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OSTEOLOGY OF LIVING AND FOSSIL NEW WORLD QUAILS (AVES, GALLIFORMES)

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OSTEOLOGY OF LIVING AND FOSSIL NEW WORLD QUAILS (AVES, GALLIFORMES)

J. ALAN HOLMAN [1]

SYNOPSIS: The family Odontophoridae is divided into two distinct groups on the basis of pelvic structure. The Dendrortyx group contains *Miortyx* of the Miocene, *Neortyx peninsularis* new genus and species from the Pleistocene, and the living genera *Dendrortyx, Philortyx, Oreortyx, Callipepla, Colinus,* and *Lophortyx. Dendrortyx* is at once the most primitive and aberrant living genus of American quails and is most closely related to *Philortyx. Oreortyx* is a near relative of the *Callipepla-Colinus-Lophortyx* complex of genera. The members of this complex are so similar that they might best be considered as subgenera.

The Odontophorus group contains the living genera *Odontophorus, Dactylortyx, Cyrtonyx,* and *Rhynchortyx. Odontophorus* appears to be the most primitive genus in this group. *Dactylortyx* and *Cyrtonyx* are similar. *Rhynchortyx* is the most aberrant genus of the group.

The Miocene species *Cyrtonyx tedfordi* probably should be transferred from the Odontophoridae to the Cracidae.

The study of more than 700 fossils of the genus *Colinus* shows a progressive trend toward reduction in size and gradual change in qualitative characters. The transition from *C. hibbardi* to *C. suilium* took place during the early Pleistocene, and the change from *C. suilium* to *C. virginianus* occurred in Wicomico time.

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[1] The author is Associate Professor of Vertebrate Zoology at Illinois State Normal University, Normal. He has published several papers on amphibians, reptiles, and mammals, living and fossil. One of these—Birds and Mammals from the Pleistocene of Williston, Florida, 1959—appeared in this journal. The present paper represents in part a doctoral dissertation accepted at the University of Florida in 1961. Manuscript submitted 29 May 1961.—ED.

Holman, J. Alan. 1961. Osteology of living and fossil New World quails (Aves, Galliformes). Bull. Florida State Mus., vol. 6, no. 2, pp. 131-233.

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INTRODUCTION

The New World quails form a group of rather small-sized galliform birds that range throughout the tropical, subtropical, and temperate regions of the Americas. Most workers consider them a subfamily of the Phasianidae, the Odontophorinae. The North American species are well known individually, and a voluminous literature on such subjects as life history, ecological tolerance, food and nutrition, and artificial propagation has grown out of their value as game birds. The Central and South American forms are generally less well known. Crispens (1960) lists literature on the economic and management aspects of the North American species. Ridgway and Friedmann (1946) give an excellent bibliography on the taxonomy of North and Central American forms; Hellmayr and Conover (1942) include the South American forms.

The classification of galliform taxa at the family level and above is based mainly on internal anatomy, whereas that of taxa below the family level is based on external features. Thus, the New World quails are defined on the following characters (Ridgway and Friedmann, 1946): 1) mandibular tomium serrated or toothed; 2) tail less than half as long to slightly longer than wing; 3) tarsus less than one-fourth to more than one-third as long as wing; 4) bill relatively short and stout; 5) rectrices 10 to 14; 6) tarsus without spurs; 7) acrotarsium with a single row of broad, transverse scutellae; and 8) planta tarsi with two or more definite rows of moderately long scutellae, but also covered with small scales. The serrated or toothed mandibular tomium is unique in the order, whereas the other characters occur singly or in various combinations in other families and subfamilies.

Genera of New World quails are defined on such characters as proportionate lengths of bill and limbs, development of head plumes, number of rectrices, relative length of primaries, markings of chest, sides, and flanks, shape of tail, and scutellation of tarsus. Species and subspecies are defined almost entirely on the basis of coloration, markings, and size.

Most recent classifications place the New World quails with the Old World quails and pheasants in the family Phasianidae (Ridgway and Friedmann, 1946, and Wetmore, 1960), or the subfamily Phasianinae (Mayr and Amadon, 1951, and Hudson, Lanzillotti, and Edwards, 1959). Sibley (1960) studied the electrophoretic properties of the egg-white proteins of four genera of North American quails and tentatively suggests that the New World quails appear to form as distinct a group as certain other galliforms given family or subfamily rank in current classifications. A study of the osteology of galliform birds by Holman (MS) indicates that the New World quails represent a natural and highly evolved group that should be recognized as a family, the Odontophoridae, rather than as a subfamily of the Phasianidae.

