcanic and southern subspecies, all of which are threatened. The long-tailed bat is also on the threatened list.

The marine mammals

Several times in the evolution of the mammals, different species took to the sea. In one case, about 50 million years ago, a wading relative of today's pigs, hippos and cattle evolved into a large otter-like animal, which gave rise to the world's whales and dolphins—the *cetaceans* (Thewissen *et al.*, 1994). Much later, between 20 and 25 million years ago, a population of wading bears also became otter-like and eventually evolved into today's seals and sea lions—the *pinnipeds* (Janis, 1994).

Some 34 species of cetaceans and 7 species of pinnipeds have been sighted in New Zealand waters, but only two are unique to New Zealand: Hector's dolphin (*Cephalorhynchus hectori*) and the New Zealand sea lion, also known as Hooker's sea lion (*Phocarctos hookeri*). The native New Zealand fur seal (*Arctocephalus forsteri*) is not endemic, being also found in southern Australia.

The massive elephant seals (*Mirounga leonina*), which live throughout the subantarctic region, were almost eliminated from New Zealand waters in previous centuries but re-colonised Campbell Island and the Antipodes Islands this century. Recently, however, unknown factors have drastically reduced elephant seal populations in parts of their range. The Campbell Island population has fallen by at least 95 percent and the Antipodes population is also small, having less than 100 pups.

The most commonly seen cetaceans in our waters are common dolphins (*Delphinus delphis*), dusky dolphins (*Lagenorhynchus obscurus*) and bottlenose dolphins (*Tursiops truncatus*). Several toothed whales are also common, such as long-finned pilot whales (*Globicephala melaena*), which normally live far out at sea but frequently strand on sloping beaches. Orcas, or killer whales (*Orcinus orca*) and pygmy sperm whales (*Kogia breviceps*) are also common and occasionally strand on New Zealand beaches.

A diverse but little-known group called the beaked whales is known mostly from strandings (Dawson, 1985). Nine species have been reported from New Zealand waters and they occasionally strand in ones and twos on our beaches. They seem rare in coastal waters but may be more common in the deep ocean. One of them, Shepherd's beaked whale (*Tamacetus shepherdi*), is rarely seen anywhere in the world, with only 30 or so specimens having been reported, most of them from strandings on New Zealand beaches.

The large whales which were most common around New Zealand were the southern right whale (*Eubalaena australis*), the humpback whale (*Megaptera novaeangliae*) and the sperm whale (*Physeter macrocephalus*). Right whales fed in the Antarctic during the summer and came north to breed in the winter. They bred close to the coast and were sometimes so abundant in places that ships had to avoid running into them. Their curiosity often drew them to ships and their protective instincts often led them to stay there after one of their number had been harpooned. They were easy prey and became almost extinct by about 1850, though a small remnant population still breeds in New Zealand's subantarctic waters.

Groups of 50–100 right whales have been seen in aerial surveys around the Auckland Islands and Campbell Island during the winter breeding season. Boat surveys have found an estimated 96 right whales around the Auckland Islands with 9 cow/calf pairs. New Zealand scientists are now studying genetic samples from the whales to identify their relationship to other right whale stocks.

Like the right whales, humpback and sperm whales were never permanent residents in New Zealand waters, but regularly passed through on their migrations between the tropical winter breeding grounds and the Antarctic summer feeding grounds. Though heavily depleted by whaling, a small humpback population still migrates past our coast. New Zealand scientists are investigating the relationship between this population, which breeds around Tonga, New Caledonia and Niue, and the rapidly recovering East Australian population.

Sperm whales are globally the most abundant of the large whales. The International Whaling Commission puts the total number of sperm whales at between 500,000 and 1,250,000. Although this is less than the pre-whaling population, they were not as heavily depleted as the other large whales. The main reason is that their breeding females are half the size of the males and were hunted less heavily. Because sperm whale society is polygynous, with one male having exclusive access to many females, most of the hunting impact fell on the reproductively 'surplus' bachelor males. In the other large whales, however, breeding females are bigger than males and so bore the brunt of the hunting.

Migrating bachelor sperm whales regularly stock up on squid and fish, including orange roughy, in the deep ocean trench off Kaikoura. In recent years a thriving whale-watch tourist industry has developed around them. Up to 20 or 30 whales may visit at a time, with some lingering for weeks or months. Several appear to be residents and are reasonably tolerant of the attention from the whale-watch boats.

Other large whales, such as the giant blue (*Balaenoptera musculus*), fin (*B. physalus*) and sei (*B. borealis*) whales, frequent polar oceans during summer months and are only rarely seen in New Zealand waters, but their smaller relatives, the 12 m Bryde's whale (*B. edeni*) and the 8 m minke whale (*B. acutorostrata*) are more common.

Unlike the cetaceans, pinnipeds spend a significant amount of their time on land. Before people arrived in New Zealand, fur seal colonies existed all around the coastline, from Northland to Bluff, though the largest populations were probably in the cooler southern regions and subantarctic islands. New Zealand sea lions (Hooker's sea lions) and elephant seals were less abundant than the fur seals but had a similar distribution (Smith, 1989). They were easy prey for the Maori settlers and their descendants and became the main meat source in many areas (Davidson, 1984). By 1600, pinnipeds had been eliminated from the North Island (Smith, 1989; Anderson and McGlone, 1992). By 1800, when the commercial sealers from Europe and America arrived, the fur and elephant seals and the sea lions had been eliminated from most of the South Island, too. Fur seal colonies survived only in the sparsely populated far south of the South Island. Sea lions had disappeared from the mainland, but still survived on Stewart Island. Elephant seals had gone completely (Smith, 1989). By 1820, the sealers had almost eradicated the remaining fur seals and sea lions and drastically depleted the large populations on the subantarctic islands (Taylor, 1982; Mattlin, 1987).

Whales and dolphins fared much better than the pinnipeds in the pre-European era. Maori hunting of whales appears to have been negligible. Stranded whales were eaten as they became available, but were rarely hunted as far as the archaeologists can tell. Dolphins, however, were hunted (Davidson, 1984; Smith, 1989). Harpoons have been recovered with dolphin remains in midden sites. Dolphins may also have been driven ashore or caught in large beach seine nets.

Apart from a few remains which have been identified as common dolphins (*Delphinus delphis*), most of the dolphin bones in Maori middens have not been identified at the species level. Some may belong to Hector's dolphin, which would have been relatively easy to catch and has more Maori names than any other cetacean. Today this dolphin is far more rare around the North Island than the South Island, but it is not known if this was always the case. Genetic analysis of bone samples may eventually shed light on this.

Whale hunting began with the arrival of American and European whalers in the late 1700s. Many coastal whaling stations were established and the remains of some are now historic places. Whales were hunted from these shore stations until the 1960s, though the greatest impact on whale numbers came from the visiting whaling fleets that killed vast numbers of whales in open waters. Each of the large species was devastated in turn, beginning with the right whales, then the blues, fins and humpbacks. The more resilient sperm whales were hunted throughout.

From the 1960s, the industry was dominated by Russian and Japanese factory fleets whose main prey were sei and minke whales, though it is now known that large quantities of other species were taken illegally or in larger quantities than reported (Yablokov, 1994; Baker and Palumbi, 1994). In 1986 the world regulatory body, the International Whaling Commission (IWC) imposed a moratorium on commercial whaling and, in 1994, created the Southern Ocean Whale Sanctuary as a permanent refuge, even if commercial whaling is resumed.

Today, only one nation commercially hunts whales. Norway kills about 300 minke whales each year in the north-east Atlantic (Motluk, 1995a; Abdulla, 1995). However, under IWC rules, 'scientific' whaling is still allowed, even within the Southern Ocean sanctuary. Japan is the only country which takes advantage of this, killing about 300 minke whales in the Antarctic each year. The meat from these frequently ends up in supermarkets rather than laboratories (Baker and Palumbi, 1994).

The whaling nations, some indigenous groups in the Arctic circle, and some pro-whaling lobby groups, continue to push for an expansion or resumption of whaling. However, most countries support the whaling moratorium and have opted for more benign forms of marine mammal commercialisation, such as whale-watching and dolphin-diving. This reflects the strong public sentiment in many of those countries that whales and dolphins are intelligent creatures deserving of special protection.

New Zealand's direct involvement in the whaling industry had dwindled by 1963 to just one shore-based station in the Marlborough Sounds. Following a sharp decline in the south-west Pacific population of humpbacks in 1960–61 the IWC banned the hunting of humpbacks in 1963. The station switched to sperm whaling but abandoned this in 1964 when the international price of sperm whale oil dropped from more than £90 per ton to about half that in one season.

With the closure of its last station, New Zealand withdrew from the IWC, but in 1976, in response to appeals from the public and the scientific community, the Government rejoined, this time to lobby for a global end to whaling. This was followed in 1978 by the passing of the Marine Mammal Protection Act, which banned the hunting and cruel treatment of marine mammals within New Zealand and its waters (with an allowance for accidental capture in fishing nets) and also banned the importation of whale products.

With hunting now largely removed, most cetacean populations appear to be recovering or, at least, holding their own, though many are still only a fraction of their former abundance (see Table 9.33). Whales in New Zealand waters now face few dangers other than becoming stranded on shallow beaches. Strandings are a problem for several deep water species (particularly pilot whales, beaked whales, and sometimes sperm whales) whose echolocation systems sometimes fail to detect gently sloping beaches. A whale rescue network is coordinated by the Department of Conservation. Each year about 200 callouts are attended and about 60 percent of the stranded whales (200–500 animals) are rescued (Department of Conservation, 1994d, 1995).

The main direct threat to fur seals and sea lions, and also some dolphins, is drowning in fishing nets, particularly the large trawl nets used in the hoki, southern blue whiting and squid fisheries (see Box 9.18 and Tables 9.33 and 9.34). Fur seal and sea lion deaths were first noted in the late 1970s and early 1980s by Government fishing observers who were placed on foreign trawlers. Since 1990, an average of almost 1,000 fur seals and nearly 70 sea lions are estimated to have been drowned each year in trawl nets.

The State of the New Zealand Sea Lion (Phocarctos hookeri)

The New Zealand sea lion was widely distributed before people arrived, though the population size is unknown. Bones found in Maori food middens reveal that sea lions once ranged the length of New Zealand right up to Houhora in the far North. They had been almost exterminated on

