

= Broad @-@ billed parrot =

The broad @-@ billed parrot or raven parrot ( *Lophopsittacus mauritianus* ) is a large extinct parrot in the family Psittaculidae . It was endemic to the Mascarene island of Mauritius in the Indian Ocean east of Madagascar . It is unclear what other species it is most closely related to , but it has been classified as a member of the tribe Psittaculini , along with other Mascarene parrots . It had similarities with the Rodrigues parrot ( *Necropsittacus rodricanus* ) , and may have been closely related .

The broad @-@ billed parrot 's head was large in proportion to its body , and there was a distinct crest of feathers on the front of the head . The bird had a very large beak , comparable in size to that of the hyacinth macaw , which would have enabled it to crack hard seeds . Subfossil bones indicate that the species exhibited greater sexual dimorphism in overall size and head size than any living parrot . The exact colouration is unknown , but a contemporary description indicates that it had multiple colours , including a blue head , and perhaps a red body and beak . It is believed to have been a weak flier , but not flightless .

The broad @-@ billed parrot was first referred to as the " Indian raven " in Dutch ships ' journals from 1598 onwards . Only a few brief contemporary descriptions and three depictions are known . It was first scientifically described from a subfossil mandible in 1866 , but this was not linked to the old accounts until the rediscovery of a detailed 1601 sketch that matched old descriptions . The bird became extinct in the 17th century owing to a combination of deforestation , predation by introduced invasive species , and probably hunting as well .

= = Taxonomy = =

The earliest known descriptions of the broad @-@ billed parrot were provided by Dutch travellers during the Second Dutch Expedition to Indonesia , led by Admiral Jacob Cornelis van Neck in 1598 . They appear in reports published in 1601 , which also contain the first illustration of the bird , along with the first of a dodo . The Dutch sailors who visited Mauritius categorised the broad @-@ billed parrots separately from parrots , and referred to them as " Indische ravens " ( translated as either " Indian ravens " or " Indian crows " ) without accompanying useful descriptions , which caused confusion when their journals were studied .

The English naturalist Hugh Edwin Strickland assigned the " Indian ravens " to the hornbill genus *Buceros* , because he interpreted the projection on the forehead in a crude illustration as a horn . The Dutch and the French also referred to South American macaws as " Indian ravens " during the 17th century , and the name was used for hornbills by Dutch , French , and English speakers in the East Indies . Sir Thomas Herbert referred to the broad @-@ billed parrot as " Cacatoes " ( cockatoo ) in 1634 , with the description " birds like Parrats [ sic ] , fierce and indomitable " , but naturalists did not realise that he was referring to the same bird . Even after subfossils of a parrot matching the descriptions were found , French zoologist Emile Oustalet argued that the " Indian raven " was a hornbill whose remains awaited discovery . France Staub was in favour of this idea as late as 1993 . No remains of hornbills have ever been found on the island , and apart from an extinct species from New Caledonia , hornbills are not found on any oceanic islands .

The first known physical remain of the broad @-@ billed parrot was a subfossil mandible collected along with the first batch of dodo bones found in the Mare aux Songes swamp . Richard Owen described the mandible in 1866 and identified it as belonging to a large parrot species , to which he gave the binomial name *Psittacus mauritianus* and the common name " broad @-@ billed parrot " . This holotype specimen is now lost . In 1868 , shortly after the 1601 journal of the Dutch East India Company ship Gelderland had been rediscovered , Hermann Schlegel examined an unlabelled pen @-@ and @-@ ink sketch in it . Realising that the drawing , which is attributed to the artist Joris Joostensz Laerle , depicted the parrot described by Owen , Schlegel made the connection with the old journal descriptions . In 1875 , because its bones and crest are significantly different from those of *Psittacus* species , Alfred Newton assigned it to its own genus , which he called *Lophopsittacus* . *Lophos* is the Ancient Greek word for crest , referring here to the bird 's frontal crest , and *psittakos*

is Ancient Greek for parrot .

