

BONES OF BIRDS COLLECTED BY THEODOOR DE BOOY FROM KITCHEN MIDDEN DEPOSITS IN THE ISLANDS OF ST. THOMAS AND ST. CROIX.

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INTRODUCTION.

The presence of avian remains in the ancient refuse heaps that mark aboriginal camp or village sites is always of interest to ornithologists. Such fragments may represent species still extant, or, more seldom, may reveal forms less fortunate in the struggle for existence, that have been exterminated, leaving these parts of skeletons, disarticulated or broken, as the only indications of their former existence.

Recently the writer has had the privilege of examining a collection of bird bones secured by Mr. Theodoor de Booy for the Museum of the American Indian, Heye Foundation, from kitchen middens on St. Thomas and St. Croix in the Virgin Islands. The remains from St. Thomas consist of fifty-one bones or parts of bones taken from a midden at Magen's Bay on the north coast of the island during December, 1916. These fragments were found below a diluvial surface deposit that was from 1 to 2 feet thick. The material examined from the island of St. Croix, 22 fragments in all, was taken during January, 1917, from a midden on the north coast of the island on the western bank of Salt River near its mouth. For a more complete account of the sites where this material was collected, and the conditions under which it was secured, the reader is referred to the preceding paper in this volume by Mr. Gerrit S. Miller, jr.¹

Mr. De Booy believes that there is certain evidence that the natives of the Virgin Islands had communication with Porto Rico and Santo Domingo, so that it is possible that bones found in these middens may in part have originated elsewhere. In spite of this element of uncertainty concerning the origin of these specimens, notes on this material are of value, as it may be considered doubtful that individuals of the native species represented have been transported for any great distance. Thirteen species of birds, including one described here as

¹ Proc. U. S. Nat. Mus., vol. 54, 1918, p. 507.

new, have been identified in the remains from both islands. A series of these specimens, including the type of the new rail described below, has been presented to the United States National Museum by Mr. George G. Heye, at whose direction the work of excavating these middens was carried out.

A detailed description of the collection follows.

LIST OF SPECIMENS FROM ST. THOMAS.

PUFFINUS LHERMINIERI Lesson.

A right ulna and a left humerus, both more or less chipped and broken about the ends, are referred to this species. These bones are somewhat heavier than those in the single modern skeleton available for comparison, but are within the limit of individual variation. In this genus, individuals of the same species often show great differences in the diameter and length of the wing bones—a fact that is well shown in a good series of skeletons of *Puffinus kuhlii borealis* in the collections of the United States National Museum. There are no other published records of the occurrence of *P. lherminieri* on the island of St. Thomas.

AESTRELATA, species.

A left tibio-tarsus from St. Thomas belongs to a petrel of this genus. In *AEstrelata* the cnemial process of the tibio-tarsus is short and rounded while in *Puffinus* it is long and broad.¹ The condyles of the specimen in hand agree in size with those in skins of *AE. hasitata*. It seems probable that it may represent either *AE. hastitata* (Lafresnaye) or *AE. diabolica* (Lafresnaye).² Skeletons of these forms are not at present available so that definite comparisons can not be made. No species of petrel has been recorded previously from the island.

SULA LEUCOGASTRA (Boddaert).

The following bones of this booby are present in the collection: A right humerus nearly entire, the shaft of a left humerus, a nearly complete right coracoid, a left femur that lacks the inner condyle, and a left tibio-tarsus with the proximal end missing. These bones in *Sula leucogastra* may be readily distinguished from those in *Sula piscator* upon careful comparison, and in some instances the differences between the two species are striking. This is true especially in the case of the head of the femur. In *S. leucogastra* the femoral head is globular with an irregularly grooved area marking the attachment of the *ligamentum teres*. In *S. piscator* the head of the femur is distinctly flattened with a large rounded pit or depression formed to receive the distal end of the ligament. The tibio-tarsus

¹ See Shufeldt, R. W., *Ibis*, 1916, p. 634.

² See Noble, G. K., *Bull. Mus. Comp. Zool.*, vol. 60, 1916, pp. 370-374.

is larger and the coracoid more slender in *leucogastra* than in *pis-cator*.

Though modern accounts do not include St. Thomas in the range of the common Booby, the species is known from other islands near by. Boodies are reported from some islets between Culebrita and Cayo Norte, about 12 miles west of St. Thomas,¹ and may occur elsewhere in the vicinity.