No comprehensive comparative study has been published of the internal anatomy of New World quails at the generic or infrageneric level. The present work consists of two phases. The skeletons of the living genera, species, and subspecies of New World quails, insofar as available, are described, and criteria for the various taxa are established. The osteological variations of the fossil material are evaluated.

ACKNOWLEDGMENTS

Deepest thanks go to Pierce Brodkorb for valuable advice and constant encouragement throughout his supervision of this problem. Sin-

cere thanks are also due other biologists who critically read the manuscript: Oliver L. Austin, Jr., Eugene Bovee, Harold K. Brooks, James N. Layne, E. Lowe Pierce, and William J. Riemer. I am also grateful to Ted T. Allen, who made the drawings, and Robert W. McFarlane, who did the photographic work. To my wife, Betty Holman, who has typed the material in this paper countless times, I owe special thanks.

MATERIALS AND METHODS

The skeletal collection of Pierce Brodkorb at the University of Florida was supplemented by material borrowed from the United States National Museum (through Herbert Friedmann), University of Michigan Museum of Zoology (through H. B. Tordoff), University of California Museum of Zoology (through Frank A. Pitelka), and Southern Illinois University Wildlife Research Collection (through W. D. Klimstra). Fossil specimens studied in the present work are from the Brodkorb collection at the University of Florida, the University of Oregon Museum of Natural History (through J. Arnold Shotwell), and the Texas Memorial Museum (through John A. Wilson).

The number of specimens studied is listed below. Incomplete skeletons are given in parentheses.

Dendrortyx leucophrys 1
Philortyx fasciatus 1
Oreortyx picta 4
Callipepla squamata 4
Colinus virginianus floridanus 9 (+ 1)
C. v. virginianus x *C. v. floridanus* 23
C. v. insignis 2 (+ 3)
C. v. coyolcos (1)
C. v. virginianus 65
C. nigrogularis (2)
C. leucopogon 4
Lophortyx californica 2 (+ 1)
L. gambelii 2
L. douglasii 2
Odontophorus gujanensis 1 (+ 1)
O. stellatus 1
O. guttatus 1
Dactylortyx thoracicus 3
Cyrtonyx montezumae 3
Rhynchortyx cinctus 1

The fossil specimens include 795 elements, detailed in the body of the work.

All measurements are linear and to the nearest tenth millimeter. Although 60 intramembral and intermembral ratios were taken, only those that proved useful are presented herein.

Anatomical nomenclature follows that of Howard (1929).

OSTEOLOGY OF LIVING NEW WORLD QUAILS

This section presents an osteological account of the living genera and species of the New World quails available for study and remarks on skeletal variation in some subspecies of *Colinus virginianus*. Charac-

ters at the generic level are numbered consecutively to facilitate intergeneric comparisons by the reader. The skeletal elements studied are those bones most frequently found as fossils.

Dendrortyx Gould, 1844

This genus includes four living species, confined to the mountains of Mexico and Central America. Only a single skeleton of *Dendrortyx leucophrys* (Gould, 1844) was available. Its measurements are given in table 1.

Rostrum. (1) Relatively long and shallow. (2) Nasal fossae elliptical.

Sternum. (3) Height of carina through sternal plate 30 percent length of sternum. (4) Dorsal lip of coracoidal sulcus projected well beyond ventral lip. (5) Depressions on anterior portion of sternal plate shallow and slightly pneumatic. (6) Base of posterior lateral process more than one-half width of sternal plate at its middle.

