

CONTRIBUTIONS TO THE NATURAL HISTORY OF THE COM-  
MANDER ISLANDS.

BY  
LEONHARD STEJNEGER AND FREDERIC A. LUCAS.

(With Plates II-IV.)

A.—CONTRIBUTIONS TO THE HISTORY OF PALLAS' CORMORANT.

BY  
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About forty years ago the Great Auk (*Plautus impennis*) of the Northern Atlantic became exterminated. A vigorous search has been made for it and its remains; fabulous sums have been paid for skins and eggs; and monographers, among whom some of the most prominent ornithologists, have collected together the most minute facts bearing upon its history, and discussed in extreme detail the number of specimens extant as well as their individual history, so that the latest account of this remarkable bird fills a quarto volume of quite respectable dimensions. There are now on record about eighty mounted specimens, or skins, seventy eggs, and countless bones as being preserved in the various museums of the Old and the New World.

Within the same period another large water bird has become extinct in the North Pacific, without having as yet attracted the attention of the monographers. It is so rare in collections that only four specimens are known to exist in museums, while nobody is the proud possessor of its eggs, and no bones had been found or preserved until I was so fortunate some years ago as to rescue a few of them. Yet, this bird was the largest and handsomest of its tribe. And so little has been known of it that there is not yet printed a detailed and good description of it. The bird which has fared so badly is Pallas's Cormorant, or the Spectacled Cormorant, *Phalacrocorax perspicillatus* Pall.

I have recorded elsewhere (Proc. U. S. Nat. Mus., VI, 1883, p. 65, and Bulletin U. S. Nat. Mus., No. 29, Res. Orn. Expl. Kamtsch., p. 180) my reasons for considering this species extinct and the causes which led to its extermination. It seems as if the very causes which terminated the existence of the Great Auk worked the same result in Pallas's Cormorant, and it is even probable that if the latter, at some earlier period,

also inhabited the other Aleutian Islands, as is most likely, volcanic eruptions may have played a rôle in this drama as well as in that of the Great Auk. True, the latter was entirely deprived of its power of flight, but it is evident both from the measurements of the skins as well as of those of the bones, given below, that the wings of this cormorant were disproportionately small. Steller speaks of its great bulk of body and its weight, which varied between twelve and fourteen pounds,\* so that one single bird was sufficient for three starving men of the shipwrecked crew.

With this bulk it combined an unusual "*stoliditas*," but it is pretty clear that this stupidity, which made them such an easy prey, was due more to their slowness of locomotion on land and in the air than to any special temperament or dullness of intellect. The natives of Bering Island inform me that the meat of this species was particularly palatable compared with that of its congeners, and that consequently, during the long winter, when other fresh meat than that of the cormorants was unobtainable, it was used as food in preference to any other. In brief, all the circumstances combined to make short work at exterminating this bird at its last refuge, for there is no evidence that it has ever been found during historical times in any other locality than Bering Island. The result was that Pallas's Cormorant, which was found by Steller and his shipwrecked comrades on that desolate island in 1741, and which at that time—that is, before man ever visited its rocky shores—occurred there in great numbers, "*frequentissimi*," as Steller says, became extinct in about a hundred years from its discovery. The history of this bird forms an interesting parallel to that of the great northern sea-cow (*Rytina gigas*).

Up to 1837 or 1839 Steller seems to have been the only naturalist who had seen this bird, for, although naming it in his Zoographia, all Pallas knew of the species was derived from Steller's observations, whose description he merely quotes. It is, then, safe to conclude that it was not among the many water birds collected by Billings's expedition, which brought home such rich spoils from the Kuriles and the Aleutian Island, but which did not touch at Bering Island. In the above-mentioned year Captain Belcher, with the *Sulphur*, visited Sitka, and was there presented by Kuprianoff, the Russian governor, with one of the specimens of this bird in his possession. This specimen is evidently the one now in the British Museum, while the others went to the St. Petersburg Academy, from which one was again secured by the Leyden Museum. Although obtained from the governor in Sitka, there is nothing to indicate whence came the specimens; but inasmuch as Bering Island at that time belonged to the administrative district of Sitka, at which port all the furs were received from that island before being shipped to Europe,

\* The average length of wing of adult *Ph. perspicillatus* is 355mm (see table beyond) and the weight 12 to 14 pounds. Compare with this the fact recorded by me (Orn. Expl. Kamtsch., p. 186) that *Ph. urile*, the nearest ally of the present species, weighs only 5 pounds, with a length of wing of 300mm.

all vessels from Bering Island consequently first stopping at Sitka, there is every probability that the specimens in question were collected on that island. This conclusion is corroborated by the manner in which *P. perspicillatus* and *Leucosticte griseogenys* are mentioned together.