FREGATA MAGNIFICENS Mathews.

The distal end of a right humerus and a left coracoid nearly complete are from the skeleton of the Man-o'-War Bird. There is marked difference in size in skeletons of males and females of this species, the female having the bones longer and heavier throughout than the male. The fragments from St. Thomas seem to have come from a male as they are small and slender.

The Man-o'-War Bird is common around the islands of the Virgin group at the present day. Published lists of the birds of St. Thomas do not include it, but the writer has observed the species in the passage east of Culebra and Culebrita.

NYCTANASSA VIOLACEA (Linnaeus).

The Yellow-crowned Night Heron is represented by two right and two left humeri, more or less complete, the distal portion of a left tarso-metatarsus and parts of two right tibio-tarsi. These fragments agree in all their characters with modern skeletons of *Nyctanassa violacea*, but are above the average in size. This heron differs from other herons examined from the West Indies and from North America north of Mexico in having the fibula ankylosed at its lower end to the shaft of the tibia. In *Botaurus lentiginosus*, *Ixobrychus exilis*, *Ardea herodias*, *Herodias egretta*, *Egretta t. thula*, *Dichromanassa rufescens*, *Hydranassa tricolor ruficollis*, *Butorides v. virescens*, and *Nycticorax n. naevius*, the distal end of the fibula remains free.² That *Nycticorax* should differ from *Nyctanassa* and resemble other herons in this respect seems strange.

It is interesting to note that the present-day natives of the Virgin Islands consider the flesh of the Yaboa (as they call the Yellow-crowned Night Heron) a delicacy, and this species is in favor as a game bird. The fragments recorded here seem to show a similar preference on the part of the aboriginal inhabitants.

GALLUS GALLUS (Linnaeus).

Among the fragments from the island of St. Thomas occur the following remains of the domestic fowl: Nine cervical vertebrae, including those from the sixth to the fifteenth inclusive, save the ninth;

¹ Wetmore, A., Birds of Porto Rico, U. S. Dept. Agr. Bull. 326, 1916, p. 19.

² Skeletons of *Ardea occidentalis* are not available for examination.

two humeri from right and left sides, respectively, broken but nearly complete; a right and a left ulna; one right metacarpus; the anterior part of a sternum including the spina sterni and the lower portion of the grooved anterior end of the keel; a broken sacrum; the distal end of a right femur; the proximal end of a right tibia and the proximal part of a left metatarsus. Apparently these bones all belonged to one individual. All seem rather small so that they may have come from a female bird. They agree in all details of structure with more modern skeletons of the domestic fowl.

Concerning these specimens Mr. de Booy wrote to Mr. Miller under date of December 25, 1916: "I am sending you herewith the fourth and last shipment from St. Thomas. Amongst other things it contains two skulls of large animals [fish] and also a set of vertebrae and some ribs, etc., of the *Isolobodon* (?). I found the latter inside a large cooking vessel in the Magen's Bay kitchen middens." In a letter to me, dated July 6, 1917, he adds: "* * * the vessel was quite deep down, and numerous other specimens were on top of it." Unfortunately the bones found in the bowl were not specially designated in the package in which they were sent to Washington. But the vertebrae of *Gallus*, listed above, were the only vertebrae in the entire collection from the island of St. Thomas, save for isolated segments of the backbones of fishes. Hence it would seem beyond doubt that part if not all, of the fowl remains must have been contained in this cooking vessel.

NESOTROCHIS, new genus.

Plate 82, figs. 1-5.

Type.—*Nesotrochis debooyi*, new species (Family Rallidae).

Characters.—Femur and tibia (no other parts of skeleton seen) much stronger and heavier in proportion to length than in other North and South American Rallidae examined; Femur equal in length to that of *Aramides cayanae* but much broader and heavier, with highest point of ridge of trochanter maxima opposite a line passing through the articular head; shaft more strongly curved; tibio-tarsus slightly longer than that of *Aramides cayanae* and much heavier especially toward distal end; proximal head larger and stronger, with inner facet more deeply excavated and the ridge external to this concavity with a rounded tubercle on its outer margin; a slight ridge on the posterior articular surface of the condyles; all crests and tubercles more strongly developed.

NESOTROCHIS DEBOOYI, new species.¹

Description.—*Type*. Cat. No. 225845 U.S.N.M., right femur, from a kitchen midden at Magen's Bay, St. Thomas, Virgin Islands, collected December, 1916, by Theodoor de Booy.