Table 9.33

The state of cetaceans (whales and dolphins) found in New Zealand waters

Species	Distribution	Global Status[1]	Status in NZ Waters
Southern Right Whale (Eubalaena australis)	*Southern Hemisphere*	*Vulnerable. Current population probably below 5,000, but recovering. Originally more than 60,000.*	*Threatened. Population in the hundreds.*
Pygmy Right Whale (Caperea marginata)	*Southern Hemisphere*	*Insufficiently known. Never hunted*	*Apparently rare.*
Humpback Whale (Megaptera novaeangliae)	*All oceans—migratory*	*Vulnerable. Perhaps 25,000, but recovering. Originally around 150,000.*	*Rare. Small migrating population passes through NZ waters.*
Blue Whale (Balaenoptera musculus intermedia)	*All oceans*	*Endangered. Below 5,000 (less than 1,000 in the Southern Hemisphere). Originally more than 200,000.*	*Very rare. Occasionally seen, but mostly polar.*
Pygmy Blue Whale (musculus subsp.)	*Southern Hemisphere*	*Endangered. Severely depleted. Population less than 8,000.*	*Rare.*
Fin Whale (Balaenoptera physalus)	*All oceans*	*Vulnerable. Probably below 150,000. Originally probably 500,000 to 1 million.*	*Rare. Occasionally seen but mostly polar.*
Sei Whale (Balaenoptera borealis)	*All oceans*	*Vulnerable. Probably less than 60,000. Originally may have exceeded 250,000.*	*Regularly seen near NZ.*
Bryde's Whale (Balaenoptera edenii)	*Tropical and temperate seas*	*Insufficiently known. Maybe 80,000—100,000. Slightly below original numbers.*	*Frequently seen off the North-east coast of NZ.*
Minke Whale (Balaenoptera acutorostrata)	*Polar oceans*	*Insufficiently known. Maybe 800,000—900,000. Some northern stocks have been depleted, but Antarctic stocks may now exceed original size.*	*Occasionally seen around NZ, but aggregate on polar feeding ground in summer.*
Sperm Whale (Physeter macrocephalus)	*All oceans*	*Insufficiently known. At least several hundred thousand. Originally probably exceeded one million.*	*Common, but far out to sea except near Kaikoura.*
Pygmy Sperm Whale (Kogia breviceps)	*Warm and temperate seas*	*Insufficiently known. Apparently uncommon, though never hunted.*	*Relatively common in NZ waters, but population trends unknown.*
Orca (Killer Whale) (Orcinus orca)	*All oceans*	*Insufficiently known. Probably several hundred thousand.*	*Apparently common, but population trends unknown*
False Killer Whale (Pseudorca crassidens)	*Warmer oceans*	*Insufficiently known, but nowhere abundant.*	*Apparently common, but population trends unknown.*
Pilot Whales (2 species) (Globicephala spp.)	*All but North Pacific Ocean*	*Insufficiently known. Probably several hundred thousand.*	*Apparently common, but population trends unknown.*
Beaked Whales (9 species)	*Open ocean*	*All species insufficiently known. Apparently uncommon, though never hunted.*	*Regularly strand around NZ. Some species rare. Trends unknown.*
Hector's Dolphin (Cephalorhynchus hectori)	*Endemic to NZ waters, mostly South Island*	*Indeterminately threatened. Numbers about 3,000–4,000. World's rarest marine dolphin. Confined to New Zealand.*	*Threatened. Original population and current trends are unknown. May have been depleted by set nets.*
Common Dolphin (Delphinus delphis)	*Tropical and temperate seas*	*Insufficiently known, but probably in the millions.*	*Abundant, but population trends unknown.*
Bottlenose Dolphin (Tursiops truncatus)	*Tropical and temperate seas*	*Insufficiently known, but possibly in the millions.*	*Common, but population trends unknown.*
Dusky Dolphin (Lagenorhyncus obscurus)	*Southern Hemisphere*	*Insufficiently known, but common in cooler waters.*	*Common off the South Island. Rare north of Hawke's Bay. Population trends unknown.*
Other cetaceans (6 dolphins, 1 porpoise, 1 melonhead whale)	*Mostly tropical or polar waters*	*Insufficiently known, but most apparently not at risk.*	*Rarely stray into NZ waters.*

1 Global population estimates are highly uncertain, being based on sporadic sightings, limited surveys, and reported catch data. Many estimates have not been updated since commercial whaling was banned in the mid-1980s (IUCN, 1991).

the mainland by 1500. When European sealers arrived, only the Stewart Island Maori were still able to hunt sea lions. The commercial sealers put a quick end to that. Although their main targets were fur seals, they killed large numbers of sea lions as well, leaving only remnant populations on several sub-antarctic islands.

Today, the species is still limited to those islands. The most recent population estimate is 10,000–15,000 (Cawthorn, 1993). Roughly 80 percent of all pup births occur on Dundas Island, a remote and almost inaccessible member of the Auckland Islands group. Another 10 percent are born on Enderby Island. Surveys on Enderby and Figure of Eight Islands have shown little population change in several decades. A small rookery exists on Campbell Island, and, until recently, a few pups were born at the Snares Islands each year.

New Zealand sea lions are now commonly sighted at Stewart Island, the Catlins coast and Otago Peninsula. Very rare sightings have been made at Banks Peninsula, and even the Kaikoura and Nelson coasts, with one sighting as far north as Plimmerton, near Wellington (Cawthorn, 1993). The Department of Conservation has recorded an influx of two-year-old males on the Otago Coast over the past 2 years. The presence of 3 females and a recent instance of breeding near Dunedin have led to speculation that the species may be re-establishing itself on the mainland after centuries in exile (Peat, 1993; Department of Conservation, 1995).

Squid trawling in the Auckland Islands began in the late 1970s and is a major fishery involving up to 40–50 boats during the summer and autumn. This is also the season when the sea lions are breeding and foraging for food on the Auckland Islands shelf. Each year squid trawl nets drown an estimated 20–140 sea lions (see Table 9.34). Sea lion bycatch data has only been systematically recorded since 1988. Although fishing industry observers have also recorded sea lion kills since 1993, official estimates use only Government observer records. Between 1988 and 1996, the percentage of trawlers carrying Government observers varied between 8 percent and 29 percent. In the 1995–1996 season the observers witnessed 557 trawl net tows and 13 sea lion kills. This represented 2.3 kills per hundred tows.

Table 9.34
Reported and estimated New Zealand (Hooker's) sea lion bycatch in the southern squid fishery, 1988–95.

	Observed number of kills [1]	Estimated number of kills	Total number of squid trawl tows	Percentage of tows observed
1988	*8*	*26–33*	*1,790*	*24%*
1989	*27*	*120–140*	*3,766*	*19%*
1990	*14*	*103–116*	*5,218*	*12%*
1991	*2*	*21*	*3,252*	*10%*
1992	*8*	*82*	*2,168*	*10%*
1993	*5*[2]	*20*	*666*	*29%*
1994	*3*	*32*	*4,675*	*9%*
1995	*8*[3]	*95*	*3,909*	*8%*
1996[4]	*13*	*100*	*4,400*	*13%*
Yearly average 1988–96	*9*	*69*	*3,273*	*13%*

Sources: Baird (1996); Ministry of Fisheries; Fishing Industry Board
[1] *Kills witnessed under the Ministry of Fisheries Scientific Observer Programme.*
[2] *A scampi trawler caught 3 of the observed kills in 1993.*
[3] *A southern blue whiting vessel caught one of the observed kills in 1995.*
[4] *Unpublished data.*

The number of sea lions killed before 1988 is not known, though concerns were expressed in the late 1970s by Government scientists on a large German research trawler. As a result, a 'no fishing' zone was designated around the Auckland Islands in 1982, extending out to the territorial sea limit of 12 nautical miles (22 kilometres). The zone became a marine mammal sanctuary in April 1993 but has been criticised as being too small in area (Bellingham, 1993a).

In 1992, the Ministers of Conservation and of Fisheries set a maximum allowable kill of 63 sea lions (including no more than 32 females). Meanwhile, the fishing industry decided to review the fishing operation of any vessel catching 3 or more sea lions and to voluntarily withdraw any vessel catching 4 or more. One boat was reviewed in 1993 when a freak incident led to three sea lions being caught in a badly deployed scampi net. Generally, the small nets used by scampi trawlers are far less of a threat to sea lions than the squid trawlers' huge pelagic nets (which can be larger than a 25-storey office block, stretching up to 80 m from top to bottom). Shortly before the end

of the 1995 and 1996 seasons, the few remaining squid trawlers voluntarily withdrew from the fishing grounds after the Ministry of Fisheries estimated that the allowable sea lion kill had been exceeded.

The State of the New Zealand Fur Seal (Arctocephalus forsteri)

The New Zealand fur seal could just as easily have acquired an Australian name. Although it lives around the South Island, lower North Island and various subantarctic islands, it is also found along the coast of Tasmania and the southern Australian coast from Victoria to Albany. Though officially classified as a single species, recent genetic research by scientists at Wellington's Victoria University indicates that the fur seals may actually belong to two very divergent sub-species, one of which is much rarer than the other (Chambers *et al.*, 1996).

The original fur seal population in the New Zealand region is unknown. When the first European sealers arrived 200 years ago, the seals had already been eliminated from most of New Zealand's coastline, but were still abundant on the subantarctic islands. One estimate, based on historical sealing records, puts their population at this time at about 1.25 million (Richards, 1994). By the time the sealers were through, several decades later, the population may have been no more than 10,000. Fur seals began to be protected by the law from 1875 when the killing season was restricted to a short period every year. From 1894 hunters needed a permit to kill seals, except for a 3-month period in 1913 when there was an open season for anyone. Since then no fur seals have been killed legally, except on Campbell Island in 1922 and 1924, and in southern New Zealand in 1946 (Melrose, 1973).

The Australian population was recently estimated at about 27,000 and increasing (Shaughnessy *et al.*, 1994). In New Zealand, a planned national census of fur seals in 1995–96 was postponed by the Department of Conservation but is among the draft research suggestions put forward for 1997–98 by the Ministry of Fisheries' Nonfish Species and Fisheries Interactions Working Group (Baird, 1996).

Current population estimates for the New Zealand region are based on data collected in the early 1970s and summarised by Wilson (1981), who put the total population at 30,000–50,000. Studies since then have found marked population increases in Cook Strait, Nelson-Marlborough, Otago and on some subantarctic islands (Baird, 1995; Crawley, 1990; Dix, 1993; Lalas and Harcourt, 1995; R.H. Taylor, 1992; Taylor *et al.*, 1995). These studies suggest that the total population, though still just a fraction of its former size, may now exceed 50,000. As the population expands, new colonies are forming, and, for the first time in four centuries, the lower North Island is being recolonised.

An average of nearly 1,000 fur seals a year have been drowned by trawl nets in recent years (see Table 9.35). Most of the reported deaths occur in the southern blue whiting fishery on the Bounty Platform, the hoki fisheries off the South Island's West Coast and Puysegur Point, and the southern squid fishery (Baird, 1994a, 1996). Fur seal drownings began to be officially monitored in 1986 by Government observers on a sample of West Coast hoki trawlers. About 60–70 boats trawl for hoki off the West Coast during the winter and early spring, from June to September. In 1992 monitoring was extended to a sample of trawlers in other fisheries throughout the Exclusive Economic Zone.

Between 1990 and 1992, the estimated probability of catching one or more fur seals in one tow of the trawl net fell from 5.6 percent to 2 percent (Mattlin, 1994a). In 1994, the Fishing Industry Board estimated the encounter rate to be about 2–3 percent. However, even though the catch rate per tow has fallen, the actual number of deaths depends on other factors as well, such as the total number of tows in a season and their proximity to seal feeding grounds. As a result, annual bycatch figures continue to fluctuate (see Table 9.35).

Based on preliminary observer reports, the total fur seal bycatch for the Exclusive Economic Zone in 1994 was higher than in previous years, with 202 reported kills, 60 of them by hoki trawlers and 97 by southern

blue whiting trawlers. If the ratio of observed to estimated kills was anything like previous years, this suggests approximately 1,600 kills, plus or minus 300 (see Table 9.35b). At present, NIWA scientists are reassessing fur seal bycatch estimates for 1992–95.

The State of Hector's Dolphin (Cephalorhynchus hectori)

Hector's dolphins are easily recognised in coastal waters by their paddle-shaped black dorsal fins. They are the world's smallest marine dolphins and live in small family groups of 2 to 12. They are found only in New Zealand waters and generally stay within 5 km of the coastline (Dawson and Slooten, 1994, 1996). Their population size and distribution before human settlement in New Zealand are unknown.

These days most Hector's dolphins occur around the South Island and their total population has been estimated at 3,000–4,000, making them one of the world's rarest dolphins (Dawson and Slooten, 1988). As yet unpublished research at Auckland University suggests that the population consists of two genetically distinct sub-populations, one on the east coast and one on the west coast, which have no contact with each other.

Modern pressures on Hector's dolphins include entanglement in fishing nets and pollution from river mouths and harbours. Between 1984 and 1988, setnets, or gill nets, removed 130–230 dolphins from the Banks Peninsula population of about 600 (Dawson, 1991). These deaths were additional to those resulting from other causes. Fears for the impact on the Banks Peninsula population led to the area being made a marine mammal sanctuary with a restriction on the use of gill nets (Dawson and Slooten, 1993).

Because they are at the top of the marine food chain and feed near river mouths, Hector's dolphins are also at risk from anything which may reduce the quantity or quality of their food supply, such as excessive inshore fishing, sediment washing down from rivers, or the accumulation of toxic chemicals in fish. Dead Hector's dolphins which

Table 9.35
Reported and estimated fur seal bycatch, 1990–94.

(a) West Coast hoki fishery alone

	Observed kills[1]	Estimated kills[2]	Best estimate	Total number of towed nets	Percentage of tows observed
1990	*28*	*199–486*	*342*	*9,560*	*8%*
1991	*36*	*196–393*	*295*	*9,580*	*12%*
1992	*31*	*140–334*	*237*	*7,898*	*13%*
1993	*60*	*248–496*	*372*	*8,970*	*16%*
1994	*60*[3]				

(b) Entire Exclusive Economic Zone (EEZ), including West Coast hoki fishery, southern blue whiting fishery and southern squid fishery.