So far as known, these are the only specimens in existence, viz: Two in the museum of the Imperial Academy of Sciences in St. Petersburg; one in the British Museum, London; one in the "Rijks Museum," Leyden, Holland.

Several pictures of Pallas's Cormorant have been published. A large colored plate by Wolf, from the British Museum specimen, is in Elliot's Birds of North America, a reduced wood engraving copy of which is given in the Standard Natural History (or Riverside Natural History), vol. IV, p. 192. The same specimen is also figured in two different positions by Gould in the Zoology of the voyage of the *Sulphur*, and poorly copied in Reichenbach's "Natatorum Novitiæ." In Schlegel's "Dierentium," p. 281, there is a wood-cut, probably taken from the Leyden specimen. According to Dr. Finsch (Abh. Natur. Hist. Ver. Bremen, III, 1872, p. 20) this species, undoubtedly from one of the St. Petersburg specimens, is represented on plate V, Fig. 4, of Brandt's "Icon. Av. Ross," a work which was never published.

Dr. Theodor Pleske kindly writes me in regard to the specimens in St. Petersburg:

Through the kind offices of Dr. Pleske I have received from Professor Brandt's heirs that part of the manuscript of his unpublished monograph of the Cormorants, which relates to the species in question, with permission to publish it. The description is very full, and being the only accurate and detailed description of the species I take great pleasure in printing it in full. In order to avoid any errors I deem it best to publish it in the language in which it was originally written. I have preceded this description with a synonymy which is thought to be nearly exhaustive.

#### Phalacrocorax perspicillatus PALL.

- 1826.—*Phalacrocorax perspicillatus* PALLAS, Zoogr. Ross. As. II, p. 305.—GOULD, Zool. Sulphur, p. 49, pl. xxxii (1844).—BONAPARTE, Cons. Av. II, p. 167 (1855).—*Id.*, Compt. Rend., 1856, XLIII, p.—TACZANOWSKI, Orn. Faun. Vert. Sibir., p. 66 (1877).—*Id.*, Bull. Soc. Zool. France, 1877, p. 41.—RIDGWAY, Nomencl. N. Am. B., p. 51 (1881).—*Id.*, Man. N. Am. B., p. 81 (1887).—COUES, Check L. and Diet., p. 118 (1882).—*Id.*, Key, 2 ed., p.—(18—).—*Id.*, Auk, 1884, p. 144.—*Id.*, Key, 3 ed., p.—(18—).—STEJNEGER, Pr. U. S. Nat. Mus, VI, 1883, p. 65.—*Id.*, *ibid.*, x, 1887, p. 138.—*Id.*, Auk, 1884, p. 173.—*Id.*, Orn. Expl. Kamtsch., pp. 180, 318 (1885).—*Id.*, Stand. Nat. Hist., IV, p. 191, Fig. 92 (1885).—BAIRD, BREWER, & RIDGWAY, Water B., N. Am., II, p. 164, fig. (1884).—A. O. U. Code and Check L., p. 351 (1886).
- 1858.—*Graculus perspicillatus* LAWRENCE, in Baird, B. N. Am., p. 877 (1858).—SCHLEGEL, Mus. P.-Bas, Pelec., p. 17 (1863).—*Id.*, Dierentium, p. 281, fig. (1871).—ELLIOT, B. N. Am., pt. —, pl. 50 (—).—GRAY, Hand-l., III, p. 127 (1871).—COUES, Key, 1 ed., p. 304 (1872).—*Id.*, Check L., p. 101 (1873).
- 1850.—*Graculus urile* REICHENBACH, Natat. Novit., pl. XVII, Figs. 2311 and 2312 (*acc GMEL.*) (Cf. BONAP., Cons. Av. I, p. 168, and A. B. MEYER, Index Reichenb., p. 44; no name on the plate!)

Brandt's description, here published for the first time, is literally as follows:

DESCRIPTIO.

*Carbo perspicillatus* specierum generis *Carbonum* hucusque notorum maximam sistere videtur. Corporis enim mole *Carborem cormoranum* superat.

Rostrum robustum, satis altum, modice elongatum, nigrum, apice summo albicanti-corneo, basi marginibusque tamen corneo. Culminis basis supra rotundata, convexa, medium supra subrectum. Culminis margine anterioris subrecti apex supra dertri basin hand prominens sed angusta sutura distinctum. Culminis superior facies nec non paratonorum atque gnathidiorum apice uncato, acuto, elongato, gonydem in rostro clauso longe superante. Exterior facies tenuiter per longitudinem subelevato-striata, striis teneris plus minusve parallelis. Dertrum in baseos faciei superioris lateribus sulco arcuato satis profundo exaratum, in facie laterali autem sulcis parum distinctis, transversis, obliquis, subparallelis 2 vel tribus instructum. Gonyes subrecta et in medio vix prominens. Myxa apice truncato rotundata.