¹ This species is named in honor of the collector, Mr. Theodoor de Booy.

Femur with head large, anterior margin produced strongly as a ridge. Depression for attachment of *ligamentum teres* deep and elongate, with two slightly indicated excavations at bottom. Neck, when viewed from above, as broad as head with a very slightly indicated constriction separating it from head. Trochanter maxima raised in a broad, strongly marked ridge, with the upper margin evenly rounded when viewed from the outer side. The highest median point in the ridge is opposite the center of the head and not anterior to this point as in other rails examined. Outer surface of upper end of bone broadly expanded, this expansion being equal on the two sides. A wide shallow depression on the anterior face below the trochanteric ridge. The shaft is more strongly curved than in other rails examined. Its anterior and inner surfaces are lightly rugose save for a narrow space at either end of the bone. These rugosities are very lightly impressed and are in a general way transverse. The medullary opening is equidistant from either end of the bone. The condyles are imperfect, being worn or eaten away distally. The rotular channel is deeply impressed. There is a shallow popliteal depression bounded distally by a high ridge passing from inner to outer condyle. At the lower end of the popliteal depression is a slightly raised ridge making a shallow distal pit. There are no pneumatic foramina. A strongly marked *linea aspera* arises on the inner side half way between the proximal end of the bone and the medullary opening. This line swings in a gradual curve to the posterior surface and then passes down to the angular base of the inner condyle. The tuberosities marking the attachments for the ilio-femoral and ischio-femoral muscles are strong and well defined. The shaft is plano-convex, being flattened on the outer portion of the posterior side. It is somewhat compressed on the antero-internal face. At the medullary opening the shaft is bent strongly backward.

Tibio-tarsus with proximal head large and strong. Inner facet deeply excavated (deeper than in *Aramides cayanae*, nearly as deep as in *Gallirallus australis*). The ridge external to this concavity has a strongly rounded tubercle on its outer anterior margin. This the writer has not seen in other rails. Anterior crest rather deeply impressed for the attachment of the strong tendon of the *muscle femoro-tibialis*. That part of the groove excavated immediately above the inner anterior crest is at right angles to the longitudinal axis of the bone and has its inner margin raised and complete. The outer anterior crest (perfect in one fragment) is broad and strong with a nearly straight margin below and a well curved outline above. The inner anterior crest is broken away, but the margins indicate that it was broad and as heavy as in other rails. The peroneal ridge is long and strong. It is higher distally, where it terminates in a blunt, slightly projecting spine. The nutrient foramen enters the

shaft immediately below and behind the peroneal ridge, 3 millimeters distant from its base. The fibula is lost, but was ankylosed by a slender attachment at its distal end to the shaft of the tibia. The lower portion of the tibio-tarsal shaft is broad and flattened on its anterior surface with the usual osseous bridge under which ran the tendon of the muscle *extensor digitorum communis*. The distal condyles are large and heavy, with a broad sulcus between them anteriorly. On the articular surface is a slight median ridge.

Measurements.—Femur, Cat. No. 225845, U.S.N.M. (type): Length, 76.5 mm.; transverse diameter through center of head, 17 mm.; transverse diameter through medullary foramen, 7.5 mm.; intercondylar diameter,¹ 16.6 mm.

Tibio-tarsus, Cat. No. 225845, U.S.N.M.: Length, 110 mm.; breadth through lower end of peroneal ridge, 9 mm.; greatest breadth through condyles, 12.5 mm.; length of articular face of peroneal ridge, 17 mm.

Remarks.—This bird is represented by portions of eight bones, all from the posterior limb—namely: Two nearly complete right femora, the proximal portion of a left femur from a smaller individual, a nearly complete right tibio-tarsus, the distal end of two others and portions of two left tibio-tarsi, one of which lacks the anterior end, while in the other the condyles are missing.

The relationships of this remarkable rail must remain for the present somewhat obscure. It might be supposed that it would resemble *Aramides* closely, but this is not the case. The bones at hand are equal in length to the same bones in *Aramides cayanaea* but are much more robust. There is no skeleton of the large *A. ypecaha* available, but there are several skins in the collections of the United States National Museum in which the knee joint has been disarticulated so that the tibio-tarsus is complete. In these the tibio-tarsus is from 20 to 25 mm. longer than in *Nesotrochis debooyi*, while the intercondylar breadth at the distal end is slightly less, though this region is covered by skin. From this it is seen that the proportions of the two birds are entirely different.

