

= Newton 's parakeet =

Newton 's parakeet or the Rodrigues parakeet (*Psittacula exsul*) is an extinct species of parrot that was endemic to the Mascarene island of Rodrigues in the western Indian Ocean . Several of its features diverged from related species , indicating long @-@ term isolation on Rodrigues and subsequent adaptation . The rose @-@ ringed parakeet of the same genus is a close relative and probable ancestor . Newton 's parakeet may itself have been ancestral to the endemic parakeets of nearby Mauritius and Réunion .

Around 40 centimetres (16 in) long , Newton 's parakeet was roughly the size of a rose @-@ ringed parakeet . Its plumage was mostly greyish or slate blue in colour , which is unusual in *Psittacula* , a genus containing mostly green species . The male had stronger colours than the female and possessed a reddish instead of black beak , but details of a mature male 's appearance are uncertain ; only one male specimen is known , and it is believed to be immature . Mature males might have possessed red patches on the wing like the related Alexandrine parakeet . Both sexes had a black collar running from the chin to the nape , but this was clearer in the male . The legs were grey and the iris yellow . 17th @-@ century accounts indicate that some members of the species were green , which would suggest that there were both blue and green colour morphs , but there is no definitive explanation for these reports . Little is known about its behaviour in life , but it may have fed on the nuts of the bois d ? olive tree , along with leaves . It was very tame , and was able to mimic speech .

Newton 's parakeet was first written about by the French Huguenot François Leguat in 1708 , and was only mentioned a few times by other writers afterwards . The specific name " *exsul* " is a reference to Leguat , who was exiled from France . Only two life drawings exist , both of a single specimen held in captivity in the 1770s . The first specimen known to science , a female , became the holotype when the species was described in 1872 . A male , the last specimen recorded , was collected in 1874 , and these two specimens are the only ones that exist today . It became scarce due to deforestation and perhaps hunting , but it is thought that it was finally wiped out by a series of cyclones and storms that hit Rodrigues in the late 19th century . There was unfounded speculation about the possible survival of the species as late as 1967 .

= = Taxonomy = =

Newton 's parakeet was first recorded by François Leguat in his 1708 memoir , *A New Voyage to the East Indies* . Leguat was the leader of a group of nine French Huguenot refugees who colonised Rodrigues between 1691 and 1693 after they were marooned there . Subsequent accounts are by Julien Tafforet , who was also marooned on the island in 1726 , and then by the French mathematician Alexandre Pingré , who travelled to Rodrigues to view the 1761 transit of Venus .

The first specimen known to science was a female collected by George Jenner , then the magistrate of Rodrigues , in 1871 . The specimen was preserved in alcohol and given to Edward Newton , a colonial administrator in Mauritius , who sent it to his brother , the British ornithologist Alfred Newton . Alfred Newton scientifically described the bird in 1872 and gave it the scientific name *Palaeornis exsul* . " *Exsul* " (" exiled ") refers to François Leguat , in that he was exiled from France when he gave the first description of the bird . Newton had tried to find a more descriptive name , perhaps based on colouration , but found it difficult . He refrained from publishing a figure of the female in his original description , though the journal *Ibis* had offered him the space . He instead wanted to wait until a male specimen could be procured , since he imagined it would be more attractive . The female , which is the holotype specimen of the species , is housed in the Cambridge University Museum as specimen UMZC 18 / Psi / 67 / h / 1 .

Alfred Newton requested further specimens , especially males , but in 1875 he finally published a plate of the female , lamenting that no male specimens could be found . Tafforet 's 1726 account had been rediscovered the previous year , and Alfred Newton noted that it confirmed his assumption that the male would turn out be much more colourful than the female . Newton 's collector , Henry H. Slater , had seen a live Newton 's parakeet the year before , but was not carrying a gun at the time .

On 14 August 1874 , William Vandorous shot a male specimen . It may have been the same specimen Slater had observed . It was subsequently sent to Edward Newton by William J. Caldwell . This is the paratype of the species , numbered UMZC 18 / Psi / 67 / h / 2 and housed in the Cambridge Museum .

Edward Newton noted that he had expected the male would be adorned with a red patch on the wing , but that the absence of this indicated it was immature . He still found it more beautiful than the female . These two specimens are the only preserved individuals of the species . The mandible and sternum were extracted from the female specimen , and subfossil remains have since been found in the Plaine Corail caverns on Rodrigues . The genus *Palaeornis* was later declared a junior synonym of *Psittacula* , and all species within the former were transferred to the latter .

= = = Evolution = = =

Based on morphological features , the Alexandrine parakeet (*Psittacula eupatria*) has been proposed as the founder population for all *Psittacula* species on Indian Ocean islands , with new populations settling during the species 's southwards colonisation from its native South Asia . Features of that species gradually disappear in species further away from its range . Subfossil remains of Newton 's parakeet show that it differed from other Mascarene *Psittacula* species in some osteological features , but also had similarities , such as a reduced sternum , which suggests a close relationship . Skeletal features indicate an especially close relationship with the Alexandrine parakeet and the rose @-@ ringed parakeet (*Psittacula krameri*) , but the many derived features of Newton 's parakeet indicates it had long been isolated on Rodrigues .