Frontis antica pars, genae, regio ophthalmica, spatium angustum pone oris angulum, mentum et gulae summum initium nuda cinnabarina, albo et coeruleo varia ut in gallopavone (Steller). In genis pennae brevissimae, solitariae, sparsae. Oculi annulo membranaceo, nudo, elevato, subelliptico, lato, albo, perspicillum quodammodo acuminate, eincti. Inter oculi annulum et superiorem oris anguli marginem calvum spatium triangulare pennis brevibus obsessum.\*

Alae complicatae vix ad uropygii posteriorem extremitatem porrigentes.

Cauda inverti subspatulata, basi angustior, e pennis 12 composita.

Tarsi pro magnitudine admodum breves.

Color in universum ater. Capitis anterior pars cum gula initio violaceonitens. Capitis posterior pars, collum, pectus, abdomen, dorsum, crissum et uropygium obscure vel aureo viride nitentia luce angulo plus minusve recto in observatoris oculos reflexa plus minusve obscure violascentia. Pennae parapterii et humerales nec non tectrices alarum supra et subpurpurascente violaceo-nitidae, anguste nigro-marginatae, rotundatae vel obtuse subacuminatae, apice fere subellipticae. Remiges primariae et tectrices alarum inferiores e subfusciscentis nigrae. Remiges secundariae nigrae, limbo externo plus minusve subnitide purpurascente violaceae. Cauda cum tectricibus atra, subopaca. Rectricum scapi supra ad apicem usque albi, marginibus nigricantibus, apice autem cum inferiore facie nigri. Frontis posterioris partis et verticis pennae dilatatae medio atrae marginibus subpurpureo-violascente vel interdum subvirescente nitidulae in cristam subtetragonam antice angustioreni basi latam, subrectam retrorsum spectantem, postice subtruncatam, 3" fere longam apice 2" latam insignem elevatae. In occipitis postrema parte et cervicis summo crista alia 2" longa 2½" lata, flabelliformis, basi angustior e pennis satis latis atris margine virescentibus media plus minusve subpurpureiscentibus formata, retrorsum spectans conspicitur. In frontis medio supra oculos, in temporibus et in lateribus superioris partis colli pennae candidae angustae ¼ ad ½ lineae latae elongatae, 1-3" longae, lineares, acutae, fere subsetaceae, subsolitariae sparsae inveniuntur, quarum quae in fronte sunt breviores, interdum pollicares vel paulo ultra; quas vero in collo observare licet multo longiores, 2-3" longi evadunt. Praeterea vero etiam in temporibus et collo pennulae albae breves penicilliformes apice tantum radiolatae. In femoribus macula candida triangularis a quovis hypocondrio late incipiens et ad crus usque angulo acuminatio extensa e pennis longis, valde acuminatis apicibus radiolis rarioribus compositis formata. Pedes atri unguibus obscure corneis.

Feminae Stellero auctore et cristis et membrana perspicilliformi, alba oculos late cingente carent.

Pondus Stellero auctore 12-14 librarum.

\* Ob hanc annulum peculiarem Pallasius haud incommode speciem nostram perspicillatum nominavit.

Mensurae avis adultae in Museo Academico servatae.

A rostri apice ad caudae apicem.....	39''
ad frontem.....	3'' 6'''
ad oris angulum.....	4'' ½'''
A fronti ad caudae basin.....	27'' 10'''
dorsi initium.....	14'' 7'''
Ab alarum angulo humerali ad remigum apicem.....	13'' 3'''
Caudae longitudo.....	7'' 5'''
Tarsi longitudo.....	2'' 6'''
Longitudo digiti interni ad unguis basin.....	1'' 3'''
secundi.....	2'' 1'''
tertii.....	3'' 1'''
quarti seu externi.....	4'' 2'''

I have thought it useful to tabulate the measurements given by the various describers reduced to millimeters:

	Brandt, Specimen in Museum St. Petersburg.	Gould, Specimen in British Mu- seum.	Schlegel, Specimen in Leyden Mu- seum.
Total length.....	1055	914	.....
Bill to forehead.....	95	.....	.....
Bill to gape.....	109	.....	.....
Bill.....	.....	102	81
Height of bill in middle.....	.....	.....	18
Wing.....	359	356	351
Tail.....	201	229	189
Tarsus.....	68	76	.....
First toe, without claw.....	34	.....	.....
Second toe.....	56	.....	.....
Third toe.....	89	.....	.....
Fourth toe.....	113	.....	168

I have already stated that no bones of this species have been preserved in museums until I was so fortunate as to find a few fragments evidently belonging to this bird. These Mr. Frederic A. Lucas has kindly undertaken to describe and illustrate in the second part of this paper.