Coracoid. (7) Entire proximal end bending ventrad above level of procoracoid process. (8) Head broadly rounded, much depressed, and much inflected. (9) Brachial tuberosity with moderate dorsal, but slight ventral overhang. (10) Furcular facet weakly inflated. (11) Bicipital attachment well developed; margin between it and head concave. (12) Shaft narrow proximally, with distal portion of its ventral surface convex medially. (13) Procoracoid process with its apex rounded. (14) Dorsal intermuscular line swinging out to lateral border of shaft; distal fifth sharply raised. (15) Ventral intermuscular line terminating in middle of distal border of sterno-coracoidal process. (16) Dorsal face weakly excavated distally, but with distinct round, deep, fossa below tubercle for ligamentum sterno-coracoideum dorsale, and above external end of sternal facet. (17) Tubercle for ligamentum sterno-coracoideum dorsale obsolete, but rounded. (18) Internal distal angle without distinct tubercle or ridge on dorsal face. (19) Sterno-coracoidal process with distal margin strongly oblique, not produced as a sharply raised ridge, but grooved dorsally, its tip directed proximally, but without a terminal knob. (20) Distal border of sternal facet shallowly concave.

Scapula. (21) Glenoid facet elliptical in dorsal view. (22) Dorsal depression just mediad to glenoid facet deeply excavated. (23) Bridge between acromion process and glenoid facet about one-half width of glenoid facet. (24) Acromion process with its apex acute and slightly deflected.

HUMERUS. (25) Pneumatic fossa a short oval, without inner shelf. (26) Median crest strongly developed, elevated throughout. (27) Capital groove deeply excavated, its internal margin strongly elevated. (28) Margin between head and internal tuberosity only slightly concave. (29) Head about as long as broad in anconal view. (30) Ridge along medial border of fossa II slightly swollen, elongate, and with its apex acute. (31) Fossa II obsolete. (32) Latissimus ridge (Ashley, 1941) extending along lateral edge of shaft throughout its length. (33) External tuberosity moderately inflated. (34) Bicipital crest arising gently from shaft, rounded, and with its distal border lacking a groove. (35) Deltoid crest strongly developed, much inflected, and its summit knoblike. (36) Entepicondyle at level of internal condyle. (37) Entepicondylar prominence weakly produced, its pit placed on internal face. (38) Depression of M. brachialis anticus deeply excavated. (39) Distal border of external condyle flat in anconal view.

ULNA. (40) Olecranon process strongly produced, its apex rounded. (41) External cotyla shortened, flattened dorsally, its distal border sloping precipitously into shaft and deeply notched by proximal radial impression. (42) Impression for M. brachialis anticus excavated, its borders distinct. (43) Height at middle of shaft 83 percent of height just distal to external cotyla (44) Distal radial impression well excavated. (45) Notch between carpal tuberosity and internal condyle weak. (46) External condyle weakly produced, arising abruptly from shaft, and its ventral border flattened.

CARPOMETACARPUS. (47) Metacarpal I moderately pointed terminally. (48) Ridge separating anterior carpal fossa from excavated area above pisiform process weak and extending only slightly onto base of metacarpal I. (49) Pisiform process round in internal view, much reflected dorsad, thus produced well above dorsal rim of inner carpal trochlea. (50) Ligamental attachment of pisiform process produced throughout, moderately swollen proximally and distally, with proximal portion separated from pisiform process by shallow sulcus. (51) Internal carpal trochlea with its proximal border shallowly concave, its ventral border slightly notched. (52) Intermetacarpal tubercle extending to and ankylosing with metacarpal III, and distally placed with a small space between its posterior border and junction of metacarpals II and III. (53) Tubercle on internal proximal face of metacarpal III obsolete. (54) One moderately developed and one obsolete tubercle on external proximal face of metacarpal III. (55) Metacarpal III moderately bowed.

PELVIS. (56) Width of pelvis through antitrochanters 51 percent length of innominate from anterior edge of ilium to ischial angle. (57)

Pectineal process obsolete, only moderately produced beyond acetabular border, and its apex rounded. (58) Depression on medial side of pectineal process deeply excavated and perforated by a foramen. (59) Posterior iliac crest without prominence. (60) Ridge originating on posterior iliac crest at level of ilio-ischiac fenestra and continuing ventrad and posteriad toward posterior border of ilium with prominence arising sharply from its posterior portion. (61) Dorsal face of postacetabular ilium moderately broad anteriad, narrowing abruptly posteriad to form acute apex of short, broad, dorsal roof of posterior process. (62) Caudal face of postacetabular ilium enlarged, triangular, and vertical in position, its posterodorsal apex forming posteromedial wall of posterior process. (63) Lateral face of postacetabular ilium with its posterodorsal apex acute and forming shortened lateral wall of posterior process. (64) Renal bar slender; both bar and posterior process excavated by renal depression. (65) Ischium at angle of about 160 degrees to ventral edge of posterior iliac crest. (66) Width through transverse processes of fourth synsacral vertebra 55 percent of length of synsacrum from centrum of first synsacral vertebra through transverse process of fourth synsacral vertebra.