In other rails available that part of the femoro-tibial depression above the inner anterior crest of the tibio-tarsus slopes inward and downward, and has no defined inner margin; there is also a terminal decurved hook on the outer anterior crest that is not present in *Nesotrochis*, though this may have been slightly developed as specimens available show some wear here. The distal ridge found on the posterior articular surface of the tibio-tarsal condyles in *Nesotrochis* is absent in other rails. The slight lateral rugae on the femoral shaft are well developed in *Aramides* and are lightly indicated in a specimen of *Tribonyx mortieri*.

¹ Not exact, as lower ends of condyles are missing

The limb bones that represent this new form bear a striking resemblance to those of *Gallirallus* in their strong, robust development. In length, bones from the hind-limb in the two genera are practically the same. *Nesotrochis* has the femur heavier and more strongly curved while the tibio-tarsus is very similar save that the condyles are broader and stronger than in *Gallirallus*. The discovery of other parts of the skeleton of *Nesotrochis* will be awaited with interest as it may be supposed that they will show marked differences from the type found in other New World rails. It is possible that this species possessed feeble powers of flight or even that it was flightless, facts that might account for its extermination when its haunts were invaded by man.

ANOÛS STOLIDUS (Linnaeus) (?).

A partly complete left humerus agrees with the large wing bone of the Noddy fairly well, but the identification is not certain. The skeletal material available at present in the Sterninae is small and several important species are lacking, so certain identification in the case of this one bone is made difficult. The Noddy is not known at present from St. Thomas, but occurs on other islands not far distant.

STERNA, species.

The shaft of a right humerus belongs in this genus. It is possible that the species represented in *Sterna anaetheta* (Scopoli), but skeletons of this species are not available for comparison.

LIST OF SPECIMENS FROM ST. CROIX.

PUFFINUS, species.

The proximal end of a right humerus in the material from St. Croix belongs to a shearwater, but with the material available it can not at present be identified. The bone in question represents a species larger than *P. lherminieri* and smaller than *P. gravis* so that by a process of elimination it may be supposed that it is *P. puffinus*, as that species is intermediate in size between the other two. Some weight is given this supposition when it is remembered that a shearwater of this group has recently been described from Bermuda as *Puffinus p. bermudae* by Nichols and Mowbray.¹ No skeletons of this species are at hand for comparison so that the matter of the determination of this fragmentary humerus is left in abeyance. The bone in question is of the type that has the shaft well rounded below the head. No species of shearwater has been recorded previously from the island of St. Croix.

SULA PISCATOR (Linnaeus).

This species is represented by the shaft of a right humerus from which both condyles and head are gone. The humeral shafts in *S.*

¹ Auk, 1916, p. 195.

piscator and *S. leucogastra* are practically identical in curvature and size, but in *S. piscator* the ridge marking the insertion of the muscle *latissimus dorsi* is placed farther from the upper margin of the humerus than in *S. leucogastra*. When the humerus is viewed directly from above (with the bone oriented in its natural position in life), this ridge, in *piscator*, is located near the inner marginal line, while in *leucogastra* it is median or slightly external to the center of the space. The fragment of bone from St. Croix agrees with *S. piscator* in the position of this ridge, and is identified as that species. *Sula cyanops* has the humerus much larger than in either of the two described above. *Sula piscator* has not been known previously from the island of St. Croix.

NYCTANASSA VIOLACEA (Linnaeus).

The anterior half of a right coracoid comes from the skeleton of this heron.

GALLINULA CHLOROPUS (Linnaeus).

The distal end of a tibio-tarsus belongs to this species without question, while a femur nearly complete is assigned here with some hesitation. Careful comparison of femora of *Fulica americana* and *Gallinula chloropus* has shown that the two are very similar, save that this bone in *Gallinula* is more slender, and in the specimens examined the trochanteric ridge is continued ventrally to the posterior margin of the articular surface as a sharp projection. In *Fulica* the femur is more robust, and the trochanteric ridge lowers as it passes back until it merges smoothly into the bone at a point median to the posterior margin. The fulicine femur in the collection from St. Croix is somewhat more slender than that in available specimens of *G. chloropus* from the United States and from the Seychelle Islands, but has the trochanteric ridge slightly intermediate in its structure between *Fulica americana* and *Gallinula*. Skeletons of *Fulica caribaea* Ridgway are not available at present, so that the characters of the femur in this species are not known. Because of its slenderness the femur from St. Croix is provisionally referred to *G. chloropus*. This species is said to be common on the island at the present time.

