Art. XXVIII.—*Notes on* Harpagornis Moorei, *an Extinct Gigantic Bird of Prey, containing Description of Femur, Ungual Phalanges, and Rib.*

By Julius Haast, Ph.D., F.R.S.

(With Illustrations.)

[*Read before the Philosophical Institute of Canterbury, 3rd May,* 1871.]

Amongst the discoveries made during the last few years in the turbary deposits of Glenmark, in which the remains of the different extinct gigantic species of *Dinornis* abound, none can be of greater interest to the student or lover of the natural history of these islands, than the occurrence of bones belonging to a raptorial bird of enormous dimensions, contemporaneous with the Moa.

During the progress of excavations undertaken in the month of March of this year on the Glenmark property, Mr. F. Fuller, Taxidermist to the Christchurch Museum, found, amongst a considerable quantity of moa bones, mostly belonging to specimens of *Dinornis casuarinus*, *crassus*, and *didiformis*, five to six feet below the surface of the swamp and over a space of about thirty feet square, a few smaller bones in an excellent state of preservation, which he at once correctly referred to a gigantic raptorial bird.

These remains include a femur, a few ungual phalanges, and one rib, all belonging doubtless to the same individual, and although the discoverer used all possible care and diligence during his subsequent researches, he was unfortunately unable to obtain any other portion of this very interesting species.

Before proceeding I wish to observe that we need not infer, from the absence of the larger species of the *Dinornithes* in that locality, that they did not exist at the same time, the fact being simply that the bones of larger species, such as *Dinornis giganteus* and *robustus*, are found in this portion of the swamp nearer to the base of the hill, the water-courses, which brought them down from the hill sides, not being powerful enough to move the heavier bones to such distances as the smaller ones.

In attempting a description of these unique specimens, which, for fear of accident, it would be unwise to send away to be described by a more competent authority, I have only been guided by the wish to make such an interesting fact as the occurrence of a gigantic bird of prey in New Zealand during the *Dinornis* age more fully known, and I trust, therefore, that any shortcomings will be leniently overlooked.

Fortunately, I could avail myself of the pencil of our talented honorary secretary, Dr. L. Powell, who has prepared the necessary illustrations for this paper, and thus, if the descriptions are deficient, the faithful drawings will, in many respects, amply make up for such shortcomings.

In order to pay a just compliment to my friend, Mr. P. H. Moore, of Glenmark, who has always afforded me every facility in his power to pursue my researches upon his property, I propose the name of *Harpagornis Moorei* for this extinct species, and I only hope that further excavations will enable me to obtain at a future date a larger portion of its skeleton than the Canterbury Museum at present possesses.

The principal bone in the collection is a left femur, it is a portion of a mature bird, as shown by the excellent preservation of the articular extremities and the strongly developed muscular ridges.

The dimensions are as follows:—

	Inches.
Total length of bone	6·66
Circumference of proximal extremity . . .	4·66
„ „ distal „ . .	5·58
„ „ shaft where thinnest . .	2·50

On Plate X., fig. 1., is given a faithful representation in natural size of this femur (back view), and it conveys better than any measurements or descriptions can do, an idea of its enormous size, principally if compared with the contours also drawn in natural size of the femur of *Polioaëtus leucogaster* (fig. 2), the white-bellied Sea Eagle of Australia, and (fig. 3) of *Circus assimilis*, the New Zealand Harrier.

This bone has all the characteristics of the femur of a diurnal bird of prey, some of them developed in a remarkable degree owing to its enormous size.

The cylindrical shaft is bent forward as usual, and above the distal extremity it is slightly curved back (fig. 1 at *a*). I find that both the *Polioaëtus* and *Circus* possess this curve, but the latter exhibits this peculiarity much more distinctly than the Australian species. The hollow on the top of the head is very large, and measures ·42 inch across.

The trochanteric ridge is well developed, and the outer side is very rough, showing that muscles of great strength and thickness must have been attached to it.

The inter-muscular linear ridges are well raised above the shaft, of which the one extending from the fore and outer angle of the epitrochanteric articular surface to the outer condyle is the most prominent.

