

# **Flightless**

## **Grounded Birds in New Zealand**



**An 8th Grade Research Paper**

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## **More than half of the birds in New Zealand either can't fly, can only partially fly, or don't like to fly. (Te Ara)**

This is a fact. Although only sixteen species in New Zealand are technically flightless, with another sixteen that are extinct (TerraNature), a majority of more than 170 bird species will not fly unless their lives are threatened, or not even then. This is surprising, since birds are usually known for flying. A flightless bird is a bird that cannot fly, such as the well-known ostrich and emu, not to mention penguins. The two main islands southeast of Australia that make up New Zealand have an unusually diverse population of these birds. I am personally very interested in New Zealand and know a lot about it because my mother was born there, and I still have family there. I was very intrigued by these birds in particular, and how different they are from most of the world's birds. I asked myself, *why New Zealand? What made this tiny little country have so many birds that can't fly, while in the rest of the world, hardly any live in one place?* My research has informed me that the population and diversity of flightless birds here is so large because it has been isolated for so long from other land masses. Almost no mammals, and no land predators, lived there in the millions of years after it split from the Australian continent, so flying birds didn't have as much of an advantage during this time. This allowed flightless birds to survive and thrive. In this paper, first I will provide background information on flightless birds and on the underwater New Zealand continent, and then I will introduce a couple of arguments about why New Zealand has so many flightless birds and explain which theory makes the most sense.

# Background

## Kiwi



The kiwi, genus *Apteryx*, is one of the most well-known flightless New Zealand birds. Five species are currently known: the Great and Little Spotted Kiwi, the Brown Kiwi, the Rowi, and the Tokoeka, which has several subspecies

(TerraNature). The kiwi is a small, round bird with legs and claws, feathers that are almost like fur, a very long beak that is rounded at the tip, and small vestigial wing stumps (Save the Kiwi). Kiwi are territorial, meaning they have certain territories that they don't let other kiwi into, and their territories range in size from

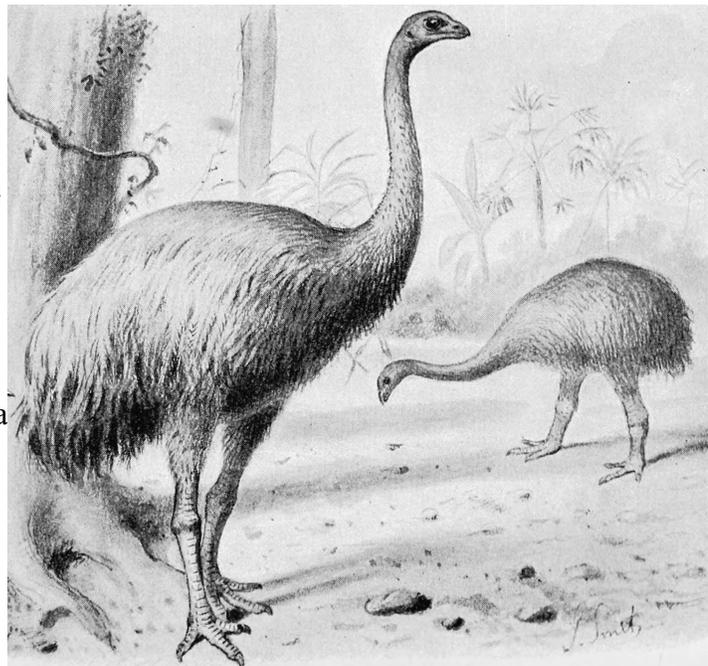
as few as 4 acres to as many as 247 (TerraNature). They may rotate through several different dens and burrows that they have in their territory. One intriguing fact about kiwi is that they lay the biggest eggs of any bird in proportion to their body size. Their eggs have about the same volume as six chicken eggs, and weigh up to a fifth of the female kiwi's body weight (TerraNature). Another interesting fact about

them is that they are ratites, a group of birds that includes the ostrich, the emu, the cassowary, the rhea of South America, and the moa, which I will mention in more detail below. These are all flightless birds, which is interesting when one looks at it from an evolutionary perspective, so I will also explore this below. The other ratites are also all much bigger than the kiwi; it may have been bigger at one time, which would explain why its egg is so large.