Many endemic Mascarene birds , including the dodo , are descended from South Asian ancestors , and the English palaeontologist Julian Hume has proposed that this may also be the case for all parrots there . Sea levels were lower during the Pleistocene , so it was possible for species to colonise some of these less isolated islands . Although most extinct parrot species of the Mascarenes are poorly known , subfossil remains show that they shared common features such as enlarged heads and jaws , reduced pectoral bones , and robust leg bones . Hume has suggested that they all have a common origin in the radiation of the *Psittaculini* tribe , members of which are known as *Psittaculines* , basing this theory on morphological features and the fact that *Psittacula* parrots have managed to colonise many isolated islands in the Indian Ocean . The *Psittaculini* could have invaded the area several times , as many of the species were so specialised that they may have evolved significantly on hotspot islands before the Mascarenes emerged from the sea . Other members of the *Psittacula* genus from the Mascarenes include the extant echo parakeet (*Psittacula eques eques*) of Mauritius , as well as the extinct Réunion parakeet (*Psittacula eques eques*) , and Mascarene grey parakeet (*Psittacula bensoni*) of both Mauritius and Réunion .

A 2011 genetic study of parrot phylogeny was unable to include Newton 's parakeet , as no viable DNA could be extracted . The same paper found that the Mascarene parrot (*Mascarinus mascarinus*) of nearby Réunion was most closely related to the lesser vasa parrot from Madagascar and nearby islands , and therefore unrelated to the *Psittacula* parrots , undermining the theory of their common origin . A 2015 genetic study by Jackson et al. included viable DNA from the toe @-@ pad of the female Newton 's parakeet specimen . It was found to group within a clade of rose @-@ ringed parakeet subspecies (from Asia and Africa) , which it had diverged from 3 @. @ 82 million years ago . Furthermore , Newton 's parakeet appeared to be ancestral to the parakeets of Mauritius and Réunion . The cladogram accompanying the study is shown below :

= = Description = =

Newton 's parakeet was about 40 cm (16 in) long - roughly the size of the rose @-@ ringed parakeet . The wing of the male specimen was 198 mm (7 @. @ 8 in) , the tail 206 mm (8 @. @ 1 in) , the culmen 25 mm (0 @. @ 98 in) , and the tarsus was 22 mm (0 @. @ 87 in) . The wing of the female specimen was 191 mm (7 @. @ 5 in) , the tail 210 mm (8 @. @ 3 in) , the culmen 24 mm (0 @. @ 94 in) , and the tarsus was 22 mm (0 @. @ 87 in) . The male specimen was greyish

blue (also described as " slatey blue ") tinged with green , and darker above . The head was bluer , with a dark line running from the eye to the cere . It had a broad black collar running from the chin to the nape , where it became gradually narrower . The underside of the tail was greyish , the upper beak was dark reddish brown , and the mandible was black . The legs were grey and the iris yellow . The female was similar , but had a greyer head and a black beak . The black collar was not so prominent as that of the male , and did not extend to the back of the neck . The general appearance of Newton 's parakeet was similar to the extant *Psittacula* species , including the black collar , but the bluish grey colouration set it apart from other members of its genus , which are mostly green .

Philibert Commerson received a live specimen on Mauritius in the 1770s and described it as " greyish blue " . Paul Jossigny made two illustrations of this specimen , the only known depictions of Newton 's parakeet in life , unpublished until 2007 . Though both existing specimens are blue , some early accounts from Rodrigues have caused confusion over the colouration of the plumage . One of these is Leguat 's following statement :

There are abundance of green and blew Parrets , they are of a midling and equal bigness ; when they are young , their Flesh is as good as young Pigeons .

If the green parrots Leguat referred to were not the Rodrigues parrot (*Necropsittacus rodericanus*) , they may perhaps have been a green colour morph of Newton 's parakeet , as Julian Hume has suggested . As Alfred Newton observed in his original description , some feathers of the female specimen display both blue and green tinges , depending on the light . This may explain some of the discrepancies . The green parrots mentioned could also instead have been storm @-@ blown members of *Psittacula* species from other islands , that survived on Rodrigues for a short time .

The two existing specimens were originally preserved in alcohol , but though this can discolour specimens , it is not probable that it could turn green to blue . Hume and Hein van Grouw have also suggested that due to an inheritable mutation , some Newton 's parakeets may have lacked psittacin , a pigment that together with eumelanin produces green colouration in parrot feathers . Complete lack of psittacin produces blue colouration , whereas reduced psittacin can produce a colour between green and blue called parblue , which corresponds to the colour of the two preserved Newton 's parakeet specimens .