	Observed kills[1]	Estimated kills[2]	Best estimate	Total number of towed nets	Percentage of tows observed
1990	*28*	*261–651*	*456*	*43,735*	*6%*
1991	*90*	*702–1,166*	*934*	*48,887*	*10%*
1992	*74*	*740–1,243*	*991*	*51,904*	*7%*
1993	*171*	*1,148–1,704*	*1,426*	*53,770*	*12%*
1994	*202*[3]				
Yearly average 1990–93	*113*[4]	*713–1,191*	*952*	*49,574*	*9%*

Source: Ministry of Fisheries (unpublished provisional data).

[1] *Bycatch kills recorded by MAF Fisheries observers.*

[2] *Estimates are based on MAF Fisheries observer data extrapolated over the whole fleet and have a 95% confidence interval.*

[3] *Preliminary figures only. Data for 1994 and 1995 were not available when going to press because a reassessment of fur seal bycatch for the years 1992–95 was in progress (Baird, 1996).*

[4] *Observed kill average is for 1990–94. Other averages are for 1990–93.*

Table 9.36

Common and bottlenose dolphin kills by jack mackerel trawlers in the Taranaki Bight, 1990–95.

Season	Fishing ground	Observed kills[1]	Estimated kills[2]	Total number of trawl net tows	Percentage of tows observed
1989–90	*North Taranaki*	*0*	*	*1,433*	*4%*
	South Taranaki	*23*	*	*1,724*	*15%*
1990–91	*North Taranaki*	*0*	*	*794*	*<1%*
	South Taranaki	*0*	*	*1,053*	*23%*
1991–92	*North Taranaki*	*7*	*	*2,663*	*5%*
	South Taranaki	*22*	*	*1,010*	*10%*
1992–93	*North Taranaki*	*0*	*	*2,374*	*7%*
	South Taranaki	*9*	*	*992*	*15%*
1993–94	*North Taranaki*	*0*	*	*2,322*	*6%*
	South Taranaki	*8*	*	*1,079*	*24%*
1994–95	*North Taranaki*	*0*	*	*1,141*	*16%*
	South Taranaki	*21*	*	*600*	*34%*

Adapted from Baird (1996)

[1] *Dolphin kills witnessed by Ministry of Fisheries observers.*

[2] *Official estimates of the total dolphin kill in the Taranaki Bight were unavailable on going to press, but a rough extrapolation from observed catches suggests that about 80–300 dolphins are caught each year (Slooten and Dawson, 1995).*

occasionally wash up on beaches or are drowned in setnets have had their blubber analysed for chemical residues. Although persistent organochlorines have been found, such as polychlorinated biphenyls (PCBs) and DDT residues, the concentrations are much lower than in Northern Hemisphere dolphins (Buckland *et al.*, 1990; Department of Conservation, 1992a; Jones, 1995).

PCB levels in Hector's dolphins are higher than in other cetaceans that live further from the coast (e.g. common dolphins, dusky dolphins, beaked whales) but are still below 5 parts per million (ppm). This compares to PCB concentrations of 37–80 ppm in US dolphins and 55 ppm in British harbour porpoises (Jones, 1995). Overseas research has linked high concentrations of organochlorines to reproductive abnormalities and immune deficiencies in a number of species, though the interpretation of such data is still controversial (Addison, 1989; Motluk, 1995b; Stone, 1994a, 1994b, 1995a; Sharpe, 1995; Tanabe, 1994). Even more controversial are claims that low organochlorine concentrations can interfere with reproduction and immunity through prolonged exposure or through a combined 'cocktail' effect (Colburn *et al.*, 1996; Wilkinson and Dawson, 1996).

Because no data were collected on New Zealand dolphin populations or their chemical residues during the years of high organochlorine use (1950–1980) it is not known whether Hector's dolphins were adversely affected during this period. It is likely that they had higher concentrations of organochlorine residues than are found in today's dolphins, but the effects on their population, if any, remain unknown.

Other dolphin species in New Zealand waters have even lower concentrations of organochlorines than the Hector's dolphins and their populations seem large enough to cope with the limited bycatch pressure from setnets and trawlers. Probably the largest dolphin bycatch is associated with jack mackerel trawlers in the Taranaki Bight (see Table 9.36). Most of the victims are common and bottlenose dolphins. More than 90 percent of the drownings occur during night trawls.

The fishing industry has developed a code of practice for trawlers catching jack mackerel in this Quota Management Area (JMA 7). The relatively small number of dolphins caught and the lack of a controlled comparison makes it difficult to draw any conclusions about the effectiveness of the code of practice (Baird, 1996). During the 1994–95 season, after several bycatch incidents with dolphins, the jack mackerel trawlers were voluntarily withdrawn from the Taranaki Bight and their operations reviewed.

SOCIETY'S RESPONSES TO THE PRESSURES ON BIODIVERSITY

The first responses to New Zealand's biodiversity crisis were made by Maori tribes before Europeans came here. They included dietary changes, internal migration, territorial warfare, access restrictions based on *whakapapa* (genealogy) or *mana* (power, prestige) and conservation measures. These conservation measures varied from place to place and were driven by practical resource needs rather than the abstract principle of preserving biodiversity for its own sake (O'Regan, 1994).

The measures included the use of *tikanga* (ritualised methods) when harvesting important plants and animals, and the use of *tapu* (sacred prohibitions) and *rahui* (temporary prohibitions) to control the areas, seasons or species harvested. Because the measures were intended to maintain harvestable supplies of particular plants and animals, they focused on species which had resource value or were spiritually safe. Lizards, for example, were generally avoided because they were believed to have strong powers, while fish, food plants and edible invertebrates were readily eaten, with some being actively transferred from areas of plenty to areas of scarcity.

Following European settlement, nature conservation was far from most people's minds. The new settlers were intent on converting 'bush' into productive European-style farmland. European birds, domestic animals and game animals were introduced. Maori protests about the loss of native fisheries and the introduction of trout were ignored, as were the deforestation protests of a small number of European conservationists. Conservation measures were few and were limited to a small number of laws protecting individual species. In fact, the first laws were designed to protect introduced species.

The Protection of Certain Animals Act 1861 was a forerunner to the establishment of acclimatisation societies. It decreed that "no Deer of any kind, Hare, Swan, Partridge, English Plover, Rook, Starling, Thrush or Blackbird" could be shot for the rest of the decade. It was followed by the Trout and Salmon Protection Act 1867 which made provision for "the preservation and propagation of Salmon and Trout in this Colony". The other side of the acclimatisation coin soon followed with the Rabbit Nuisance Act 1876, the Small Birds Nuisance Act 1882 and the Noxious Weeds Act 1900.

The first legislation to protect indigenous species was the 1864 Wild Birds Protection Act which said: "No Wild Duck, Paradise Duck, or Pigeon indigenous in the colony shall be hunted, taken, or killed except during the months of April, May, June, and July in any year." In 1875 seal hunting was restricted to a short annual season, followed in 1894 by a requirement for sealing permits. In the 1890s, legal protection was also bestowed on such unique species as the tuatara and the doomed huia. Attitudes to indigenous species changed slowly. In 1907, legal protection was given to several more native birds (e.g. the tui, kaka, paradise shelduck and oystercatcher). The Animals Protection and Game Act 1921–22 extended protection to more species (including, however, the possum). Over the years, more native birds were given full protection (e.g. the Stewart Island diving petrel, or kuaka, in 1923, and the New Zealand pigeon, or kereru, in 1941).

Eventually, the protection of native animals was consolidated in the Wildlife Act 1953, which conferred protection on most native vertebrates (with some exceptions for sport hunting and pest control). In 1980, several dozen invertebrates were added to the list and in 1996 all of our lizards became protected species. Under these laws, most of the larger native land animals received some protection from harvesting, but were not protected from habitat decline and the encroachment of pests and weeds.

In 1908, the Fisheries Act empowered Ministers to use regulations if necessary to restrict the harvest of marine and freshwater species. These regulatory powers were later used to further limit seal hunting and to control the harvesting of toheroa, oysters, whitebait and some other fisheries. The original Fisheries Act and regulations have since been superseded by several new Acts, culminating in the Fisheries Act 1996 with its better safeguards for aquatic ecosystems and non-target species. Seals are now covered by separate marine mammal legislation. Non-commercial indigenous freshwater fish are managed under the Conservation Act 1987.

It was not until 1934 that protection measures were introduced for native plants outside of reserves and national parks. The Native Plants Protection Act makes it illegal to take most native plants without landowner consent. This Act is still in operation but provides little real protection for native plants.

Habitat protection was almost non-existent last century, except for a few small areas of lowland forest, which became scenic reserves, and extensive areas of high mountain forest, which were protected for flood control purposes. In 1887, Te Heuheu IV, paramount chief of the Tuwharetoa people of the central North Island, gifted their sacred mountains and surrounding land to the Government to protect them from encroaching farmers. Much of this land was tussock grassland which had been converted from forest by Maori fires centuries earlier. The land and its mountains, Ruapehu, Ngauruhoe and Tongariro, became New Zealand's first national park, the Tongariro National Park.

Over the next century, a dozen more national parks were established and about 4,000 smaller reserves, but only a few of these had biodiversity as a central consideration. Most were preserved for their scenery. A Scenery Preservation Commission was established in 1904, but provided little protection for the lowland forests, wetlands, dunelands, South Island tussock lands or river ecosystems. The concept of protecting marine areas was not recognised until the late 1960s. As a result of lobbying by marine scientists, the Marine Reserves Act was passed in 1971 and the first marine reserve was established in 1975.

Attitudes to biodiversity still vary widely in New Zealand. To some people, indigenous species are fellow beings with intrinsic value and a fundamental right to exist. To others they are resources whose value depends on their economic, recreational or cultural usefulness. These philosophical differences have an important bearing on how conservation priorities are set, which species and ecosystems are protected, and the degree of protection given. Despite the different perspectives, however, more than three-quarters of those surveyed in a 1992 Heylen poll believed that protecting endangered species is a very important issue, whether for ethical, economic or cultural reasons (Department of Conservation, 1993). This general sentiment is reflected in our key conservation laws.

The Government has listed the protection of indigenous habitats and biological diversity as one of its 11 most important environmental issues (Ministry for the Environment, 1995). To help it achieve its objective in this area, and to lay the groundwork for a more constructive and coordinated approach to sustaining biodiversity, the Government is developing the New Zealand Biodiversity Strategy (see Box 9.21).

Box 9.21

The New Zealand Biodiversity Strategy

Under the global Convention on Biological Diversity (CBD), which was signed at the 1992 Earth Summit in Rio de Janeiro, New Zealand joined with many other governments in agreeing to a range of measures for the conservation and sustainable use of biological diversity. In Article 6 of the Convention they agreed to develop national strategies, plans or programmes and to integrate these into relevant sectoral (social and economic) plans, programmes and policies.

The New Zealand Biodiversity Strategy is now being developed by the Department of Conservation and the Ministry for the Environment. An outline strategy document based on discussions with a range of interested parties is expected to be released in mid 1997. The document will outline various issues affecting the management of biodiversity and potential responses to these issues. It will invite submissions from the public. The submissions will be reviewed and the New Zealand Biodiversity Strategy will then be released. Some of the issues likely to come within the scope of the Strategy include:

- the conservation and sustainable management of indigenous biodiversity;
- threats to indigenous biodiversity from habitat destruction and fragmentation, introduced plant pests and animal predators, over-exploitation by recreational and commercial activities, and global environmental change;
- the sustainable management of introduced biodiversity—in terms of the threats it poses to our indigenous biodiversity;
- biosecurity—protecting both indigenous and productive ecosystems from further foreign plant and animal pests.

The Biodiversity Strategy will not be just a statement of good intentions. It will be action-oriented with a focus on how best to sustain our biodiversity. It will help to coordinate the different biodiversity initiatives up and down the country and ensure they are better integrated.