In 1973 , based on remains collected by Louis Etienne Thirioux in the early 20th century , D. T. Holyoak placed a small subfossil Mauritian parrot in the same genus as the broad @-@ billed parrot and named it *Lophopsittacus bensoni* . In 2007 , on the basis of a comparison of subfossils together with 17th and 18th century descriptions , Hume reclassified it as a species in the genus *Psittacula* and called it Thirioux 's grey parrot . Previously , James Greenway speculated that reports of grey Mauritian parrots referred to the broad @-@ billed parrot .

= = = Evolution = = =

The taxonomic affinities of the broad @-@ billed parrot are undetermined . Considering its large jaws and other osteological features , Edward Newton and Hans Gadow thought it to be closely related to the Rodrigues parrot ( *Necropsittacus rodricanus* ) , but were unable to determine whether they both belonged in the same genus , since a crest was only known from the latter . Graham S. Cowles instead found their skulls too dissimilar for them to be close relatives .

Many endemic Mascarene birds , including the dodo , are derived from South Asian ancestors , and the English palaeontologist Julian Hume has proposed that this may be the case for all the parrots there as well . Sea levels were lower during the Pleistocene , so it was possible for species to colonise some of the then less isolated islands . Although most extinct parrot species of the Mascarenes are poorly known , subfossil remains show that they shared features such as enlarged heads and jaws , reduced pectoral bones , and robust leg bones . Hume has suggested that they have a common origin in the radiation of the tribe *Psittaculini* , 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* may 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 . A 2011 genetic study instead found that the Mascarene parrot ( *Mascarinus mascarinus* ) of nearby Réunion was most closely related to the lesser vasa parrot ( *Coracopsis nigra* ) from Madagascar and nearby islands , and therefore unrelated to the *Psittacula* parrots , undermining the theory of their common origin .

= = Description = =

The broad @-@ billed parrot possessed a distinct frontal crest of feathers . Ridges on the skull indicate that this crest was firmly attached , and that the bird , unlike cockatoos , could not raise or lower it . The 1601 Gelderland sketch was examined in 2003 by Hume , who compared the ink finish with the underlying pencil sketch and found that the latter showed several additional details . The pencil sketch depicts the crest as a tuft of rounded feathers attached to the front of the head at the base of the beak , and shows long primary covert feathers , large secondary feathers , and a slightly bifurcated tail . Measurements of sub @-@ fossils known by 1893 show that the mandible was 65 ? 78 millimetres ( 2 @.@ 6 ? 3 @.@ 1 in ) in length , 65 mm ( 2 @.@ 6 in ) in width , the femur was 58 ? 63 mm ( 2 @.@ 3 ? 2 @.@ 5 in ) in length , the tibia was 88 ? 99 mm ( 3 @.@ 5 ? 3 @.@ 9 in ) , and the metatarsus 35 mm ( 1 @.@ 4 in ) . Unlike other Mascarene parrots , the broad @-@ billed parrot had a flattened skull .

Subfossils show that the males were larger , measuring 55 ? 65 centimetres ( 22 ? 26 in ) to the females ' 45 ? 55 cm ( 18 ? 22 in ) and that both sexes had disproportionately large heads and beaks . The sexual dimorphism in size between male and female skulls is the largest among parrots . Differences in the bones of the rest of the body and limbs are less pronounced ; nevertheless , it had greater sexual dimorphism in overall size than any living parrot . The size differences between the two birds in the 1601 sketch may be due to this feature . A 1602 account by Reyer Cornelisz has traditionally been interpreted as the only contemporary mention of size differences among broad @-@ billed parrots , listing " large and small Indian crows " among the animals of the island . A full transcript of the original text was only published in 2003 , and showed that a comma had been incorrectly placed in the English translation ; " large and small " instead referred to " field @-@ hens

", possibly the red rail and the smaller Sauzier 's wood rail .

There has been some confusion over the colouration of the broad @-@ billed parrot . The report of van Neck 's 1598 voyage , published in 1601 , contained the first illustration of the parrot , with a caption stating that the bird had " two or three colours " . The last account of the bird , and the only mention of specific colours , was by Johann Christian Hoffman in 1673 ? 75 :

There are also geese , flamingos , three species of pigeon of varied colours , mottled and green perroquets , red crows with recurved beaks and with blue heads , which fly with difficulty and have received from the Dutch the name of ' Indian crow ' .