The conditions under which they were found I have already described elsewhere (*Deutsche Geograph.*, *Blatte VIII*, p. 272), but a brief account may not be out of place in the present connection.

During my circumnavigation of Bering Island I landed on September 1, 1882, at Pestshanij Mys near the northwestern extremity of the island. Ascending the steep coast escarpment which is here about 35 feet high, I found near the edge of the terrasse a rather extensive deposit of bones of various mammals and birds arranged in thin layers of sand and sod alternating. The average thickness of the deposit was about 2 feet, and the present area covered in the neighborhood of 600 square feet, though it was evident that it was formerly of much greater extent, the ocean having encroached upon the land and carried away great portions of the terrasse. The bones were in fairly good condition, some of the smaller and more delicate ones even excellently well preserved, and none of them showed signs of violence. There were bones of the Arctic Fox, the Sea-otter, the Sea Lion, and other species of seals, as well as various

kinds of water birds. Among the latter a particularly large pelvis of a *Phalacrocorax* at once attracted my attention, and as I had had Pallas's Cormorant on my mind since I started from Washington I was not slow in concluding that I had to do with the bones of this bird. Had I had time to dig out the whole deposit I should probably have obtained more bones, but with the above suspicion I did as much digging and collected as many bird bones as the circumstances would allow.

A full account of this find is given by Mr. Lucas in his report which forms the remaining portion of this article.

B.—DESCRIPTION OF SOME BONES OF PALLAS' CORMORANT (*PHALACROCORAX PERSPICILLATUS*.)

BY

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Dr. Stejneger has very kindly placed in my hands for description the bones above mentioned. They are as follows:

Rostral portion of cranium in advance of the fronto-nasal hinge, with attached palatines.	Right fused metacarpals, very imperfect.
Lower mandible.	Three pelves, lacking pubic bones.
Right ramus of lower mandible.	Left femur.
Two nearly complete sterna.	Two left tibiae.
Right coracoid.	Right tibia.
Right humerus.	Two left tarsi.
Left humerus of another individual.	Second cervical vertebra.
Right ulna.	Third cervical vertebra.
Right fused metacarpals.	Ninth (?) cervical vertebra.

The more important of these are figured on the accompanying plates, all figures being of natural size, and drawn by the author.

The bones, although stained, are in a good state of preservation, being but slightly weathered, and all are from thoroughly adult individuals.

For the better and briefer description of these bones they have been compared with those of an adult *Phalacrocorax carbo*, and the opportunity has been taken to test, to some extent, the value of the subgenera *Urile* and *Phalacrocorax*, by comparing at the same time the corresponding bones of *P. urile* and *P. dilophus*.

The former bird is, for the species, large and the latter somewhat undersized, although adult.

The rostrum of *perspicillatus* is nearly as long as in *carbo*, but much more slender, and is readily distinguished from it by the deep, lateral, longitudinal groove characteristic of the sub-genus *Urile*.

The under surface of the rostrum is less grooved, longitudinally, than that of *carbo* and much less so than that of *P. urile*.