Key conservation laws

The **Conservation Act 1987**, and amendments to it, have established the Department of Conservation, the New Zealand Conservation Authority and Boards, and the New Zealand and Regional Fish and Game Councils with the aim of promoting the conservation of natural and historic resources. It defines conservation as the preservation and protection of natural and historic resources (which include plants and animals of all kinds as well as fungi, algae and bacteria) for the purpose of maintaining their intrinsic values, providing for their appreciation and recreational enjoyment by the public, and safeguarding the options of future generations.

The **Wildlife Act 1953** provides for the protection of wildlife, except for certain species named in Schedules to the Act, and also provides for the control of wildlife. It allows game(birds) to be hunted or killed, subject to restrictions. Recent amendments to this Act include the protection of several marine groups, namely black corals (Antipatharia), red corals (Stylasterids) and spotted black groper (*Epinephalus daemelii*).

The **Reserves Act 1977** allows the classification of different types of public reserves. The Act contains provisions for their acquisition, control, management, maintenance, preservation, development and use.

The **Marine Reserves Act 1971** makes the Department of Conservation responsible for the management and protection of marine reserves. Management functions include marking marine reserve boundaries, law enforcement, the issuing of permits for scientific studies, and monitoring environmental changes. The legislation has scientific study and preservation of marine life as its primary focus and is the key legislation for protection of marine biodiversity.

The **Marine Mammals Protection Act 1978**, administered by the Department of Conservation, provides for the conservation, protection and management of marine mammals. Under the Act, a permit is required for anyone to 'take' a marine mammal. (The definition of 'take' includes actions that harm, harass, injure, and attract.) The Act does not prevent the accidental (or incidental) catching of marine mammals (bycatch) during fishing operations.

The **National Parks Act 1980** provides for the establishment, administration, control and management of national parks. National parks comprise land with scenery of such distinctive

quality, ecological systems or natural features so beautiful, unique or scientifically important that their preservation is in the national interest. National parks are preserved for their intrinsic worth and for the benefit, use and enjoyment of the public.

The **Resource Management Act 1991,** which sets out the environmental management responsibilities of local authorities, aims to promote the sustainable management of natural and physical resources (which are defined as including all forms of plants and animals). The authorities must provide for "matters of national importance" which include, among other things, the protection of areas of significant indigenous vegetation, significant habitats of indigenous fauna, and wetlands.

They are also required, among other things, to have particular regard for any finite characteristics of natural and physical resources, the protection of trout and salmon habitat, and, most significantly, the intrinsic values of ecosystems, which are defined as those aspects and parts of an ecosystem "which have value in their own right", including (a) their biological and genetic diversity; and (b) the essential characteristics that determine the integrity, form, functioning and resilience of the ecosystem.

The Environment Act 1986, which reformed the Commission for the Environment and established the Ministry for the Environment, aims to ensure that, in the management of natural and physical resources (which are defined to include, among other things, all forms of flora and fauna), full and balanced account is taken of, among other things, their sustainability, the intrinsic values of ecosystems (which are defined as systems of interacting organisms within their natural environment) and the needs of future generations.

The 1993 amendment to the **Forests Act 1949** requires that the milling of indigenous timber from most privately owned indigenous forests in New Zealand be subject to a sustainable forest management regime that maintains the forest's ability to provide products and amenities in perpetuity while also retaining its natural values.

The **Fisheries Act 1996** aims to use fisheries resources while "ensuring sustainability". This is defined as both maintaining their potential to meet the needs of future generations, and avoiding, remedying or mitigating any adverse effects of fishing on the aquatic environment. In pursuing these objectives, the Act requires that the following environmental principles be taken into account: (a) associated or dependent species should be maintained above a level that ensures their long-term viability; (b) biological diversity of the aquatic environment should be maintained; (c) habitat of particular significance for fisheries management should be protected. In addition, the Act's information principles require that decisions be based on the best possible information, be cautious when information is uncertain, unreliable or inadequate, and not be deferred because of inadequate information.

Besides these main laws, a range of more specific laws operate to promote conservation at the national and local levels. Some of these have already been mentioned. They include the Native Plants Protection Act 1934; the Marine Reserves Act 1971; the Wild Animal Control Act 1977; the Queen Elizabeth II National Trust Act 1977; the Marine Mammal Protection Act 1978; the National Parks Act 1980; the Trade in Endangered Species Act 1989; the Local Government Amendment Act 1989; the Maori Fisheries Act 1989; the Treaty of Waitangi (Fisheries Claim) Settlement Act 1992; the Biosecurity Act 1993; and the Hazardous Substances and New Organisms Act 1996. Some of these are discussed below or in earlier chapters.

Rules in regional and district plans have the status of law under the Resource Management Act as do Heritage Protection Orders and Water Conservation Orders issued by central Government under that Act. A range of funding mechanisms also exist to purchase land for conservation purposes or to pay landowners for reserving land through legally binding protection covenants.

International conservation obligations

The need to protect biodiversity is not just a national or local concern. It has also become an international obligation. Because New Zealand's endemic species are found nowhere else on Earth, their loss is a world loss. Conversely, because New Zealanders are part

of the global community, the extinction of any overseas species is also our loss. New Zealand is therefore an active member of the international conservation network and a party to many international agreements related to biodiversity.

Three of the most significant biodiversity conventions are: the Convention on Biological Diversity; the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); and the International Convention for the Regulation of Whaling.

Of these, the **Convention on Biological Diversity** is the most all-embracing. It was opened for signing at the United Nations Earth Summit in Rio de Janeiro on 5 June 1992 and came into force on 29 December 1993. The Convention spells out principles and obligations for the conservation, sustainable use and fair and equitable exploitation of other species. It notes that the fundamental requirement for maintaining biological diversity is the *in-situ* conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings. The Convention also notes that lack of full scientific certainty should not be used as a reason for postponing measures that may avoid or minimize threats to biodiversity.

Although the Convention does not prescribe any particular methods for conserving biological diversity, it does require member countries to develop national biodiversity strategies and to integrate these with other forms of planning. It also requires countries to monitor their biodiversity, establish a system of protected areas, introduce procedures to assess, and avoid or minimise the impact on biodiversity of proposed projects, and promote public education and awareness. Where compatible with conservation or sustainable use requirements, Convention members are also to encourage customary use of biodiversity in accordance with traditional practices and facilitate access for other resource users.

The **Convention on the International Trade in Endangered Species (CITES)** aims to limit the threat posed by trade through a system of import and export controls. The Convention came into force on 1 July 1975, but New Zealand only ratified it in 1989 when the Trade in Endangered Species Act was passed. Under the Act, species are listed in three categories: endangered; threatened; and exploited. Endangered species may only be traded when accompanied by an export permit, issued by the country of origin, and an import permit, issued by the country of import. Threatened species may only be traded if accompanied by an export permit from their country of origin stating that the transaction is not harmful to the species. The CITES appendices are periodically revised and member countries are required to amend their import and export controls accordingly. Of prime concern are species targeted by international collectors (such as parrots, rare reptiles, corals, turtle shells, elephant ivory, rare animal skins) and those targeted by the Asian medicaments industry (such as tigers, bears and rhinoceroses).

The **International Convention for the Regulation of Whaling** was signed in 1946 and established the International Whaling Commission (IWC). New Zealand was an IWC member until our whaling industry ceased in the 1960s. In 1978, however, in response to growing public pressure for an end to whaling worldwide, New Zealand rejoined the Commission to support other non-whaling countries in their bid for a global ban on commercial whaling.

New Zealand has taken a consistently conservationist and humanitarian position at the IWC, reflecting most New Zealanders' opposition to both the ecological destructiveness of whaling and its cruelty. In 1986, the IWC imposed a moratorium on whaling, with exceptions for 'traditional' and 'scientific' whaling. In 1994, the IWC voted to establish a southern ocean whale sanctuary surrounding the South Pole. Together with the existing Indian Ocean sanctuary, this means that almost one-third of the world's oceans will be off-limits to whalers if the moratorium were ever lifted.

Other significant biodiversity conventions to which New Zealand is a party are: the Convention on Wetlands of International Importance Especially as Waterfowl Habitats (Ramsar Convention) (see Chapter 7 for discussion); the Convention on the Conservation of

Nature in the South Pacific (Apia Convention); the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention); the Convention on the Conservation of Antarctic Marine Living Resources; the Convention on the Prohibition of Fishing with Long Drift Nets in the South Pacific (Wellington Convention); and the Convention for the Conservation of Southern Bluefin Tuna. New Zealand is also participating in United Nations-sponsored talks to regulate the fishing of migratory fish stocks in open seas.

Finally, Chapter 17 of the Rio Summit's *Agenda 21* document (see Chapter 7) calls on nations to work towards protecting marine ecosystems within their Economic Exclusion Zones by identifying ecosystems with high levels of productivity and biodiversity or with critical habitat areas and, where necessary, limiting use in these areas through, among other things, the designation of protected areas.

New Zealand's conservation network

A large number of organisations and individuals are involved in efforts to maintain New Zealand's biological diversity. They include Government departments, other statutory agencies and a wide range of voluntary organisations, professional groups and biodiversity resource users.

The **Department of Conservation** is the main Government agency responsible for protecting and sustaining biodiversity. Established in 1987 under the Conservation Act, it undertakes the day-to-day management of New Zealand's protected areas and unallocated public lands. In addition to advising the Government and other agencies on conservation and biodiversity matters, the Department advocates, promotes and encourages the conservation of all natural and historical resources. It can voice its opinions on any issues of natural resource management (including statutory advocacy through the Resource Management Act, commenting on marine fisheries, indigenous forestry management, freshwater fish habitats etc.).

The Department consists of a Wellington-based head office, 3 regional offices (at Hamilton, Wellington and Christchurch) and 14 conservancy offices distributed throughout the country. Its main functions include:

- managing nearly one-third of New Zealand's land in the form of national parks, reserves and stewardship land;
- managing species protected under the Wildlife Act 1953 both on and off the 'conservation estate';
- managing indigenous and recreational freshwater fisheries, and protecting freshwater fish habitat;
- protecting marine mammals;
- controlling designated wild animals;
- carrying out weed and pest control, and fire control, on the conservation estate and unallocated Crown land;
- managing the Crown foreshore and seabed, developing the New Zealand Coastal Policy Statement and approving regional coastal plans;
- creating and managing marine protected areas;
- acting as an advocate for the Crown to achieve protection for indigenous species through local authority plans and polices, voluntary agreements with land owners, land purchases and legislation; and
- meeting New Zealand's international conservation commitments.

The Department also has a consultative voice in the management of marine fisheries and in sustainable forest management plans for indigenous timber production. Apart from sustaining biodiversity, the Department is also responsible for providing recreational, tourist and visitor services on conservation land, a role which consumes more than a third of the Department's $127 million annual budget (Department of Conservation, 1995).

Several other statutory organisations also play important roles in New Zealand's conservation network. Among these are the **New Zealand Conservation Authority** and its 17 **Regional Conservation Boards** which act as bridges between the Department of Conservation and the public. The Authority and boards are housed within the Department and serviced by its staff but are quite independent in their advice and functions.

Its members are drawn from organisations representing Maori interests, the tourism sector, recreational users of conservation land and environmentalists.

Their role is to ensure that the Department manages its lands in accordance with public wishes, subject to the Conservation Act's requirement that protected species and indigenous habitats and other sites be maintained. The Authority produces discussion documents and invites public feedback on contentious issues, such as the cultural harvesting of indigenous species, and they provide independent advice to both the Department and the Minister on conservation issues of national importance. Authority approval is also required before the Department can implement its policies and plans for national parks or its conservation management strategies and plans.

The **Forest Heritage Fund** and **Nga Whenua Rahui** are also independent of the Department of Conservation, though they are housed within it and serviced by Department staff. These special-purpose committees were set up in 1990 to pay for the protection of indigenous forests of high conservation value on private land either through legally binding protection covenants or direct purchase. Each year these funds are allocated a total of $6.8 million for this purpose, with the Forest Heritage Fund receiving $4.5 million and Nga Whenua Rahui $2.3 million. About 130,000 hectares were protected or earmarked for protection by mid-1996.