In spite of the mention of several colours , authors such as Walter Rothschild claimed that the Gelderland journal described the bird as entirely blue @-@ grey , and it was restored this way in Rothschild 's 1907 book Extinct Birds . Later examination of the journal by Julian Hume has revealed only a description of the dodo . He suggested that the distinctively drawn facial mask may represent a separate colour . The head was evidently blue , and in 2007 , Hume suggested the beak may have been red , and the rest of the plumage greyish or blackish , which also occurs in other members of Psittaculini .

In 2015 , a translation of the 1660s report of Johannes Pretorius about his stay on Mauritius was published , wherein he described the bird as " very beautifully coloured " . Hume accordingly reinterpreted Hoffman 's account , and suggested the bird may have been brightly coloured with a red body , blue head , and red beak ; the bird was illustrated as such in the paper by Ria Winters . Possible iridescent or glossy feathers that changed appearance according to angle of light may also have given the impression that it had even more colours . It has also been suggested that in addition to size dimorphism , the sexes may have had different colours , which would explain some of the discrepancies in old descriptions .

= = Behaviour and ecology = =

Johannes Pretorius ( on Mautirius from 1666 to 1669 ) kept various now @-@ extinct Mauritian birds in captivity , and described the behaviour of the broad @-@ billed parrot as follows :

The Indian ravens are very beautifully coloured . They cannot fly and are not often found . This kind is a very bad tempered bird . When captive it refuses to eat . It would prefer to die rather than to live in captivity .

Though the broad @-@ billed parrot may have fed on the ground and been a weak flier , its tarsometatarsus was short and stout , implying some arboreal characteristics . The Newton brothers and many authors after them inferred that it was flightless , due to the apparent short wings and large size shown in the 1601 Gelderland sketch . According to Hume , the underlying pencil sketch actually shows that the wings are not particularly short . They appear broad , as they commonly are in forest @-@ adapted species , and the alula appears large , a feature of slow @-@ flying birds . Its sternal keel was reduced , but not enough to prevent flight , as the adept flying Cyanoramphus parrots also have reduced keels , and even the flightless kakapo , with its vestigial keel , is capable of gliding . Furthermore , Hoffman 's account states that it could fly , albeit with difficulty , and the first published illustration shows the bird on top of a tree , an improbable position for a flightless bird . The broad @-@ billed parrot may have been behaviourally near @-@ flightless , like the now @-@ extinct Norfolk Island kaka .

Sexual dimorphism in beak size may have affected behaviour . Such dimorphism is common in other parrots , for example in the palm cockatoo and the New Zealand kaka . In species where it occurs , the sexes prefer food of different sizes , the males use their beaks in rituals , or the sexes have specialised roles in nesting and rearing . Similarly , the large difference between male and female head size may have been reflected in the ecology of each sex , though it is impossible to determine how .

Masauji Hachisuka suggested the broad @-@ billed parrot was nocturnal , like the kakapo and the night parrot , two extant ground @-@ dwelling parrots . Contemporary accounts do not corroborate this , and the orbits are of similar size to those of other large diurnal parrots . The broad @-@ billed parrot was recorded on the dry leeward side of Mauritius , which was the most accessible for people

, and it was noted that birds were more abundant near the coast , which may indicate that the fauna of such areas was more diverse . It may have nested in tree cavities or rocks , like the Cuban amazon . The terms raven or crow may have been suggested by the bird 's harsh call , its behavioural traits , or just its dark plumage . The following description by Jacob Granaet from 1666 mentions some of the broad @-@ billed parrot 's co @-@ inhabitants of the forests , and might indicate its demeanour :

Within the forest dwell parrots , turtle and other wild doves , mischievous and unusually large ravens [ broad @-@ billed parrots ] , falcons , bats and other birds whose name I do not know , never having seen before .