The palatines are as long as those of *carbo*, anteriorly narrower and

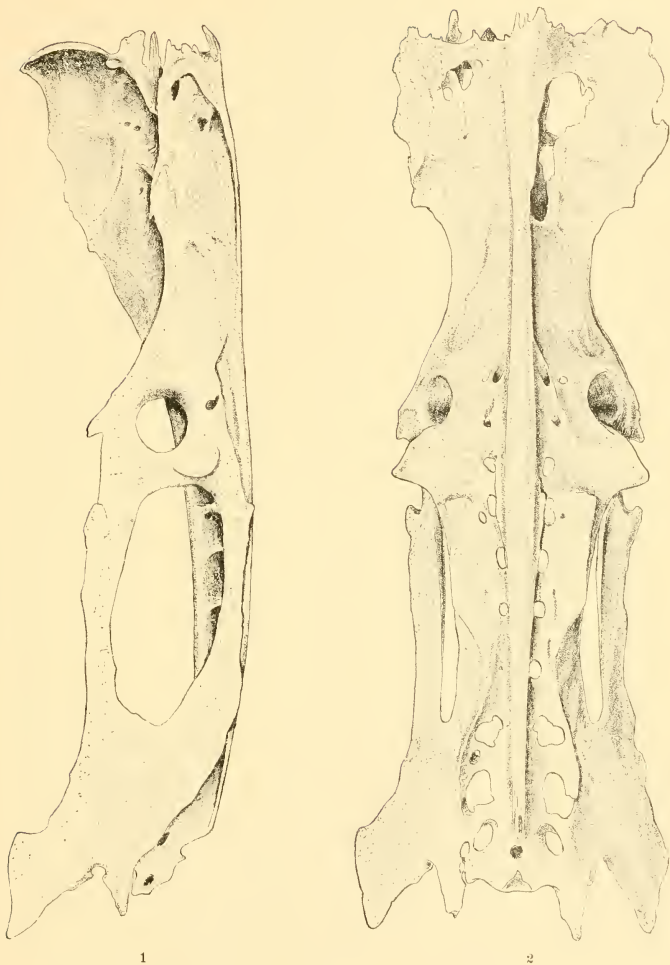


BONES OF PALLAS'S CORMORANT—NATURAL SIZE. (Page 88.)

1. Ventral aspect of rostrum.
2. Lateral aspect of rostrum.
3. Right ramus of lower mandible, external aspect.
4. Right ramus of lower mandible, internal aspect.
5. Right metacarpals







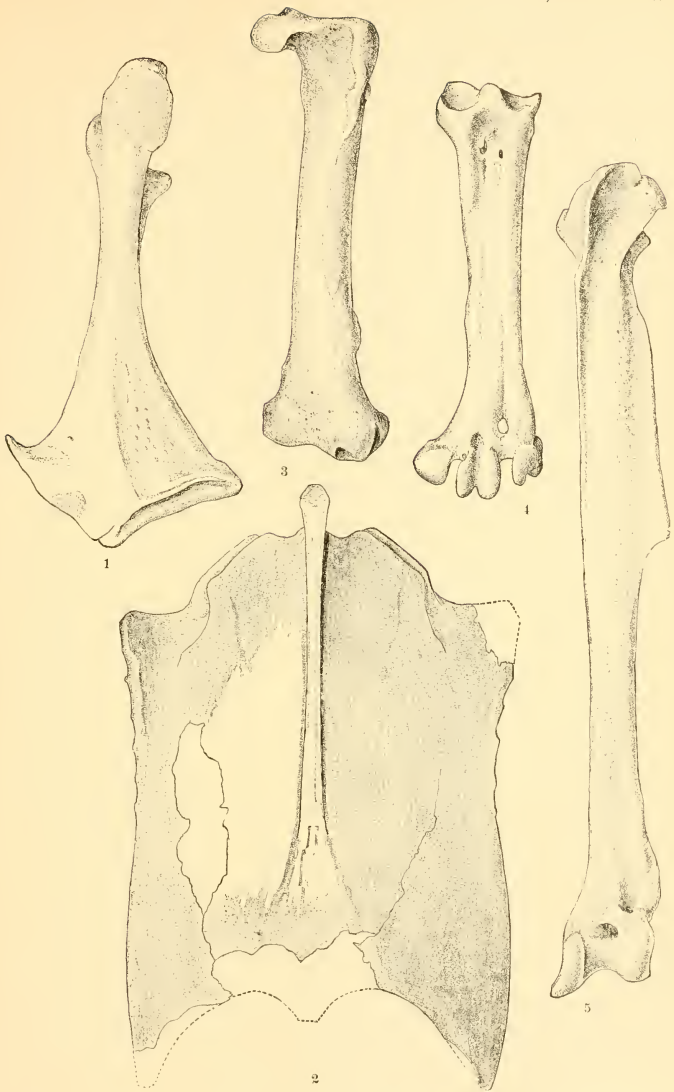
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BONES OF PALLAS'S CORMORANT—NATURAL SIZE. (Page 88.)

1. Left lateral aspect of pelvis.
2. Dorsal aspect of pelvis.





BONES OF PALLAS'S CORMORANT—NATURAL SIZE. (Page 88.)

- 1. Right coracoid, ventral aspect.
- 2. Sternum, ventral aspect.
- 3. Femur, anterior aspect.

- 4. Tarsus, anterior aspect.
- 5. Tibia, anterior aspect.



posteriorly wider, conforming in pattern very nearly to those of *urile*, while *dilophus* resembles *carbo* in this respect.

The trans-palatine angle is more rounded than in *carbo*, much more than in *urile*, resembling in this *dilophus*.