Kiwi have adapted to be more like mammals in several ways. Their feathers, as I said above, are more like fur, which keeps them warmer as opposed to keeping them aloft in the air or being streamlined. They also have bone marrow, unlike the hollow, light bones of most birds (TerraNature). Their blood temperature would be about average if they were mammals, but is about 3.5 degrees colder than the blood of the average bird (TerraNature). They also mark their territory with anal output. It is quite impractical for most birds to do this, but quite a lot of mammals do it.

## Moa

The extinct moa, order *Dinornithiformes* with nine species currently recognized (TerraNature), was a very interesting bird indeed. It holds a couple of world records: tallest known bird, and fastest extinction of a megafauna. Most moa species (the ones from family *Emeidae* and the one from *Megalapterygidae*) were only about the



size of a large turkey, weighing about 40 pounds when fully grown, and 1.5 feet tall at the back. But two

of the species, the ones from family *Dinornithidae*, were gigantic; they weighed up to 600 pounds, and their backs were about 6 feet off the ground (TerraNature)! That's the height of a tall person, and that's only their back! If they stuck their neck all the way up, they would come to about 13 feet! (They're measured to the back because it's thought that they usually stuck their necks out horizontally to graze on short trees.) Their eggs were up to 10 inches long (TerraNature). Their relative, the elephant bird of Madagascar, was heavier at up to 1100 lbs, but not as tall. Not much is known about the habitat of the moa, except that they used to live all over New Zealand before extinction. An interesting fact that is known is that the female giant moa were larger than the males, on average. This is known as reverse dimorphism (TerraNature).

It is currently believed that moa went extinct mainly because of the arrival of settlers and hunting. The natives of New Zealand, the Maori, have their ancestral roots in Polynesia, and are estimated by fossils to have arrived sometime in the 1200s. The moa were enthusiastically hunted by Maori because they provided so much meat. Their eggs were eaten and their habitat largely burned. Radiocarbon dating shows a sudden absence of moa bones in fossilized campsites around the early 1300s (TerraNature). The moa were driven to extinction in less than 100 years. With them went their main natural predator, the giant Haast's eagle, the largest eagle ever known with a wingspan of up to 10 feet (TerraNature).

## Kakapo

The kakapo, *Strigops habroptilus*, is another interesting New Zealand bird. It is the only flightless parrot, the only nocturnal parrot and the world's heaviest parrot (males weigh up to 9 pounds) (TerraNature). It is a large parrot, about two feet tall when full-grown, a mossy green in color with off-white feathers around the face, with strong claws and wings that it uses for balance. It is a very

friendly and affectionate bird, and apparently makes a very good pet. (However, it also acts very friendly toward things such as weasels, which will kill it very quickly.) It is said to have a musty, sweet smell, like honey or wildflowers, which unfortunately also makes it easier for land predators to find it.



Healthy kakapo will often live 80-100 years (TerraNature)! (This is one of the reasons that it was able to survive for so long, even with predators.) It originally lived all over New Zealand, but after the European settlers hunted it nearly to extinction for its delicious white meat, it could only be found in Fiordland, which is a large area of

waterways and islands in the south of New Zealand. For much of the 20th century, no female was known of, and the kakapo were just barely hanging on. 130 kakapo are currently living, all in captivity.

One of the most interesting things about the kakapo is its mating behavior, known as “lekking.” Every three to five years, during abundant fruit seasons, male kakapo will find bowl-shaped depressions in the earth that have been used by other kakapo for hundreds of years. These are often in select spots, like next to cliff faces, that will make their mating call loudest and spread it out for females to hear. The males then inflate their thoracic air sacs, becoming the size and shape of a basketball, and proceed to make a loud booming noise that sounds a bit like a foghorn. They sometimes do this for up to 17 hours straight, if the females aren’t showing up (TerraNature). This is yet another reason that kakapos are so endangered; if a predator hears the booming and follows it, it finds a big kakapo just waiting to be eaten.