Many other endemic species of Mauritius were lost after the arrival of man , so the ecosystem of the island is severely damaged and hard to reconstruct . Before humans arrived , Mauritius was entirely covered in forests , almost all of which have since been lost to deforestation . The surviving endemic fauna is still seriously threatened . The broad @-@ billed parrot lived alongside other recently extinct Mauritian birds such as the dodo , the red rail , the Mascarene grey parakeet , the Mauritius blue pigeon , the Mauritius owl , the Mascarene coot , the Mauritian shelduck , the Mauritian duck , and the Mauritius night heron . Extinct Mauritian reptiles include the saddle @-@ backed Mauritius giant tortoise , the domed Mauritius giant tortoise , the Mauritian giant skink , and the Round Island burrowing boa . The small Mauritian flying fox and the snail *Tropidophora carinata* lived on Mauritius and Réunion but became extinct in both islands . Some plants , such as *Casearia tinifolia* and the palm orchid , have also become extinct .

= = = Diet = = =

Species that are morphologically similar to the broad @-@ billed parrot , such as the hyacinth macaw and the palm cockatoo , may provide insight into its ecology . *Anodorhynchus* macaws , which are habitual ground dwellers , eat very hard palm nuts . Carlos Yamashita has suggested that these macaws once depended on now @-@ extinct South American megafauna to eat fruits and excrete the seeds , and that they later relied on domesticated cattle to do this . Similarly , in Australasia the palm cockatoo feeds on undigested seeds from cassowary droppings . Yamashita suggested that the abundant *Cylindraspis* tortoises and dodos performed the same function on Mauritius , and that the broad @-@ billed parrot , with its macaw @-@ like beak , depended on them to obtain cleaned seeds . Many types of palms and palm @-@ like plants on Mauritius produce hard seeds that the broad @-@ billed parrot may have eaten , including *Latania loddigesii* , *Mimusops maxima* , *Sideroxylon grandiflorum* , *Diospyros egrettorium* , and *Pandanus utilis* .

On the basis of radiographs , D. T. Holyoak claimed that the mandible of the broad @-@ billed parrot was weakly constructed and suggested that it would have fed on soft fruits rather than hard seeds . As evidence , he pointed out that the internal trabeculae were widely spaced , that the upper bill was broad whereas the palatines were narrow , and the fact that no preserved upper rostrum had been discovered , which he attributed to its delicateness . G. A. Smith , however , pointed out that the four genera Holyoak used as examples of " strong jawed " parrots based on radiographs , *Cyanorhamphus* , *Melopsittacus* , *Neophema* and *Psephotus* , actually have weak jaws in life , and that the morphologies cited by Holyoak do not indicate strength . Hume has since pointed out that the mandible morphology of the broad @-@ billed parrot is comparable to that of the largest living parrot , the hyacinth macaw , which cracks open palm nuts with ease . It is therefore probable that the broad @-@ billed parrot fed in the same manner .

= = Extinction = =

Though Mauritius had previously been visited by Arab vessels in the Middle Ages and Portuguese ships between 1507 and 1513 , they did not settle on the island . The Dutch Empire acquired the island in 1598 , renaming it after Maurice of Nassau , and it was used from then on for the provisioning of trade vessels of the Dutch East India Company . To the Dutch sailors who visited Mauritius from 1598 and onwards , the fauna was mainly interesting from a culinary standpoint . Of

the eight or so parrot species endemic to the Mascarenes , only the echo parakeet ( *Psittacula echo* ) of Mauritius has survived . The others were likely all made extinct by a combination of excessive hunting and deforestation .

Because of its poor flying ability , large size and possible island tameness , the broad @-@ billed parrot was easy prey for sailors who visited Mauritius , and their nests would have been extremely vulnerable to predation by introduced crab @-@ eating macaques and rats . Various sources indicate the bird was aggressive , which may explain why it held out so long against introduced animals after all . The bird is believed to have become extinct by the 1680s , when the palms it may have sustained itself on were harvested on a large scale . Unlike other parrot species , which were often taken as pets by sailors , there are no records of broad @-@ billed parrots being transported from Mauritius either live or dead , perhaps because of the stigma associated with ravens . The birds would not in any case have survived such a journey if they refused to eat anything but seeds .