The inner portion of the post-palatine is less produced ventrally than in *carbo*, and the pterygoid articulation wider and flatter than in *carbo*, the palatine thus lacking the keel present in *carbo*.

The same differences are found between the same parts of *urile* and *dilophus*.

The maxillo-jugal bar is as long as that of *carbo* but more slender.

The lower mandible is slightly shorter and decidedly weaker than that of *carbo*, and the lower mandible of *urile* is proportionately still weaker than that of *dilophus*.

The dentary portion of the mandible is more deeply grooved along the inner surface than that of *carbo*, being comparatively the same as in *urile*.

The cutting edges of the mandible are comparatively straight as in *carbo* and *dilophus*, but *urile* differs from all three in having the mandible distinctly recurved.

The sternum is transversely flatter than that of *carbo*, being a trifle more flattened even than that of *urile*. The carina is also shorter than in *urile*, but in size and general appearance the sterna of *perspicillatus* and *urile* resemble one another very closely.

From manubrium to meso-xiphoid the sternum is 13<sup>mm</sup> shorter than that of *carbo*, being exactly as long as that of *urile*.

The proportion of carina to total length is shorter than in either *carbo* or *urile*, the sternum from anterior end of carina to meso-xiphoid measuring 2<sup>mm</sup> less than that of *carbo* and 4<sup>mm</sup> less than that of *urile*.

Between the costal borders the sternum is slightly wider than in either *carbo* or *urile*.

The rudimentary manubrium, like that of *urile*, lies in the plane of the body of the sternum, while in *carbo* and *dilophus* the manubrium lies in the plane of the keel.

If a line be drawn between the costal processes it will be found that the coracoid articulations project less beyond this line and form a more obtuse angle with one another than they do in *carbo*, and the same is true of *urile* as compared with *dilophus*. The sternum is non-pneumatic, as in *urile*, but in *carbo* and *dilophus* good-sized foramina pierce its dorsal face just back of the ridge formed by the coracoidal groove.

It is certainly interesting to find the sterna of these two representatives of the sub-genera *Phalacrocorax* and *Urile*, respectively, agreeing with one another in these slight structural points.

Articulations are present for five pairs of ribs, the same number as in *carbo*. One specimen of *urile* has four pairs of articulations, another has five on the left side and four on the right, and *dilophus* has but four pairs of costal facets.

The number of ribs articulating with the sternum is, however, subject to slight variation, especially among water birds, and without an extensive series of specimens it is a little difficult to be sure of the normal number.

The coracoid is of the same length as that of *carbo*, 10<sup>mm</sup> longer than in *urile*; but, while the proximal end is but little heavier than in *carbo*, the shaft and especially the distal end are much more massive.

The epicoracoid is prolonged upward into a sharper hook than in any of the other species at hand, but this process is subject to considerable variation with age or in various individuals.

One humerus is a little longer than that of *carbo*, the other is of exactly the same length; both are much stouter, especially in the proximal half.

The humerus is practically non-pneumatic, the foramina being very minute, while the pneumatic foramina of *carbo*, though not large, are readily seen.

The humerus of *urile* differs from that of *dilophus* precisely as that of *perspicillatus* from *carbo*.

The ulna is distinguishable from that of *carbo* only by its greater weight, and the same may be said of the humerus of *urile* as compared with that of *dilophus*.

The fused metacarpals are slightly shorter and slightly stouter than in *carbo*, and here again the same differences are observable between the metacarpals of *urile* and *dilophus*.

The "sacrum," as a whole, is as long as that of *carbo*, but its component parts are more heavily built.

It comprises six pre-sacrals, two true sacrals, and nine post-sacrals, and the three "sacra" of *perspicillatus* agree with one another in these particulars.

*Phalacrocorax carbo* has six pre-sacrals, two true sacrals, and nine or ten post-sacrals. *P. urile* has six, two, eight, and *dilophus* six, two, nine.

The hypapophyses of the anterior three vertebræ have been broken off, but although the compressed centra are larger than in *carbo*, the hypapophyses seem to have been smaller.

The six pre-sacrals present few salient characters, but the diapophyses of the fourth vertebræ lie at right angles to the vertebral column, while in the three other species the diapophyses of this vertebra are directed forward.

The sacral and immediate post-sacral vertebræ vary in the development of their parapophyses in all four species under consideration.

In all three specimens of *perspicillatus* the two true sacrals bear no parapophyses, while the two succeeding vertebræ have them extended to, and ankylosed with, the ilium.

The diapophyses and parapophyses of these vertebræ are united by a thin plate of bone, but that this is due to age is shown by the condition obtaining in the other species.