Another statutory organisation which has the role of funding voluntary protection of 'open spaces' on private land is the **Queen Elizabeth II National Trust,** which was established under its own Act in 1977. Nearly 100,000 hectares of forest, wetland and other 'open spaces' were protected or earmarked for protection by mid-1996. The Trust receives funding from Government grants, the Forest Heritage Fund and public donations. The Conservation Department also has a small, self-generated fund for buying land that has high biodiversity. This is financed from the sale of less important conservation land and has amounted to about $1.5 million a year.

The **New Zealand Fish and Game Council** and its 12 **Regional Fish and Game Councils** are modern descendants of the old acclimatisation societies which brought so many pest species into New Zealand. Today these organisations are charged with managing, maintaining and enhancing populations of introduced sports fish (e.g. trout and salmon) and native and introduced game birds (e.g. ducks, geese, pheasants). As some of the sports fish have negative impacts on native fish, and some of the game birds are declining indigenous species (e.g. grey and shoveler ducks), the game councils' activities have important implications for biodiversity. The councils and the Department of Conservation are required to coordinate their management plans wherever sports fish and game birds are involved.

The **Ministry of Fisheries** (formerly a part of the Ministry of Agriculture and Fisheries) is responsible for the management of marine and commercial freshwater fisheries. Under the Fisheries Act, the Minister is required to sustain not only the target species of a fishery, but also any associated or dependent species, the biological diversity of the marine environment, and any habitat of particular significance to fisheries.

The Ministry provides the expert advice for this, drawing on data from the fisheries scientists at the Crown Research Institute, NIWA, and on consultations with fishing companies, Maori interests, recreational fishers, environmental groups and Government agencies such as the Department of Conservation and the Ministry of Maori Affairs (Te Puni Kokiri).

The **regional and unitary councils** and **district councils** enforce resource management policies and plans in consultation with the community and Maori interests. In doing this, they are required, among other things, to sustain ecosystems and have regard for their intrinsic values and for the protection of significant habitat of indigenous species as well as the habitat of trout and salmon.

The **Ministry for the Environment** has an oversight role in the planning and policy-making process and also furnishes advice to the Government and the councils on a range of environmental issues, including some relating to biodiversity.

The **Ministry of Forestry** has an Indigenous Forestry Unit whose role is to ensure that sustainable management permits and plans for the milling of native timber follow the requirements of Part III of the Forests Act 1949, which was amended in 1993 to ensure that the forest's natural values are retained while the forest is being harvested.

Several **Crown Research Institutes**, particularly Landcare Research and NIWA, maintain biodiversity and pest databases and undertake research on species and ecosystems.

Conservation activities, policies or research are also pursued by a number of non-governmental organisations (NGOs) such as ECO, Friends of the Earth, Greenpeace, the Maruia Society, the New Zealand Ecological Society, the Royal Forest and Bird Protection Society and the Worldwide Fund for Nature (NZ). Some are special-purpose organisations, such as the Botanical Society of New Zealand, Ducks Unlimited, the Federated Mountain Clubs, the Native Forests Restoration Trust, the Ornithological Society of New Zealand, Project Jonah, the Rainforest Coalition and the Yellow Eyed Penguin Trust. Groups such as these have been instrumental in bringing conservation issues to the attention of national and local government, lobbying for effective solutions and initiating practical biodiversity conservation projects.

Several companies have also become involved in conservation activities by making financial contributions to conservation projects. Their sponsorships are managed through partnerships with the Department of Conservation, the Royal Forest and Bird Protection Society and the New Zealand Conservation Authority under the Threatened Species Trust Programme. The Bank of New Zealand contributes to the Kiwi Recovery Programme; Comalco provides funds to help save the kakapo; State Insurance helps support the kokako; Flightcentre New Zealand is sponsoring the Takahe Recovery Programme; and Ace Dynaco Magicdoors has pledged $30,000 to saving threatened native frogs.

Other corporate conservation sponsors who work in conjunction with the Department of Conservation are Hannahs (walkways), Corbans Wines (wetlands), Carter Holt Harvey (Project Crimson—pohutukawa planting), Westpac (Project Crimson and other tree projects), Software Education (various bird support projects) and McDonald's (tree planting programme). Some companies support conservation by donating to voluntary organisations or conservation trusts. Mainland Cheese, for example, supports the Yellow-eyed Penguin Trust, a private organisation which purchases coastal sites for penguin habitat. Besides these big companies whose conservation sponsorship is widely known, many small firms and businesses support conservation projects at the local level.

Over the years, a significant number of landowners have chosen to retain small areas of indigenous forest or wetland on their properties. These have not been formal arrangements sealed by covenants but simply personal decisions to hold on to patches of "bush" and wetland for aesthetic or conservation reasons, or because the land owners have no other use for the land. Often the preserved forest is in gullies and alongside streams. Such strips are important refuges for indigenous biodiversity, but unfortunately many are too small or isolated to sustain viable populations of rare or threatened species for very long. However, the forest remnants can provide temporary footholds, and could provide more permanent habitat if they were modestly expanded and, where possible, connected up.

Maori tribes or **iwi** have a strong interest in the management of activities which affect our biodiversity, both as traditional users of some species and as significant land owners and commercial fishers. Maori interests own 40 percent of the commercial fishing quota and a considerable amount of biodiversity habitat is on Maori land (i.e. more than half a million hectares of native forest). Conversely, many species traditionally harvested by Maori communities are now protected by law, with some species restricted to conservation land or subject to harvesting prohibitions or restrictions.

Most of the claims before the Treaty of Waitangi Tribunal include areas of conservation land. Often these areas include mahinga kai (traditional food-gathering areas), waahi tapu (sacred sites), and urupa (burial sites). One claim (Wai-262), which was submitted in

1991 and was still being considered in 1996, seeks iwi control of all New Zealand's biodiversity; its use, study, conservation, and sale (Murray *et al.*, 1991).

Maori interest in biodiversity and resource management is recognised in the Conservation Act 1987 and the Resource Management Act 1991, which require resource managers to consult with Maori. Maori interests and claims have also been recognised in the Maori Fisheries Act 1989 and the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. In some areas the Minister of Fisheries has established taiapure or traditional fishery zones managed by the local Maori runanga. Separate legislation to provide for customary Maori fisheries is currently being drafted.

Resources for biodiversity conservation

In the 8 years from 1987/88 and 1994/95 the Crown contribution to the Department of Conservation's budget was reduced by about 20 percent in real terms and staff numbers fell from a peak of 2,300 in March 1988 to approximately 1,500 full-time equivalent positions (Department of Conservation, 1993). Current DOC staffing is approximately 1,300 full-time equivalent positions. The Department had a total budget of $123 million in 1994/95, of which almost $95 million came from the Crown and $28 million came from other sources.

In 1995/96, the Department received a $5 million increase in Government funding, most of which was earmarked for possum control and threatened species work. This boosted the Department's budget for threatened species and island habitat programmes from nearly $16 million in 1994/95 to nearly $19 million in 1995/96 (Department of Conservation, 1995). On 20 May 1996, the Government announced a further increase of $68.4 million in funding for the Department of Conservation to be spread over the following three years.

The new financial allocation came as part of the Government's Budget strategy in what has been called a 'Green Package.' The increase will take the Department's total funding to $181 million a year by 1998/99. Of the new funding, $20 million will be used to combat pests and weeds, $18 million will go toward the protection of threatened species, and $6.25 million will be allocated to research to find new and cost-effective ways of controlling possums.

Responses to the pressures on biodiversity

The combination of laws, statutory organisations and interest groups has produced a wide range of responses to the main pressures on our biodiversity. Most of these responses have focused on reducing human predation but, increasingly, measures are being developed to deal more effectively with the pressures of habitat decline and pests and weeds.

Responding to human predation

The Conservation Act 1987 and other Acts covering reserves and national parks prohibit the taking of indigenous species on protected land without the Department of Conservation's consent. Several other laws prohibit or regulate the taking of indigenous plants and animals anywhere in New Zealand.

The ***Native Plants Protection Act 1934*** is generally acknowledged to provide little real protection for native plants. It appears to have been written to limit the collection by gardeners of small herbaceous plants (Bellingham, 1993b). Fines are very small (not exceeding $40 for the third offence) and in the only test case a pohutukawa tree was found not to be a 'plant' under the Act. The Act prohibits the taking of significant quantities of most native plants without landowner permission. On public land, that permission must come from Government or local authorities.

Exceptions are made for medicinal, research or horticultural plant uses and for the following plant taxa: hutiwai or piripiri (*Acaena* spp.), tutu (*Coriaria* spp.), tauhinu (*Cassinia* spp.), fireweed (*Erechtitoid* spp.), waterfern (*Histiopteris incisa*), kanuka (*Kunzea ericoides*), manuka (*Leptospermum scoparium*), hard fern (*Paesia scaberula*), tauhinu (*Pomaderris phylicifolia*), bracken (*Pteridium esculentum*), nettles (*Urtica* spp.), thallose liverworts (*Marchantia* spp.) and all mosses. The Act also does not apply to lichens, other fungi or algae.

The ***Wildlife Act 1953*** gives varying levels of protection to native and introduced animals which live in a wild state in New Zealand.

The definition of 'animal' is legal rather than scientific. It includes most wild mammals (but not rabbits, hares or marine mammals), all wild birds, all reptiles and native frogs, but very few fish and invertebrates. The protected invertebrates include the giant wetas, all the large land snails, some weevils and other beetles, a grasshopper and the cave spider.

The Act was recently amended to include some marine species (e.g. black and red corals, and black spotted groper) that were formerly protected under fisheries regulations, and to extend its coverage out to the 200 mile limit of the Exclusive Economic Zone. Most fish, however, are covered separately by the Conservation Act 1987 (in the case of freshwater native and sports fish) and the Fisheries Acts 1996 (in the case of commercially harvested freshwater fish and all marine fish). The vast majority of invertebrates are also excluded from the Act's definition of animal. Most of the species covered by the Act are totally protected from being killed, moved, liberated, held or disturbed. Several species, however, are in the following special protection categories:

Game birds may be hunted in season, but are protected at other times. They include the native grey duck, shoveller and paradise ducks and pukeko, as well as a number of introduced species.

Partially protected species may be killed as pests by landowners, but are otherwise protected. They include the southern skua, white-eye, harrier hawk, black shag and little owl.

Publicly notifiable species may be killed subject to conditions set by the Minister of Conservation in a *Gazette* notice. They include the sooty shearwater and grey-faced petrel (which may be killed by Maori customary hunters), peafowl, little shag and pied shag. They also include (in the Chatham Islands only) grey ducks, pukeko and South Island wekas, plus introduced black swans and mallard ducks, and (on islands in Foveaux Strait and off Stewart Island) the Stewart Island weka.

Unprotected species may be killed at any time. They include introduced mammals (cat, dog, cattle, sheep, horse, weasel, stoat, ferret, polecat, rat, mouse, hedgehog), birds (black-backed gull, blackbird, red-vented bulbul, cirl bunting, Cape Barren goose, Malay dove, feral goose, chaffinch, goldfinch, greenfinch, guinea-fowl, kookaburra, magpie, mynah, budgerigar, eastern rosella, sulphur-crested cockatoo, rock pigeon, redpoll, skylark, hedge sparrow, house sparrow, starling, thrush, turkey, yellowhammer) and frogs (green frog and whistling frog).

The Wildlife Act also prohibits the export of any bat, bird (other than farmed fowl, duck, turkey or pheasant), reptile, amphibian, *Paryphanta* land snail, or any parts thereof, without the consent of the Director-General of Conservation.

The ***Fisheries Act 1996*** requires all commercial fishing to be authorised by a fishing permit. It empowers the Minister of Fisheries to impose sustainability measures on any fishery by setting limits on catches (annual quotas, daily bag limits), minimum sizes, prohibited areas, fishing methods and seasons. More than 50 fish and invertebrate species are currently managed this way, most of them through the Quota Management System (QMS). About 120 more species will eventually be added to the QMS, bringing about 15 percent of our marine fish species under quota management.

The Minister may also impose a three-month moratorium on any fishery if the stock, associated species, or environment are being depleted by fishing activity. However, the Minister can no longer impose absolute protection through fisheries regulations. A small number of marine species which were protected in this way are now protected under an amendment to the Wildlife Act 1953.