NESOTROCHIS DEBOOYI Wetmore.

Nine of the 22 bones examined from the island of St. Croix belong to this remarkable rail. All are fragments of the tibio-tarsus more or less complete according to the specimen. Two of these are nearly entire, three fragments come from the head of the bone, three have the shaft and condyles nearly complete, while the remaining bone is a badly crumbled bit from the condylar region. These fragments are identical in form with those examined from St. Thomas, but on the whole average stronger and heavier. Three of the bones from

St. Croix are much larger and heavier than the others and illustrate what may have been sexual differences as an equivalent difference is found between males and females of *Gallirallus australis* (the males in *Gallirallus* being larger). The average difference in size between the series of tibio-tarsi from St. Thomas and St. Croix is so apparent that the birds from the two islands seem distinct when it is supposed that the variation among individual bones from the same locality is due to sex. This point, however, is uncertain, while it is a fact that the largest bones from St. Thomas are equal to the smallest ones from St. Croix. For this reason it is thought inadvisable at the present time to separate the bird from St. Croix as a distinct form. There is at best considerable uncertainty as to the exact place of origin of bone remains from kitchen midden deposits, but it may be supposed that where so many bones representing one species are found, that these came from the island on which the midden was located. There is no proof, however, that they belong to a truly indigenous species, nor is it known that they were not brought as needed from somewhere else. The comparative abundance of the remains of this rail in these deposits when compared with other species of birds indicate that it possessed flesh that was held in high esteem as a source of food. This being the case, there is no evidence to show that these rails may not have been kept as captives and transported from island to island by their owners. We may suppose, however, that this was not true to any great extent for rails in general feed largely upon animal food and are not readily kept in captivity for any length of time.

CORVUS LEUCOGNAPHALUS Daudin.

The discovery of bones of *Corvus* in these kitchen midden deposits is of great interest, as no species of this genus has been recorded farther east in the West Indies than Porto Rico. The crow is represented in the present collection by a femur, one nearly entire humerus, and the proximal end of a second one. These bones are identical in configuration with the form found in Porto Rico save that the entire humerus has the shaft more slender. Humeri of male birds only are available for comparison so that this difference may be considered sexual as males and females of *Corvus brachyrhynchos* Brehm from the United States differ in the same way.

The presence of these bones in kitchen midden deposits is of course not certain proof of the former presence of a crow native to St. Croix, but may be taken as representing a possibility. Crows may have been kept captive in cages and transported from island to island or may have been killed and eaten on Porto Rico and their bones brought in some way to St. Croix. That there might have been an indigenous bird of this genus in St. Croix is made somewhat prob-

able by the fact that the island when first discovered was covered by dense forests such as crows inhabit in Porto Rico at the present time. The French who founded a colony on St. Croix some time after 1650 (the island was first settled about 1625) found their settlement very unhealthy. After severe losses from fevers and other diseases fostered, as they thought, by the dense, damp tree growth they finally set fire to the forest and burned off the densely wooded covering of the entire island. To this great conflagration may be ascribed the present-day paucity of species that make up the existing island fauna as there can be no question but that many indigenous forms were destroyed either by the fire or by the sudden change in ecological conditions that followed it. Elsewhere in the West Indies species of the genus *Corvus* have retreated before the clearing of forested areas. This is especially true in Porto Rico where Gundlach found *Corvus leucognathus* common in 1875, while at the present time the few known survivors of this bird are restricted to the Luquillo Forest above Mameyes, the only wooded area of any extent remaining on the island. Complete destruction of the forests of St. Croix might therefore have led to the extermination of the crow had it been resident there in pre-Columbian times.

EXPLANATION OF PLATE 82.

(All figures about natural size.)

FIGS. 1-2. Right femur of *Nesotrochis debooyi* type, Cat. No. 225845, U.S.N.M.

3-5. Right tibio-tarsus of *Nesotrochis debooyi*, Cat. No. 225845, U.S.N.M.



Wetmore, Alexander. 1918. "Bones of birds collected by Theodoor de Booy from kitchen midden deposits in the islands of St. Thomas and St. Croix." *Proceedings of the United States National Museum* 54(2245), 513–522.
<https://doi.org/10.5479/si.00963801.54-2245.513>.

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