The pits for the attachment of the ligaments in the inter-condyloid fossa are strongly marked. The femur is pneumatic, the proximal orifice is large and ear-shaped, resembling in form more the air passage of the New Zealand *Circus* than that of the Australian Sea Eagle, the only two bones I possessed for comparison. The junction of the head with the shaft is more deeply cut and more distinctly defined than in *Polioaëtus*, the same being the case with *Circus*, so that the trochanter of both are more rounded and distinct than in the Australian Eagle.

On Plate X., fig. 4, is represented the articular surface of the proximal end with the large oval depression on the head of the bone, and at fig. 5 that of the distal end. On the latter the angular concavity on the outer condyle is of considerable size and depth.

Also in this point the close resemblance of the fossil bone to the corresponding limb bone of our present Harrier is very striking, suggesting that as *Apteryx* is the diminutive representative of the extinct gigantic *Dinornis*, so the New Zealand Harrier is that of *Harpagornis*. If this hypothesis is accepted, two important considerations may be deduced therefrom, which will assist us in understanding better the mode of life of the different extinct species of the *Dinornithes*.

In the first instance we have ample evidence, as I have shown elsewhere, that the principal feeding grounds of the gregarious Moas were either the open plains, or the grassy downs and low hills, they eschewing, for many reasons, the forests with their dense undergrowth, which not only would have opposed almost insurmountable obstacles to their locomotion, but would not have afforded such quantities of suitable food as the more open districts covered with *Phormium tenax*, *Coriaria*, and *Cordyline* offered.

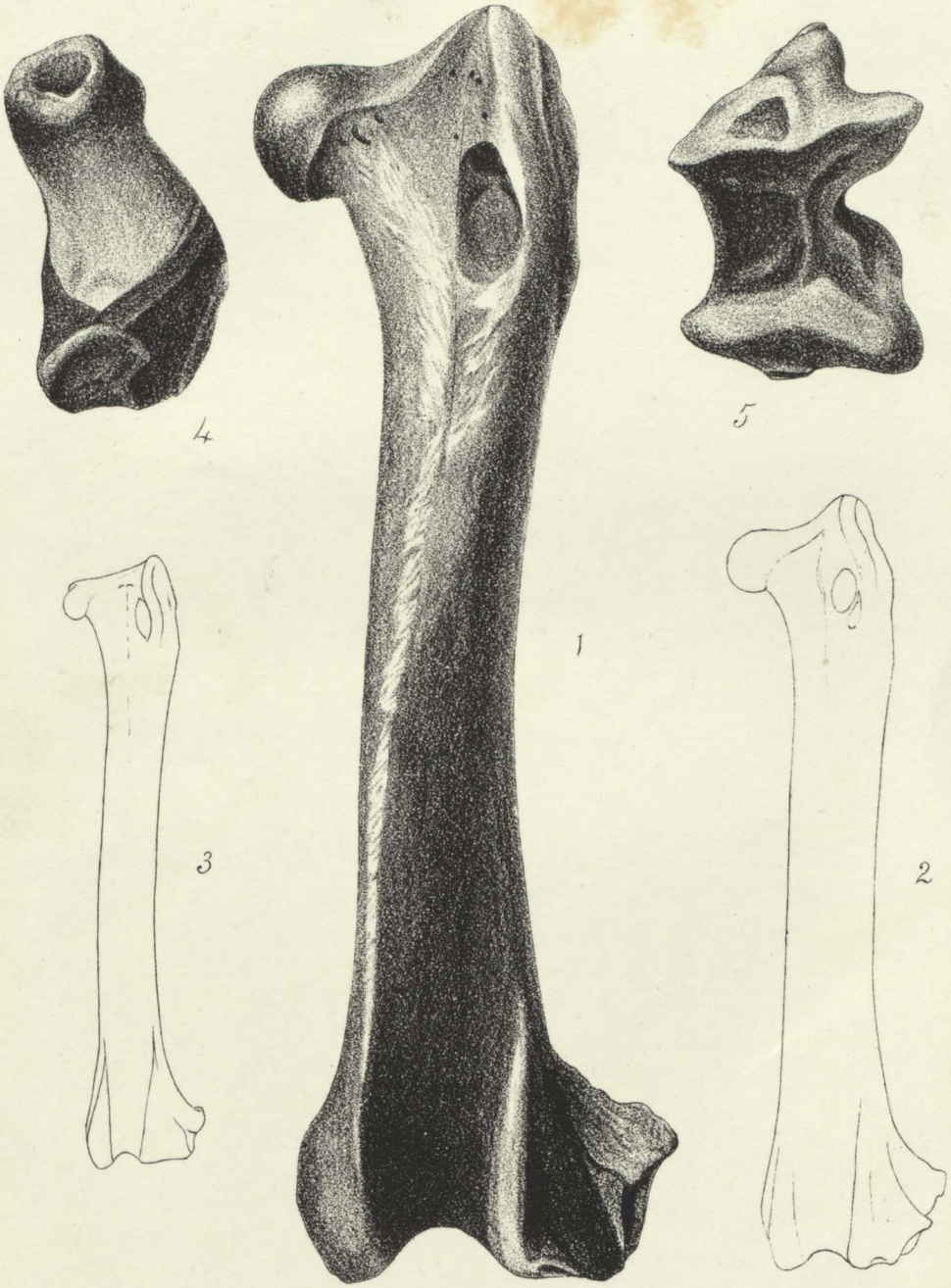
The presence of a proximal orifice for the admission of air proves at the same time that the *Harpagornis* was a diurnal bird of prey, the owls having the femur filled with marrow; and from this fact we may conclude, without being too hazardous in our deductions, that at least the greater portion of the different species of *Dinornis* were also diurnal in their habits, and not nocturnal as the *Apterygidæ* of the present day.