The Fisheries Act also sets out a process for dealing with bycatch, or 'fishing related mortality' where it affects any of the species covered by the Wildlife Act 1953 or the Marine Mammals Protection Act 1978. Both of these Acts were amended to allow the Minister of Conservation to produce Population Management Plans which establish allowable bycatch limits for protected species. The Fisheries Minister is required to manage the fishery in accordance with these plans, or, in the absence of a plan, to consult with the Minister of Conservation on measures to be taken.

The ***Marine Mammals Protection Act 1978*** combines conservation and animal welfare objectives by prohibiting people from injuring, killing or molesting marine mammals around New Zealand's coasts and throughout the Exclusive Economic Zone (EEZ). The Minister is also empowered to establish marine mammal sanctuaries in which fishing or other disturbances to marine mammals can be restricted or prohibited. At present, two such sanctuaries exist, around Banks Peninsula and the Auckland Islands. The Act allows the accidental killing of marine mammals in fishing nets but empowers the Minister of Conservation to impose limits on this through Population Management Plans.

The ***Trade in Endangered Species Act 1989*** and the Trade in Endangered Species Order 1991 fulfil New Zealand's obligations under the Convention on Trade in Endangered Species (CITES). The CITES list is periodically revised and includes the following New Zealand species: Campbell and Auckland Island teals, brown teal, parakeets (Forbes', Antipodes Island, orange-fronted, yellow-crowned and red-crowned), kakapo, kaka, kea, falcon, Australasian harrier, buff weka, tuatara, all *Paryphanta* snails, black coral, Cyathea and Dicksonia tree ferns, and all orchids. It is illegal to export these species or to import other CITES-listed plants, animals or body parts without a country of origin permit. Fines range up to $100,000 for an individual and $200,000 for a corporation.

New Zealand has a more liberal interpretation of export permits than some other CITES members, such as Australia. Since 1988, export permits for both native and imported species have only been withheld where it can be shown that the species have been illegally imported, captured or killed (Ansley, 1995). Imports are closely policed, however, with the Department of Conservation, the Customs Department and the Ministry of Agriculture jointly operating the National Flora and Fauna Investigations Unit (NFFIU). More than 6,000 illegally imported CITES-listed specimens are apprehended each year.

Responding to habitat decline and alien species

Legal protection

The responses to habitat decline occur at two levels: legal protection, which is effectively protection from encroachment by people; and ecological protection, which is protection from introduced species and the effects of previous environmental destruction. The main legal protection measures have already been described in chapters 4 and 5. In brief, nearly 8 million hectares of land and about 1 million hectares of sea have been set aside in parks, reserves, or other protected areas, and are administered by the Department of Conservation (see Tables 9.37 and 9.38).

Despite their size, however, these protected areas are not representative of the habitats where much of our indigenous biodiversity is found. The bulk of the protected land is in the mountains, and most of the protected marine area is around the Kermadec Islands and in marine mammal sanctuaries, leaving barely 15,000 hectares of protected marine habitat in our coastal waters (see Figure 9.8). While the Kermadec Marine Reserve boosts the protected portion of our marine environment to nearly 7 percent of the territorial sea (i.e. waters within 12 nautical miles of the coast), the remaining marine reserves cover less than 2 percent of our coastal mainland waters (i.e. waters within a kilometre of the coast). All marine protected areas combined cover barely a fraction of 1 percent of our Exclusive Economic Zone. In fact, New Zealand's parks and reserves have made a surprisingly small contribution to species conservation. Only a few reserves were set aside to protect native species. They include the island sanctuaries of Little Barrier, Kapiti and the subantarctic islands, a few mainland sanctuaries, such as Waipoua Forest, and a scattering of small scientific reserves.

In most places, protected areas were chosen more because they were available and not wanted for anything else than because they had high biodiversity value (Towns and Williams, 1993). Almost all the national parks were established for their landscape features. Some were amalgamations of scenic reserves which were developed for aesthetic

reasons and to service a tourist industry. Forested areas were not routinely set aside for their scientific value until the Forests Act was amended in 1976. As a result, the lowland forests, which made up about 50 percent of the original forest area, and supported a wider variety of species than the mountain forests, now comprise only about 16 percent of the protected forest area, and less than 7 percent of the original lowland forest area.

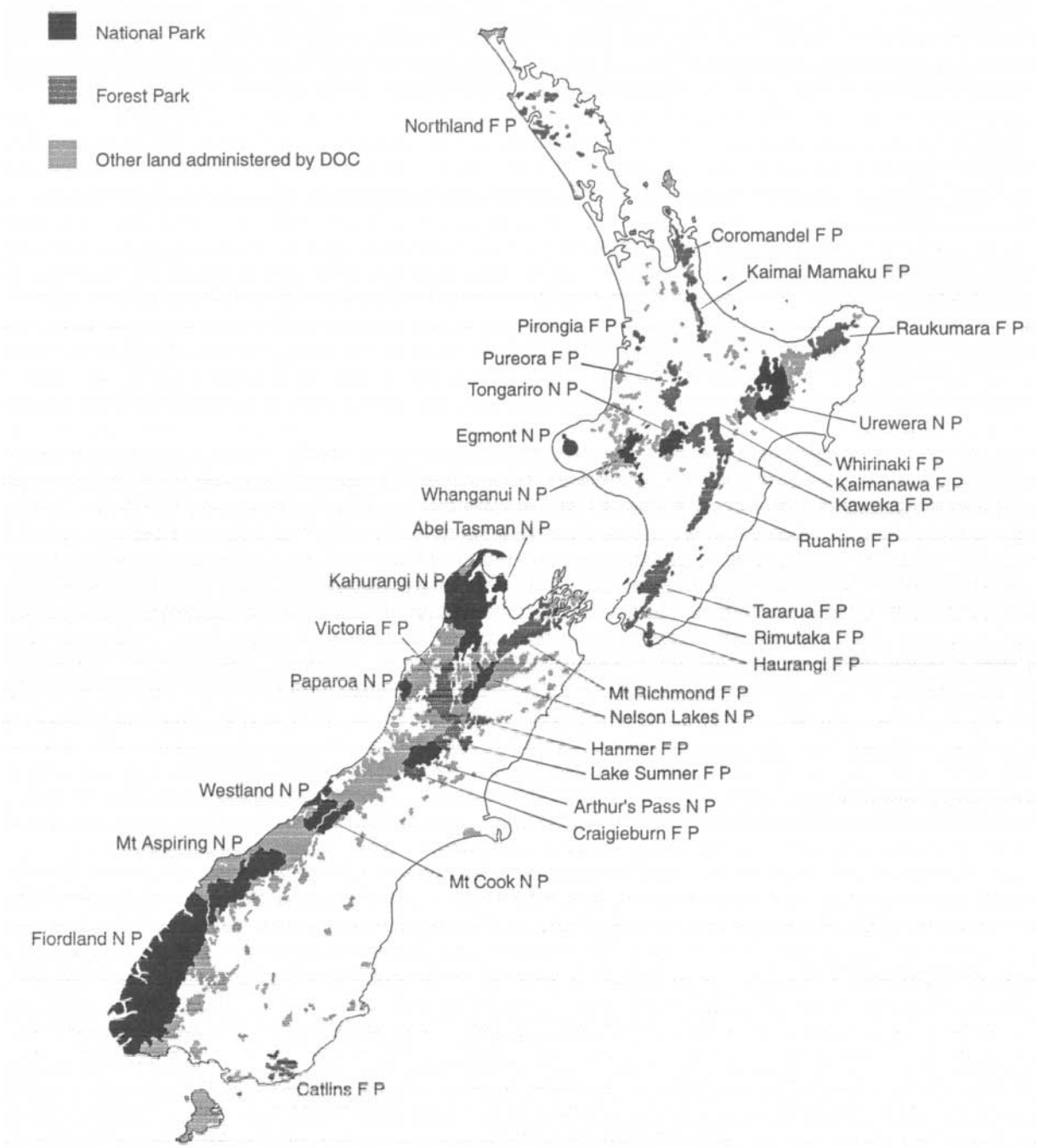
The Department of Conservation is attempting to improve the representativeness of our protected areas. Through the Protected Natural Areas Programme (PNAP) it is identifying under-represented habitats, many of which are on private land in lowland areas or on high-country leasehold land. Legal protection for these is achieved in various ways (e.g. through local authority plans, covenants and other contractual arrangements with landowners, land purchases, leases and exchanges). The Department can also take action under the statutory advocacy functions provided by Section 6 of the Conservation Act and through the processes contained in the Resource Management Act 1991.

Table 9.37
Parks and reserves administered by the Department of Conservation in 1996

Protected areas	North Island	South Island
13 National Parks *(Total area approximately 2.8 million hectares)*	*Tongariro* *Urewera* *Egmont* *Whanganui*	*Abel Tasman* *Kahurangi* *Nelson Lakes* *Paparoa* *Arthur's Pass* *Westland* *Mount Cook* *Mount Aspiring* *Fiordland*
19 Forest Parks *(Total area approximately 1.4 million hectares)*	*Northland* *Coromandel* *Kaimai-Mamaku* *Raukumara* *Pirongia* *Whirinaki* *Pureora* *Kaimanawa* *Kaweka* *Ruahine* *Tararua* *Rimutaka* *Haurangi*	*Mount Richmond* *Victoria* *Hanmer* *Lake Sumner* *Craigieburn* *Catlins*
4000 Reserves *(approximately)*	*Dispersed throughout New Zealand*	
2 Marine Parks	*Mimiwhangata (near Whangarei)* *Tauharanui (near Auckland)*	
1 Marine Protected Area	*Sugar Loaf Islands (near New Plymouth)*	
13 Marine Reserves	*Kermadec Islands* *Cape Rodney-Okakari Point* *Poor Knights Islands* *Whanganui-A-Hei* *Tuhua/Mayor Island* *Motu Manawa-Pollen Island*	*Long Bay-Okura* *Kapiti* *Long Island - Kokomohua* *Westhaven Te Tai Tapu* *Tonga Island (Abel Tasman National Park)* *Piopiotahi* *Te Awaatu Channel* *(The Gut, Doubtful Sound, Fiordland)*
2 Marine Mammal Sanctuaries	*Banks Peninsula (for Hector's Dolphin)* *Auckland Islands (for New Zealand Sea Lion)*	
2 World Heritage Natural Sites	*Te Wahipounamu (south-west New Zealand)* *Tongariro National Park*	
1 World Heritage Cultural Site	*Tongariro National Park*	

Source: Department of Conservation

Figure 9.8
Land administered by the Department of Conservation in 1996



Source: Department of Conservation

Table 9.38

Area of parks and reserves administered by Department of Conservation in 1996.