## Takahē

The takahē, *Porphyrio hochstetteri*, is a rail (another group of related birds), and another bird that was nearly extinct. It is a short but quite colorful bird, with green and blue plumage and bright red



legs and beak. Large takahē can be 6.5 pounds, 20 inches tall and 25 inches long (TerraNature). Takahē are also native to Fiordland, but could be found all over the South Island of New Zealand before introduced mammals began killing them. The takahē looks almost the same as its relative, the pūkeko, *Porphyrio porphyrio*, except that the pūkeko is taller and has longer legs. The pūkeko flies reluctantly for short distances, and occasionally roosts in very short trees. It is known as New Zealand’s “marsh hen” and

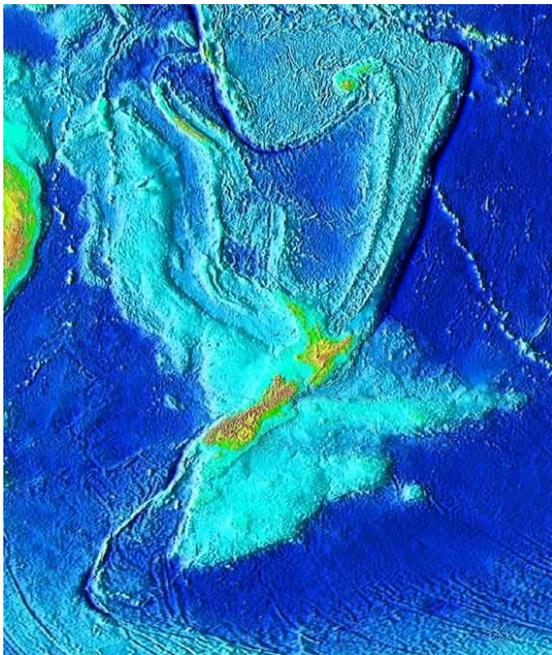
is native, but not endemic like the takahē. (This means that it can be found in other places.) Another version of the takahē, *Porphyrio mantelli*, that was taller and thinner-boned, lived in the North Island but is now extinct (TerraNature). In 1900, nobody had seen any takahē anywhere for many years, so they were assumed to be extinct. However, in 1948 a naturalist managed to discover some in a remote corner of New Zealand (Birds.com), which made everyone quite excited. At the beginning of 2013, 263 takahē were in existence.

## Other Birds

Another flightless bird that is notable in New Zealand (and everywhere else in the general

Antarctic area) is the penguin, family Spheniscidae. Six penguin species, out of 17 total in the world, currently nest in New Zealand (TerraNature). Four of them are endemic and can't be found anywhere else. The most endangered of these is the Yellow-eyed Penguin, *Megadyptes antipodes*, of which only about 4000 are left. New Zealand was also home to the tallest known penguin, the Narrow-flipped Penguin, *Palaeudyptes antarcticus*, which was about 3.5-4.5 ft tall (significantly taller than the Emperor Penguin), and is now extinct (TerraNature).

The weka is a flightless rail that is interesting in regard to conservation because of its tendency to eat other birds' eggs (TerraNature). In many cases, it ate the eggs of other endangered flightless birds that were trying to multiply on islands, and it had to be removed so that the birds could recover properly. At one point, three flightless wren species and three flying wrens lived in New Zealand, but all three flightless wrens and one of the flying ones went extinct, and only two remain (TerraNature). Two flightless duck species live in New Zealand, and one of them is the rarest known duck in the world (TerraNature).



## Zealandia

Zealandia is an underwater continent- about 1.5 million square miles, with 93% below sea level. (The 7% that's above is New Zealand.) It is a very long and skinny continent, stretching all the way from 19°S to 56°S (Te Ara). It is made up of two parallel ridges that run northwest to southeast. The seafloor in Zealandia is about 1100-1600 yards deep, which is a lot higher than most of the ocean floor, usually about 5500 yards deep (Te Ara). However, it

is still 3-6 miles thinner than most continents. Zealandia is right on the edge of the giant tectonic plate that lies under the Pacific. Many fault lines run through it, including several that run straight through the middle of Wellington, New Zealand's capital city. The fault lines have also caused many volcanoes to form from magma that seeped through the breaks. One of the most famous of these volcanoes is Mt. Ruapehu, an active stratovolcano. (It last erupted in 2007, but it is likely to erupt again.)