These latter also indicate that the canal formed by these processes, the centra of their vertebræ, and the ilium, is larger on the right side than on the left, and that it is first obliterated on the left side.

In *carbo* neither the sacrals nor the second post-sacral bear parapophyses, although these are present on the first post-sacral, uniting it firmly with the ilium.

In one example of *urile*, slender, but well marked, parapophyses connect the two sacrals with the ilia.

In another and much smaller specimen the second sacral has a parapophysis on the left side, there being no parapophyses on the first sacral.

In both specimens of *urile* the first, but not the second, post-sacral bears parapophyses. Finally, *dilophus* has strong parapophyses on the second sacral and first post-sacral, but none on the second post-sacral.

The variation in the sacral region of these specimens is not only interesting in itself, but interesting from the fact that it is unusual for parapophyses to be present at all on the true sacral vertebræ of birds.

Viewed from above the ridge formed by the confluent spinous processes of the "sacrals" is wider than in *carbo*, and the interpopphysial foramina are nearly closed, while in *carbo* they are very open.

Although these characters depend to some extent on age, they do not entirely, and the same differences exist between the "sacra" of *urile* and *dilophus* as between those of *perspicillatus* and *carbo*.

The pelvis is much more rugose than in *carbo*, all attachments for muscles being strongly emphasized.

The anti-trochanter is placed farther back than in *carbo*, and is much more rounded, thus affording more play to the femur.

Just back of the anti-trochanter the outer edge of the ilium is raised and thickened, forming a flat, subtriangular spot about an inch in length.

This peculiar flattening of the ilia, taken in connection with the size and rugosity of the pelvis, is sufficient to distinguish it from that of other species.

The ilium of *urile* has a flattened spot, but proportionately smaller than in *perspicillatus*.

Back of this flattened portion the dorsal edge of the ilium is bent outward, making this part of the ilium outwardly concave, where in *carbo* it is convex.

The post ilia of *carbo* and *dilophus* round gently outward and downward throughout their entire length from their junction with the diapophyses.

Viewed from the side the dorsal outline of the "sacrum" is slightly decurved, while that of *carbo* is very nearly straight, and the same difference exists between *urile* and *dilophus*.

The acetabulum is slightly larger and forms more nearly a perfect circle than in *carbo*.

The ilio ischiatic foramen is subelliptical and wide, the longitudinal

diameter being nearly twice the vertical, while in *carbo* this foramen is more pointed posteriorly, and narrower, the length being more than three times the height.

In consequence of the size of this foramen the distance from the dorsal edge of the ilium to the ventral edge of the ischium is much greater than in *carbo*.

The bar of the ischium bounding the obturator space is sharp-edged, rugose, and concave exteriorly on the posterior portion, while the corresponding portion of the ischium in *carbo* is comparatively smooth and slightly convex posteriorly.

The posterior border of the ischium is straighter than in *carbo* and the ilio-pubic articulation one-third shorter.

The femur is 5<sup>mm</sup> longer than that of *carbo*, in every way much more massive, and with all the muscular ridges more pronounced, while curiously enough it is more pneumatic, having several foramina in the ventral aspect of the neck that are lacking in *carbo*.

There is nothing to distinguish the femur of *urile* from one of *dilophus* of the same length, and of the two that of *dilophus* is slightly the heavier.

But in the specimen of *urile* in which the humerus corresponds in length to that of *dilophus*, the femur and tibia are both longer and heavier than in *dilophus*, and the tarsus a little lighter.

The phalanges, again, are more massive in *urile* than in *dilophus*.

The smallest of the three tibiæ is slightly longer than that of *carbo*, the cnemial crest is more expanded, and the cnemial ridges farther apart and more pronounced.

The distal extremity of the tibia is also wider than in *carbo*, but at its smallest diameter the shaft is no larger.

The muscular ridges and grooves are more marked than in *carbo*, but in the absence of more material and making due allowance for individual variation, it is difficult to point out characters which definitely distinguish the tibiæ of the two birds.

The tarsus is of the same length as in *carbo*, but much wider, and, as throughout, with all the ridges more pronounced.

Little can be said concerning the three cervical vertebræ, except that unlike the other bones they are less strongly built than the corresponding bones in *carbo*.

From the foregoing notes it will be seen that the differences existing between corresponding bones of *perspicillatus* and *carbo* also exist between the same bones of *urile* and *dilophus*, and that conversely *perspicillatus* and *urile* agree with one another as do *carbo* and *dilophus*.

The sub genera *Phalacrocorax* and *Urile*, therefore, seem to rest on good structural foundations, each being characterized by internal as well as external characters.