Protected Area Categories	IUCN Category[1]	Area (hectares)
Public land subject to the National Parks Act 1980		***2,425,884***
specially protected areas	*Ia*	*55,176*
wilderness areas	*Ib*	*205,260*
national parks (balance)	*II*	*2,165,448*
Public land subject to the Conservation Act 1987		***4,668,440***
conservation parks	*II*	*1,815,026*[2]
ecological areas	*Ia*	*215,116*
sanctuary areas	*Ia*	*16,420*
wilderness areas	*Ib*	*167,597*
stewardship areas	*IV*	*2,769,683*
Public Land subject to the Reserves Act 1977		***809,570***
national reserves	*II*	*96,361*[3]
nature reserves	*Ia*	*189,472*
historic reserves	*III*	*3,279*
scenic reserves	*III*	*518,501*
scientific reserves	*Ia*	*10,368*
wildlife purpose reserves	*III*	*18,621*
recreation and other reserves	*V*	*68,969*
Public land subject to the Wildlife Act 1953		***10,821***
wildlife refuges and management areas	*IV*	*10,226*
wildlife sanctuaries	*Ia*	*595*
Private land subject to the Conservation Act 1987 and the Reserves Act 1977		***61,760***
reserved under conservation covenants or private agreements	*IV*	*61,760*[4]
Total land conservation area		***7,976,475***
Marine reserves subject to the Marine Reserves Act 1971	*Ia*	***760,513***
Marine mammal sanctuaries subject to the Marine Mammal Protection Act 1978	*Ia*	***335,111***
Marine parks subject to the Fisheries Act 1983 and the Harbours Act 1950	*Ia*	***2,350***[5]
Marine protected area subject to the Sugar Loaf Islands Marine Protected Area Act 1991	*Ia*	***800***[6]
Total marine conservation area		***1,098,774***

[1] *As defined by the International Union for the Conservation of Nature and Natural Resources.*

[2] *The total area figure for 'conservation parks' also includes many ecological and sanctuary areas, as well as two wilderness areas. The 'double counts' are excluded from the net total area.*

[3] *The total areas figure for 'national reserves' also includes units of nature, scenic and historic reserves. These 'double counts' are excluded from the net total area.*

[4] *Further areas of private land, totalling at least 70,000 hectares, were committed for protection as of mid-1996, but not yet gazetted.*

[5] *The lead administrative agency is the Ministry of Fisheries which shares responsibilities with the Department of Conservation (at Mimiwhangata) and the Auckland Regional Council (at Tauharanui).*

[6] *Fisheries matters within this reserve are administered by the Ministry of Fisheries.*

Figure 9.9
Marine reserves, proposals and investigations in 1996

Source: Department of Conservation

Box 9.22

Marine reserves as rock lobster nurseries

New Zealand's oldest marine reserve is the 518-hectare Cape Rodney-Okakari Point Marine Reserve at Leigh north of Auckland which extends about 800 metres out from the shoreline for a length of some 7 kilometres. Since 1975 it has offered full protection to all the species within its boundaries, including much sought-after species such as snapper and rock lobster. Surveys of the reserve's rock lobsters found that, while commercially-harvested populations elsewhere were declining, those at the Leigh reserve and also the Tawharanui Marine Park further south, were becoming denser and their adult lobsters were reaching larger sizes (Ayling, 1978; MacDiarmid, 1991).

In the mid-1980s, as rock lobsters became rarer everywhere else, fishing boats began targeting the boundaries of the reserve and marine park. From 1990, the reserve's male lobsters, but not its females, went into a steep decline. Investigations found that the male lobsters were being caught outside the reserve area during their summer "vacations" (MacDiarmid, 1991; Kelly, 1997 in press). The lobsters like to holiday at deep offshore reef patches up to two kilometres from their dens where they forage on shellfish on the sandy sea floor. Males are caught much more than females because they spend more time out of the reserve. In any case, egg-bearing females that are caught must be thrown back.

The irony is that the reserve which was designed to protect the lobsters from commercial pressures has actually benefited the local lobster fishery. The spillover of adult males from the protected areas makes up a significant part of the local commercial catch. Catch rates on the reserve boundaries are substantially higher than in other areas where the lobsters and their nursery environments have been over-exploited. While this one small reserve makes an insignificant contribution to the national rock lobster catch, it shows that reserves can have commercial as well as environmental benefits. However, for marine reserves to play a more significant role in the nation's rock lobster fishery, there would need to be many more of them than there are at present (MacDiarmid, 1991).

An increasing amount of habitat protection is being achieved on private land through the Forest Heritage Fund, Nga Whenua Rahui, the Queen Elizabeth II National Trust, and private organisations such as Ducks Unlimited, the Native Forests Restoration Trust and the Yellow-eyed Penguin Trust. The Department is also considering proposals for about 24 new marine reserves (see Figure 9.9) and has begun a process similar to that followed by the Protected Natural Areas Programme (PNAP) for the nearshore marine area, to ensure that protected marine areas are representative. The Department aims to establish a network of marine reserves that will include key ecological communities in each biogeographic region.

Even with legal protection, however, most of our terrestrial and freshwater habitats are in ecological decline as a result of previous or surrounding land use (e.g. forestry, agriculture) and the impacts of introduced pests and weeds. Legal protection, therefore, has to be accompanied by ecological protection (i.e. controlling pests and enhancing native habitat) in many cases.

Ecological protection

The Department undertakes about 70 ecosystem restoration programmes each year, ranging from pingao planting in sand dunes to artificial restoration of water tables in drained wetlands (e.g. Whangamarino wetland). This sort of work can require extensive maintenance. In other cases, restoration may involve intensive pest and weed control or nothing more complex than the erection of a fence to keep stock out.

One of the most successful mainland restorations is at Mapara wildlife management reserve, 35 km south of Te Kuiti in the North Island, where a comprehensive programme controlled rats and possums. The nesting success rate for native birds rose from less than 30 percent to nearly 60 percent, with kokako, New Zealand falcons, fernbirds and native pigeons all showing population increases. Similarly, at Kaharoa, near Rotorua, three years of intensive possum and rat control raised the kokako population from 7 to 13 pairs and lifted the rate of breeding success from 14 percent to 85 percent.

Box 9.23

Island sanctuaries

Only a handful of islands in the world are still relatively free of human influence and introduced animals. New Zealand has some of these among the 330 islands with areas greater than 5 hectares which lie off-shore and beyond. Many islands have become sanctuaries for threatened species, either as last outposts for plants or animals which occur nowhere else, or as rehabilitation centres for species transferred from the mainland or other islands. These island sanctuaries include most of the subantarctic outlying islands, such as the pristine Snares Islands, as well as the smaller islands in the Chathams group, the Three Kings (where Great Island became naturally reforested within 40 years of the eradication of goats), Whakaari (White Island), the Poor Knights, the Kermadec group, and Little Barrier Island (Towns *et al., 1990*).

The big advantage of islands is their isolation which makes it relatively easy to keep them free of weeds, browsing animals and predators. Their main disadvantage is their small size, which limits the population levels and species diversity they can support. Many islands also have a history as death traps because, once invaded by mammals or noxious plants, the vulnerable indigenous species have nowhere to run. When ship rats invaded Big South Cape Island in 1964, for example, robins, fernbirds, bush wrens, snipe, saddlebacks and the larger short-tailed bat were wiped out.

Ecological restoration is possible, however, even though extinct species cannot be brought back. Little Barrier Island is probably the most celebrated example. This 3,083 hectare island near Auckland was logged for kauri last century, but was made a Nature Reserve in 1894. Although it took some time, all mammals were removed from the island, except the Pacific rat (kiore). Today it has a rich regenerating lowland forest with an abundance of native birds and invertebrates. More recently, the eradication of possums from Kapiti Island, near Wellington, has resulted in a resurgence of flowering trees and bird populations. Rat eradication is now under way on the island. In Fiordland, the elimination of rats from Breaksea Island has allowed the return of the Fiordland skink (*Oligosoma acrinasum*), threatened weevils and the South Island saddleback, a forest bird which is now extinct on its namesake island (Taylor and Thomas, 1993). It has also created an opportunity to rehabilitate several other species. A restoration programme has also begun on denuded Motutapu Island near Auckland. It involves environmental groups, local Maori and the wider Auckland public. Two-thirds of the island will be replanted in indigenous species during the next 50 years, including plants which have traditional cultural uses. A wetland will be restored and archaeological and traditional sites will be protected.

One of the most critical island restorations is occurring on 11,216 hectare Campbell Island, New Zealand's southernmost subantarctic island. It is the breeding ground for 95 percent of the world's royal albatrosses as well as elephant seals, yellow-eyed penguins, and many other species. In 1984 cattle were removed and, in 1991, the last sheep, allowing the island's original vegetation to start recovering. The eradication of cats and rats is being considered as an option over the next 5 to 10 years, as these have wiped out many of the islands' insects and all the smaller ground-dwelling birds, such as pipits and storm petrels. The Campbell Island teal is now a refugee on nearby Dent Island. Getting rid of the introduced species may not be enough, however. The numbers of large animals on the island have been dwindling for decades, perhaps because their food supplies are changing in response to changing sea temperatures. The waters around New Zealand have risen more than half a degree this century (Thwaites, 1994). The crustaceans on which the island's penguins usually feed have apparently migrated south, forcing the penguins to rely wholly on fish, in competition with marine mammals and fishing boats. Rockhopper penguin numbers have fallen from about 1 million pairs in the 1940s to about 50,000 pairs. Yellow-eyed penguin numbers have also declined and elephant seal numbers have decreased by more than 95 percent.

Box 9.24

The legacy of 'Old Blue'

Through the ages, animal heroes, real and imaginary, have been immortalised in legend: Black Beauty (horse), Tarka (otter), Elsa (lioness), Didget (gorilla), Smokey (bear), Tex (whooping crane), Martha (the last passenger pigeon) and, closer to home, Pelorus Jack and Opo (dolphins), Z12 (yellow-eyed penguin) and Grandma (royal albatross). Each of these animal heroes has, in one way or another, advanced the causes of animal welfare or conservation. Not one, however, has matched the achievement of Old Blue, a female black robin in the Chatham Islands. Besides winning hearts and minds, she also won the race against extinction. Her story must surely be unique—a true tale of an individual who, with a little help from mate, rescued her kind from oblivion (Merton, 1992).

Old Blue came into the world about 1970 on Little Mangere Island. This speck in the sea, with its seven hectares of scrub-forest, had become the last refuge for her species. Although black robins had once been widespread throughout the Chatham Islands, by 1871, rats, cats and habitat disturbance by humans had exterminated them on all but two small islands. One hundred years later, the black robins were down to 18 individuals eking out a precarious existence on the smaller of these islands. By 1976, their numbers had slipped to just 7 individuals—5 males and 2 females. One of the females was Old Blue. She was lucky to survive because even this tiny pocket of forest was shrinking fast, strangled by encroaching noxious plants. In 1976, all 7 robins were captured by Government wildlife experts in an audacious rescue operation, and transported down the 200 metre cliffs of Little Mangere and across the rough sea to Big Mangere Island. The following year a massive avalanche obliterated a third of their new forest refuge and the population fell to 5. Old Blue and her infertile mate were among the charmed survivors. By now she had already passed the average life span of her species, 5–6 years, and showed little sign of becoming the saviour of her kind. She had not produced a single chick.

In 1978, however, Old Blue did an unusual thing. Defying black robin custom, she changed mates, taking up with the only other male on the island, dubbed Old Yellow by the scientists. At age 9, robin dotage, she became a mother for the first time and, from then, until her death at age 13, she and Old Yellow produced 11 healthy offspring. Even this late effort would have been futile, however, were it not for the resourcefulness of her scientist midwives who knew the risks of putting all one's eggs in one basket. They fostered some of Old Blue's eggs to birds of other species in a bid to keep her eggs coming. It worked. By mid-1996, the black robin population had grown to 200 birds on two islands, all descendants of Old Blue and Old Yellow. This makes the black robin the most inbred wild bird species on Earth, and the only one for which the parentage and lineage of every individual is known and traceable to a single ancestral couple. Without that couple, and the scientists who watched over them, the black robins would be gone. The only question now, is whether the limited genetic variability in the surviving population will be sufficient to cope with the environmental conditions of the future. Only time will tell the answer to this, but, in the meantime, conservation scientists are attempting to spread the risk by establishing colonies of the species on several different islands.

Species conservation

Much of the ecological restoration work is undertaken as part of species conservation programmes. New Zealand's programmes have been described as the most imaginative and cost-effective in the world (Diamond, 1990). Innovative techniques pioneered here include the restoration and use of off-shore islands as refuges for threatened species and the use of cross-species fostering to increase chick production (see Boxes 9.23 and 9.24). In 1995/96 the Department ran 490 species conservation programmes, comprising 132 for birds, 171 for plants, 49 for reptiles, frogs, and bats, 40 for fish, 34 for invertebrates, and 78 multi-species programmes. Marine mammals are also the subject of ongoing programmes. The Banks Peninsula Hector's dolphins and the New Zealand sea lions on the Otago coast are being monitored, fur seal populations and bycatch are being studied, and about 200–500 stranded whales are rescued each year.

Among the conservation programmes are about 40 species recovery programmes which target highly threatened species. These include bats, birds, reptiles, amphibians, fish, invertebrates and plants. The programmes include research and monitoring, habitat restoration, predator control, captive breeding and transfers to new or underpopulated areas. Recovery programmes with high priority are those for kakapo, kiwi, black stilt, parea (Chatham Island pigeon) and taiko (Chatham Island

seabird). Other birds receiving special attention are the yellow-eyed penguin, the New Zealand shore plover, the Chatham Island oystercatcher, the blue duck, brown teal, stitchbirds and the New Zealand dotterel.