## Arguments

### Argument 1

I found two main theories that answer my question of why so many flightless birds live in New Zealand; here is the first one. Formerly, Zealandia was part of the giant southern continent Gondwana, but it broke off 60-80 million years ago (Te Ara). Most mammals had not been able to get there before then, so the only native mammals that ever lived in New Zealand were three tiny bat species (Save the Kiwi). The only main predators of birds were other birds, like the New Zealand eagle, harrier, falcon, and owl. No land mammals at all lived there, and no significant land predators. According to this argument, in the millions of years with no contestants for the ground, bird babies born flightless were able to survive and have more flightless babies, whereas in other places, these birds would have been killed quickly. In fact, these birds were able to do even better than flying birds in some cases, because flightlessness allowed them to save more energy for feeding and raising their flightless babies (rather than using it all for flying). Eventually, these flightless birds occupied the ecological "niches" that were taken up by mammals in other places (Native Birds). All of the ways that the kiwi is more like a mammal that I mentioned above are results of this; heavier bones with marrow help the birds make more cells, since

light bones are only needed for flying. The two main advantages to flying are that it lets the animals escape land predators, and it lets them get food that's out of reach of mammals (Te Ara). Neither of these apply to birds in New Zealand, especially because flightless birds don't need food as rich as other birds, since they don't have to use it to power their wings. Evolution has allowed flightless birds to survive and thrive.

## Argument 2

However, some scientists use another interesting argument; they say that some birds were already flightless before they even came to New Zealand. This is mainly because the kiwi and the moa are both in the same family as many other flightless birds: the ratites. (If you've forgotten, this family of birds also includes the ostrich, the emu, the cassowary, the rhea, and the elephant bird; all are large flightless birds.) These birds are all so similar that they must have had a common ancestor, especially if you consider that the kiwi may have been bigger because of the size of its egg. And since they're all flightless, their common ancestor must have been flightless, too (TerraNature). This would mean that the moa and the kiwi didn't become flightless because of isolation alone, but that they may have already been flightless before Zealandia split from Gondwana. However, this does not explain the fact that the kiwi has wing stumps, and the moa has none. Another version of this theory is that moa were already there, but that kiwi were flighted originally and flew into New Zealand about 40 million years ago, and then became flightless (TerraNature). (Evidence does suggest that kiwi and moa separated before they were ever flightless.) This would explain the wing stumps. However, this theory assumes that the common ancestor of the ratites must have been able to fly, which seems unlikely.

## Why the First Argument is Better

The first argument is better, and more likely to be true, for several reasons. One reason is that not nearly enough evidence exists to prove the second argument. The entire thing is speculative, and nobody really knows at this point what happened back then. Another reason is that even if it is true, plenty of other flightless birds aren't ratites, and this wouldn't explain how they became flightless. A similar thing could have happened with them, but it's not likely. They probably became flightless through isolation and evolution. Another reason is that even if the kiwi did fly over and then become flightless, isolation probably helped evolution to perfect its flightlessness, so that it could properly survive without flying. Even the kiwi and the moa probably had lots of other quirks that they evolved over tens of millions of years.

## Conclusion

My original question was, "Why does New Zealand have so many flightless birds?" The best answer that I found was, "Because it has been isolated for so long without land predators, and the birds evolved to be more efficient in their environment." I proved this by explaining how they have evolved to be more efficient, and by explaining how the other argument doesn't make sense in this context. Now, a new question is, "Why do I have to know this?" and the answer is, "Because a lot of these birds are dying." You know now how quickly the moa went extinct after the arrival of humans, and other birds didn't do so well either. Plus, pets like dogs and cats, and animals like weasels, that were brought there from other places, have been eating the mostly defenseless birds. The very traits that helped flightless birds thrive are now threatening their existence. Most of the kakapo and takahē currently living are in

captivity, and it's hard to keep them reproducing. As I said before, only about 130 known kakapo are living. These bird programs need money to keep going, and that money comes chiefly from donations. Now you know why they are dying so fast, and how it is connected to their unique evolutionary traits. If we don't help these amazing birds that are rendered at a disadvantage by evolution, they may all die.

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