And thus, as the small Harrier now flies leisurely during the day time over the plains and downs in search of food, consisting of carrion, birds, lizards, and insects, so the *Harpagornis* doubtless followed the flocks of Moas, feeding either upon the carcases of the dead birds, or killing the young and disabled ones.

Another bone which belongs to the same species is a rib. It is the third rib on the right side, the first after the pleurapophyses or two floating ribs, and articulates with the hæmapophysis or sternal rib, and through the latter bone with the sternum.

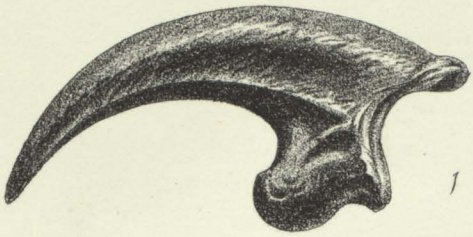
Pl. XI., fig. 5, represents in natural size this well preserved bone, of which only at *b* the upper portion of the epipleural appendage is broken off. The coalescence of this latter portion of that bone, which is a well marked peculiarity of raptorial birds, is well shown in this specimen, thus offering additional evidence as to the specific character of the specimen under review.

Two other bones, found close to each other in the same locality, and belonging without doubt to the same skeleton, are full of suggestive interest, as they, better than any other portion of the skeleton could do, exhibit the



HARPAGORNIS MOOREI, *HAAST.*

Ll. Powell del. J.B. lith.



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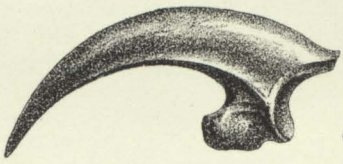

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1. a.

3. a.

HARPAGORNIS MOOREI, *HAAST.*

Lt. Powell, del. J.B. lith.

remarkable size and strength of the raptorial bird of which they are a portion. They consist of two ungual phalanges, of which the largest one (Pl. XI., figs. 1 and 1*a*), measures as follows :—

	Inches.
Length from summit of articular end to point .	2·92
Circumference near articular end, including lower process	3·17

As far as the scant material for comparison will allow, I believe that this bone is the ungual phalanx of the hallux or first toe of the left foot.