Island restorations

Island restorations have been particularly successful (see Box 9.23). Each year the Department undertakes about 110 restoration programmes on off-shore islands. These involve pest eradications, revegetation and the introduction or reintroduction of threatened species. The Department's Pest Eradication Database shows that by April 1994, Norway rats had been eliminated from 20 islands and were in the process of being eliminated from 5 more. Ship rats had been eradicated from 6 islands and were still being eradicated from 12 more. Pacific rats had been eradicated from 14 islands and were being eradicated from 5 more. Mice had been eradicated from 5 islands and were being removed from 4 more.

The Department also has island eradication programmes for possums (3 complete, 8 in process, 1 failure); rabbits (12 complete, 4 in process), stoats (3 complete, 1 failure), ferrets (1 complete), cats (8 complete, 1 stopped), pigs (8 complete, 1 failed), goats (15 complete, 2 in process), cattle (4 complete), sheep (4 complete) and wekas (9 complete, 2 in process, 2 stopped, 2 failed). In 1996, an eradication programme for Norway and Pacific rats was initiated on Kapiti Island.

Pest control

Pest control is a central element of all ecological protection programmes in New Zealand, on both islands and mainland reserves. Under the Wildlife Act 1953, the Wild Animals Control Act 1977 and the Conservation Act 1987, the Department of Conservation is responsible for controlling 'wild animals' (ecologically destructive mammals) and other pests and weeds on the conservation estate and unallocated Crown lands. These responsibilities are separate from those covered by the Biosecurity Act 1993 (which deals with pests and weeds in agricultural and urban areas, but not on conservation or forestry land) and by the Hazardous Substances and New Organisms Act (which covers the importation of potentially harmful foreign organisms and the creation of new ones through genetic manipulation).

In 1994/95, 328 animal pest control operations were carried out over 1.2 million hectares of conservation land, rising to 1.3 million hectares in 1995/96. Because of the size of the conservation estate, pest control is limited to selected high priority areas. The top priority pest is the Australian brushtail possum (see Box 9.25). Funding for possum control has increased in recent years. In 1994/95 the Department's control operations aimed to reduce possum numbers by at least 80 percent over some 200,000 hectares of forest. Increased funding in 1995/96 enabled the Department to expand these operations to about 380,000 hectares and more funding increases announced in the 1996 'Green Package' should enable further expansions in possum control during the next three years.

Feral goats are also major targets. In 1994/95 the Department ran more than 100 goat control operations covering about 760,000 hectares. It planned to do the same in 1995/96 and also to begin 8 tahr control operations to reduce numbers below the critical 10,000 mark. Besides animal pests, about 136 weed species have been identified as needing management on the conservation estate. Each year the Department carries out about 300 weed control operations for ecosystem restoration, targeting everything from old man's beard in forests, to wilding pines in tussock lands and spartina grass in waterways.

Box 9.25

Possum control as a way of life

Few overseas tourists realise the extent to which conserving our beautiful forests requires the poisoning and trapping of millions of small furry mammals every year. Increasing efforts are being made to develop methods which are cost-effective, humane and harmless to other species, and improvements are slowly being made in each of these areas. Of the 60–70 million Australian possums estimated to infest our forests and shrublands, two-thirds are in the North Island. Numbers appear to have peaked in most areas between 1930 and the late 1960s (i.e. about 30–40 years after local colonisation). By 1980, possums were estimated to cover more than 90 percent of the country. They are still spreading into remote areas of South Westland, south-east Fiordland, Coromandel and Northland (Parliamentary Commission for the Environment, 1994; Department of Conservation, 1994c).

From 1951 to 1961, a bounty was offered for dead possums, but this had little effect on their numbers. Since then, widespread poisoning has been the main control method, augmented by trapping methods which range from the inhumane and non-lethal leg-hold or gin traps, to the more humane but lethal-to-kiwis kill-traps. The main poison used is a natural plant toxin called sodium fluoroacetate, which is more widely known as 'ten-eighty' (or 1080) after the sample label by which it was first identified. The poison occurs naturally in Africa, South America and Australia. In New Zealand, it is applied to diced carrot or pollard baits. Like the more humane sodium cyanide, which is also used for possum control, 1080 is fast-acting and biodegradable, leaving no residues in soil or water (Parliamentary Commission for the Environment, 1994).

However, considerable debate has occurred about its effect on non-target species which eat poisoned bait or carcasses. Invertebrates, birds and native bats are all susceptible though, on balance, their populations are thought to be more at risk from possum damage than from 1080. Dogs which eat freshly poisoned carcasses are highly sensitive to it, though not so cats and mustelids. No effects on human health have been demonstrated from environmental exposure to 1080, though a suicide and several cases of illness have resulted from drinking large quantities. Two other widely used poisons are: phosphorus and brodifacoum (Talon). Phosphorus causes painful death, but leaves little toxic residue. Talon is not painful and is usually broken down in the soil by bacteria and fungi, but it can leave toxic residue for up to a year in dry environments (Parliamentary Commission for the Environment, 1994).

The Department of Conservation is responsible for possum control on protected land, but possums are also a threat on farmland where they can pass bovine tuberculosis (Tb) on to cattle. As a result, possum control involves an intricate network of Government agencies, regional councils, research organisations and land users, all coordinated by the Animal Health Board through a national possum management strategy which was formulated under the Biosecurity Act 1993. Possums are not the only Tb carriers, but they are the most numerous. Deer, pigs, goats, cats, ferrets and stoats can also pass on the bacterium. The cattle's innate curiosity is partly to blame. When very ill possums stagger into fields they are often surrounded and closely inspected by curious cattle who then pick up the disease from the dying animals' breath.

The amount of money spent on possum control has risen considerably in recent years. At $20–$30 per hectare, control operations are costly. Total funding rose from $34 million in 1992–93 to $58 million in 1993–94. Most of this was to protect cattle from Tb, but one-third of it was also to protect indigenous ecosystems from possums. Government funding for the control of possums in natural areas rose from $7.3 million (with the Department of Conservation's share totalling $3.4 million) to $19.7 million (with Conservation's share rising to $8.4 million) (Parliamentary Commission for the Environment, 1994). The 1995 Budget further increased this sum, with the Department receiving an extra $5 million to help combat the 'furry chainsaws' and the 1996 'Green Package' increased funding again, providing an extra $20 million over three years for the Department's pest control operations and $6.25 million for research on better possum control methods.

Complete eradication is not feasible, so control measures have to be continual, with the focus constantly shifting to areas that are most vulnerable. While 1080 remains the control method of choice at present, researchers are striving to find methods which are more cost-effective, more humane and even less threatening to native wildlife. Biological controls have been suggested, but their development appears to be a long way off and carries biodiversity risks of its own. At present, poisons and traps are the price that we and the possums have to pay for the privilege of living in this unique but biologically ravaged part of the world.

CONCLUSIONS

New Zealand's environment has been substantively changed in a time span that is very short in evolutionary terms. Though, from today's perspectives, we may wonder whether it was necessary to remove quite so much forest, drain quite so many wetlands, introduce quite so many alien species, create quite so much pasture, and extinguish quite so many native species, New Zealand's economic and social progress was based on these changes . We are what we are today because of our past. We cannot undo history - we can only learn from it.

In recent decades, New Zealanders have become less complacent about their natural environment. There is a growing awareness of what has been irrevocably lost. New Zealanders are also seeing how people from other parts of the world admire what does remain, which is reflected in the ecotourism boom and in the success of our 'clean and green' export promotions. A large majority of New Zealanders now support efforts to save our threatened species and their habitats.

Their sentiments are reflected in our key environmental laws which require that native species, habitats or ecosystems, including fisheries, be protected from use or sustainably managed during use, not just for resource purposes but also for their intrinsic value. More specific laws provide varying degrees of harvesting protection to most of our native vertebrates and vascular plants. These laws and the success of the Department of Conservation's species management and habitat protection programmes have markedly improved the survival prospects of some threatened and declining species.

Despite this, however, many species remain threatened and more appear to be joining them. New Zealand has lost a third of its native land and freshwater birds, and now has a greater percentage of threatened endemic birds than almost any other country. Two thirds of our land is now a biodiversity desert in which 1,000 known taxa of plants, animals and fungi are struggling to survive. Some may not even reach the next century. The threat is greatest for our endemic vertebrates and for plants, fungi and invertebrates with restricted populations.

The reasons for the continuing pressure on our threatened species are partly perceptual and partly historical. The perceptual problem is shared by most New Zealanders. It rests on the belief that the remaining area of natural habitat, in the mountains and isolated reserves, is sufficient to support our surviving indigenous species, provided it is protected or properly managed. In fact, the remaining area is not sufficient. For many of our threatened species, the existing habitat is in the wrong location or in reserves which are too small.

The historical problem is a dual legacy: habitat loss and introduced species. The massive habitat change wrought by previous generations has incurred an 'extinction debt' which is still being paid by our indigenous species. With each generation, the vulnerable populations shrink further. If the damage is to be undone, native forests will need to be restored to at least 10–20 percent of the lowlands and foothills, particularly along streams and rivers. Other native habitats, such as wetlands, will also have to be expanded. Because of the slow regrowth of native forest, some of the habitat-deprived species will need intensive conservation programmes for several generations while this restoration is occurring.

The remnant areas of forest and wetland that have been deliberately spared by private landowners provide an opportunity to make some biodiversity gains in lowland areas without large changes in area. Significant recovery and rehabilitation of the indigenous biodiversity in these habitats could be achieved by landowners modestly increasing the width of some forest strips and working together, voluntarily or with community support, to form larger forest areas by joining up some of the existing forest remnants.

Our second historical legacy is the army of predatory and browsing animals and aggressive weeds which were introduced by previous generations and which now threaten our remaining natural habitats. They have turned many reserve areas into war zones where ceasefires are temporary and the pressure is constant. Costly though it is, pest and weed control is now a necessary component of the modified New Zealand ecosystem.

Faced with these pressures and problems, the future seems bleak for many of our indigenous species unless current rescue and restoration efforts can be expanded. To meet this huge challenge, land uses will need to become more accommodating to native species, effective pest control will need to be maintained over large areas, systematic monitoring of biodiversity will need to be undertaken in all regions and fishery areas. In addition, our recently increased rescue and restoration efforts for vulnerable species and habitats on the protected estate will need to be consistently maintained or increased to ensure success. More effort will also need to go into public awareness and education programmes.

Even our marine species are increasingly vulnerable, despite being substantially removed from the pressures affecting the land and freshwater species. They, too, are experiencing environmental changes as a result of increasing harvesting pressures from commercial fishing, rising sea temperatures and sediment entering coastal waters from land-based activities.

Although New Zealand's fisheries are now managed on a strong scientific footing, the principle of Maximum Sustainable Yield on which quotas are based, has a single-species focus which is largely blind to the ecological impacts of stock reductions. New fisheries legislation now makes the tension between single species management and ecosystem management explicit by requiring the impacts of fishing on ecosystems and non-target species to be minimised. This will require wider monitoring and a more precautionary approach to fisheries management.

New Zealanders are slowly beginning to realise that indigenous species have been the main victims and the silent cost-bearers of our impacts on the environment. Sacrificing them on the march toward economic progress was once seen as a small price to pay. But a small price in human terms converted to a massive cost for the species concerned. Now that commitments have been made to safeguard our remaining species, the true cost of our environmental destruction is becoming more apparent as we seek affordable methods of halting and reversing the damage.

If lasting solutions are to be found, they will be based, in part, on new attitudes to the species which were once sovereign here—and to those which have displaced them. Vilifying introduced pests has become a part of the New Zealand psyche, but these innocent killers did not come here of their own volition. In making scapegoats of them, we lose sight of our own role. Our historical hunger for land and often poor self-control when harvesting indigenous plants and animals are significant causes of the nation's biodiversity crisis. Likewise, our earlier careless importation of pests and weeds has compounded the problem.

Ultimately, the fate of New Zealand's biodiversity will depend on our ability to better manage the exotic species we have brought here, including ourselves, and on our willingness to share more of the nation's land and water resources with the depleted species which have nowhere left to run. It may also depend on our willingness to accept a simple ethical proposition: that the species which evolved here have a basic right to be here, whether we need them or not.

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