Julien Tafforet also described what appears to be green Newton 's parakeets in his 1726 *Relation de l'Île Rodrigue* , but the issue of colouration was further complicated :

The parrots are of three kinds , and in quantity ... The second species [mature male Newton 's parakeet ?] is slightly smaller and more beautiful , because they have their plumage green like the preceding [Rodrigues Parrot] , a little more blue , and above the wings a little red as well as their beak . The third species [Newton 's parakeet] is small and altogether green , and the beak black .

It has been proposed that the last two types mentioned were male and female Newton 's parakeets , and that the differences between them were due to sexual dimorphism . Alexandre Pongré also mentioned green birds , perhaps with some red colours , but his account is partially unintelligible and therefore ambiguous . A red shoulder patch is also present on the related Alexandrine parakeet . None of the existing Newton 's parakeet specimens have red patches . The single @-@ known male specimen may have been immature , judged on the colour of its beak , and this may also explain the absence of the red patch . When *Psittacula* are bred by aviculturalists , blue is easily produced from green ; the production of blue may suppress red colouration , so blue morphs may have lacked the red patch .

= = Behaviour and ecology = =

Almost nothing is known about the behaviour of Newton 's parakeet , but it is probable that it was similar to that of other members of its genus . Leguat mentioned that the parrots of the island mainly ate the nuts of the bois d ? olive tree (*Cassine orientale*) . It may have fed on leaves as the related echo parakeet does . The fact that Newton 's parakeet survived long after Rodrigues had been heavily deforested shows that its ecology was less vulnerable than that of , for example , the Rodrigues parrot .

Leguat and his men were hesitant to hunt the parrots because they were so tame and easy to catch

. Leguat 's group took a parrot as a pet and were able to teach it to speak :

Hunting and Fishing were so easie to us , that it took away from the Pleasure . We often delighted ourselves in teaching the Parrots to speak , there being vast numbers of them . We carried one to Maurice Isle [Mauritius] , which talk ? d French and Flemish .

As the kind of parrot mentioned here by Leguat is not specified , some sources attribute it to Newton 's parakeet , and others to the Rodrigues parrot .

Many other species endemic to Rodrigues became extinct after humans arrived , and the island 's ecosystem remains heavily damaged . Forests covered the entire island before humans arrived , but very little forestation can be seen today . Newton 's parakeet lived alongside other recently extinct birds such as the Rodrigues solitaire , the Rodrigues parrot , the Rodrigues rail , the Rodrigues starling , the Rodrigues owl , the Rodrigues night heron , and the Rodrigues pigeon . Extinct reptiles include the domed Rodrigues giant tortoise , the saddle @-@ backed Rodrigues giant tortoise , and the Rodrigues day gecko .

The authors of the 2015 study which resolved the phylogenetic placement of the Mascarene island parakeets suggested that the echo parakeet of Mauritius would be a suitable ecological replacement for the Réunion parakeet and Newton 's parakeet , due to their close evolutionary relationship . The echo parakeet was itself close to extinction in the 1980s , numbering only twenty individuals , but has since recovered , so introducing it to the nearby islands could also help secure the survival of this species .

= = Extinction = =

Of the roughly eight parrot species endemic to the Mascarenes , only the echo parakeet has survived . The others were likely all made extinct by a combination of excessive hunting and deforestation . Leguat stated that Newton 's parakeet was abundant during his stay . It was still common when Tafforet visited in 1726 , but when Alexandre Pingré mentioned it in 1761 , he noted that the bird had become scarce . It was still present on southern islets off Rodrigues (Isle Gombrani) , along with the Rodrigues parrot . After this point , much of Rodrigues was severely deforested and used for livestock .

According to early accounts praising its flavour , it appears Newton 's parakeet was commonly eaten by visitors . Several individuals would likely be needed to provide a single meal , owing to the bird 's small size . Pingré stated :

The perruche [Newton 's parakeet] seemed to me much more delicate [than the flying @-@ fox] . I would not have missed any game from France if this one had been commoner in Rodrigues ; but it begins to become rare . There are even fewer perroquets [Rodrigues parrots] , although there were once a big enough quantity according to François Leguat ; indeed a little islet south of Rodrigues still retains the name Isle of Parrots [Isle Pierrot] .

According to government surveyor Thomas Corby , Newton 's parakeet may still have been fairly common in 1843 . Henry H. Slater reported that he saw a single specimen in south western Rodrigues during his three @-@ month stay to observe the 1874 Transit of Venus , and assistant colonial secretary William J. Caldwell saw several specimens in 1875 during his own three @-@ month visit . The male that he received in 1875 and gave to Newton is the last recorded member of the species . A series of cyclones struck the following year and may have devastated the remaining population . Further severe storms hit in 1878 and 1886 , and since few forested areas were left by this time , there was little cover to protect any remaining birds . The male could therefore have been the last of the species alive .

There were unfounded rumours of its continued existence until the beginning of the 20th century . In 1967 James Greenway stated that an extremely small population might still survive on small offshore islets , since this is often the last refuge of endangered birds . Hume countered that these islets were probably too small to sustain a population .