Unfortunately no skull of *perspicillatus* is to be had, but the crania of *carbo* and *dilophus* agree with one another, while differing strikingly from the cranium of *urile*.



From the harmony of the other parts it is not assuming too much to suppose that the skull of *perspicillatus* would resemble that of *urile*.

With the exception of the sternum the greater size of the bones distinguishes those of *perspicillatus* from those of *urile*, while well-marked differences of shape or proportion exist between the corresponding bones of *perspicillatus* and *carbo*.

*P. perspicillatus* appears to have been a much heavier bird than *carbo*, and a bird of weaker flight; with more robust and muscular legs, and a more slender and more feeble head and neck.

In comparing the following tables of measurements it must be said that they do not adequately convey the impression produced by a comparison of the bones themselves. Thus, in the measurements of the lower mandible the greatest vertical width is comparatively as great as in *carbo*, but from this point the ramus tapers rapidly either way so that as a whole the mandible is much weaker than that of *carbo*.

So too with the humerus, where the greatest proximal width is only 2<sup>mm</sup> greater than in *carbo*, although the bone in its entirety is much more stoutly built.

*Measurements (in millimeters) of corresponding bones of Phalacrocorax perspicillatus, carbo, urile, and dilophus.*

[All measurements are in a direct line and not along curves.]

	<i>P. perspicillatus</i> (National Museum, 17041).	<i>P. carbo</i> (Yale College Museum, 535).	<i>P. urile</i> (National Museum, 12502).	<i>P. dilophus</i> (National Museum, 18050).
<b>Rostrum:</b>				
Tip of mandible to extremity of maxillo-jugal bar.	134	140	108	105
Maxillo-jugal bar	68	69	56	56
Tip of mandible to posterior end of palatine	109	117	91	86
Width across nasals, at fronto-nasal hinge	21	20	13	14
<b>Lower mandible:</b>				
Length of ramus	139	144	112	110
Greatest height of ramus	13	13	9	12
<b>Sternum:</b>				
Anterior end of carina to meso-xiphoid	104	119	97	91
Manubrium to meso-xiphoid	83	97	84	76
Depth of carina	28	33	31	26
Width across articulations of first rib	64	66	64	54
Width across articulations of fourth rib	63	59	60	51
<b>Coracoid:</b>				
Length	84	87	71	70
Breadth of sternal articulation	25	25	24	20
Greatest distal breadth	18	17	16	13
<b>Humerus:</b>				
Length	170	170	140	140
Greatest proximal breadth	30	28	25	23
Greatest diameter midway between extremities	11	9	10	8
Greatest distal breadth	21	20	18	17
<b>Ulna:</b>				
Length	190	178		
Greatest proximal breadth	21	18		
Greatest diameter of shaft midway between extremities	8	7		
<b>Pelvis:</b>				
Greatest length of ilium	151	152	122	120
From anterior border of ilium to external angle of anti-trochanter	72	65	58	49
Greatest width of ilia in advance of acetabula	48	44	42	38
Least width of ilia in advance of acetabula	23	23+	19	18
Width between outer extremities of anti-trochanters	43	46	37	33
Length of ilio-ischiatic space	42	41	32	38

Measurements (in millimeters) of corresponding bones of *Phalacrocorax perspicillatus*, *carbo*, *urile*, and *dilophus*.

[All measurements are in direct line and not along curves.]

	<i>P. perspicillatus</i> (National Museum, 17041).	<i>P. carbo</i> (Yale College Museum, 535).	<i>P. urile</i> (National Museum, 12502).	<i>P. dilophus</i> (National Museum, 18050).
Pelvis—Continued:				
Greatest width of ilio-ischiatic space.....	18	13	13	10
From dorsal edge of ilium, above the ilio-ischiatic foramen, to ventral edge of ischium.....	23	23	23	19
Length of ilio-pubic articulation.....	21	28	15+	23
Between posterior terminations of ischia.....	46	40	42	40
Femur:				
Length.....	74	70	66	55
Greatest proximal width.....	21	19	16	15
Greatest diameter midway between extremities.....	11	10	9	8
Greatest distal width.....	22	18	16	15+
Tibia:				
Length.....	140	127	117	102
Width across cnemial ridges.....	15	13	11	10
Width at distal end of articulation with fibula.....	15	13	11	13.
Least transverse diameter of shaft.....	8	8	7	7
Distal width.....	16	15	12	13
"Tarsus:"				
Length.....	71	72	60	62
Proximal transverse width.....	19	16	14	14
Distal width.....	20	18	15	14