A comparison with fig. 3, Pl. XI., the ungual phalanx of the left foot (hallux) of the *Aquila audax*, the great Wedge-tailed Eagle of Australia, and with fig. 4, the corresponding bone in the New Zealand Harrier, will not only prove the close resemblance between that bone, belonging to these birds and the *Harpagornis*, but also their striking difference in size, and gives evidence of the enormous strength this extinct moa-hunter of the feathered tribe must have possessed. Only the lion and tiger, amongst the recent carnivorous mammalia, perhaps have larger ungual phalanges than this extinct raptorial bird, and after having seen its curved talons, the fable of the bird Roc no longer seems so very extravagant and strange, and I may add, that a human being, if not well armed or very powerful, not to speak of children, would have stood a very poor chance against such a formidable foe, if it had chosen to attack him.

In former publications I have, as I believe, conclusively shown that the native race who hunted and exterminated the different species of *Dinornis*, was a pre-historic people, and that the Maoris, the present aboriginals of New Zealand, probably the direct descendants of the former, have not the least tradition about them.

The discovery of these bones offers additional confirmation to my conclusions, as there is no doubt in my mind that, if reliable traditions about the *Dinornis* had been handed down to us, the still more alarming existence of this gigantic bird of prey, contemporaneous with the former, would most certainly have also been recorded.

A second ungual phalanx, applying the mode of measurement previously used, is 2·75 inches long, and has a circumference of 2·92 inches. It belongs probably to the second toe of the right foot. Plate XI., fig, 2, shows its articular proximal surface.

The Canterbury Museum possesses also the fragment of a right humerus, with both apophyses broken off, 7 inches long and 2·25 inches in circumference, found together with a considerable quantity of moa bones in a small water-course about two miles from Glenmark.

This fragmentary bone is most probably also a portion of the wing of this or of another bird of prey of very large dimensions.

As I intend to have further excavations made for the discovery of other portions of this unique species, I hope soon to be able to offer some additional information on the same subject.

Description of Plates X. and XI.

Plate X.—Fig. 1. Femur of *Harpagornis Moorei*, back view of left leg. Fig. 2, Femur of *Polioaëtus leucogaster*, back view of left leg. Fig. 3. Femur of *Circus assimilis*, back view of left leg. Fig. 4. Proximal end of femur of *Harpagornis Moorei*, left leg. Fig. 5. Distal end of femur of *Harpagornis Moorei*, left leg.

Plate XI.—Fig. 1. Ungual phalanx (of hallux, left leg) of *Hapagornis Moorei*. Fig. 1*a*. Proximal articular surface of fig. 1. Fig. 2. Ungual phalanx, probably of second toe of right foot. Fig. 3. Ungual phalanx of hallux, left leg of *Aquila audax*. Fig. 3*a*. Proximal articular surface of fig. 3. Fig. 4. Ungual phalanx of hallux, left leg of *Circus assimilis*. Fig. 5. Third rib right side of *Harpagornis Moorei*.

Note.—All these figures are of the natural size.

Art. XXIX.—*Notes on the Fur Seal of New Zealand*, Arctocephalus cinereus, *Gray (?)* By James Hector, M.D., F.R.S.

(With Illustrations.)

[*Read before the Otago Institute*, 31*st October*, 1871.]

On 13th February last, during the visit of H.M.S. 'Clio,' to Milford Sound, on the west coast of the South Island, several seals were shot by His Excellency Sir George Bowen, which proved to be the Eared Seal or Fur Seal of New Zealand, as it is termed by the traders. They were shot from a boat while basking on ledges of rock, and although several were mortally wounded, their great activity enabled them to scramble into deep water, so that only three were secured. I took the following measurements of the two largest, which were male and female adults.

Both had the same form, colour, and general appearance, the male being the larger in every respect, except the length of the hind flippers and tail, which were of slightly greater proportional dimensions in the female. The male weighed 258 pounds, and the female 208 pounds.

In both the snout was obliquely truncate, the upper surface being prolonged so as to overhang the mouth; nostrils vertical elongated slits; nose jet black; a few stout black bristles on the snout, which is short and not separated from the head. Head round; the eyes lateral. Ears with slender pointed tubular