Femur. (67) Distal width 17 percent of length. (68) Head moderately enlarged, bent dorsally, and rotated posteriorly. (69) Neck long. (70) Iliac facet compressed; posterior border straight. (71) Dorsal crest of trochanter depressed and deflected, its dorsal border flat. (72) Trochanteric ridge 20 percent length of femur. (73) Distal depth 85 percent of distal width. (74) Internal condyle moderately wide, its anterior border much produced throughout. (75) External condyle depressed, flattened anteriorly.

Tibiotarsus. (76) Depth of inner cnemial crest 59 percent of its length. (77) Outer cnemial crest decurved. (78) Interarticular tubercle moderately produced. (79) Area between external articular surface and outer cnemial crest moderately concave in dorsal view. (80) Posterior margin between external and internal articular surfaces weakly notched. (81) Area just anterior to ridge from proximal internal ligamental attachment with deeply excavated depression. (82) Internal ligamental prominence on internal condyle strongly produced. (83) Face of internal condyle well excavated, its border highly elevated. (84) Dorsal border of supratendinal bridge oblique.

Tarsometatarsus. (85) Distal width 14 percent of length. (86) Proximal depth 94 percent of proximal width. (87) Intercotylar prominence moderately deflected, its apex pointed. (88) Posterior intercotylar area moderately excavated as a triangular depression. (89) Area surrounding posterior opening of inner proximal foramen deeply

excavated. (90) Hypotarsus with 2 well-developed and 1 obsolete calcaneal ridges, 2 calcaneal grooves, and 1 closed calcaneal canal. (91) Anterior face of shaft extensively excavated by anterior metatarsal groove. (92) Depth of middle trochlea 56 percent of distal width. (93) Trochlea for digit II only slightly inflected. (94) Wing of trochlea for digit IV depressed anteroposteriorly; thus entire trochlea slightly longer than deep.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 52 percent. (96) Ulna/humerus 88 percent. (97) Tarsometatarsus/femur 88 percent. (98) Tarsometatarsus/tibiotarsus 63 percent. (99) Humerus/femur 71 percent. (100) Humerus/tibiotarsus 51 percent. (101) Ulna/femur 63 percent. (102) Ulna/tibiotarsus 45 percent. (103) Ulna/tarsometatarsus 72 percent. (104) Carpometacarpus/femur 37 percent. (105) Carpometacarpus/tibiotarsus 27 percent. (106) Carpometacarpus/tarsometatarsus 42 percent. (107) Tarsometatarsus/humerus 124 percent. (108) Ilium/sternum 89 percent. (109) Height of sternal carina/ilium 34 percent.

Philortyx GOULD, 1846

This monotypic genus is confined to the mountains of Mexico. Measurements of *Philortyx fasciatus* (Gould, 1844) are given in table 1.

ROSTRUM. (1) Relatively long and shallow. (2) Nasal fossae elliptical.

STERNUM. (3) Sternum incomplete. (4) Dorsal lip of coracoidal sulcus projected well beyond ventral lip. (5) Depressions on anterior portion of sternal plate deep and slightly pneumatic. (6) Base of posterior lateral process less than one-half width of sternal plate at its middle.

CORACOID. (7) Entire proximal end straight above procoracoid process. (8) Head pointed, much compressed, and much reflected. (9) Brachial tuberosity obsolete dorsally, but with moderate ventral overhang. (10) Furcular facet weakly inflated. (11) Bicipital attachment well developed; margin between it and head concave. (12) Shaft wide proximally, distal portion of its ventral surface concave medially. (13) Procoracoid process with its apex acute. (14) Dorsal intermuscular line swinging out to medial surface of shaft, distal half sharply raised. (15) Ventral intermuscular line terminating at tip of sterno-coracoidal process. (16) Dorsal face weakly excavated distally, without fossa. (17) Tubercle for ligamentum sterno-coracoideum dorsale well developed and rounded. (18) Internal distal angle with distinct dorsal ridge extending obliquely to above lateral end of sternal facet. (19) Sterno-coracoidal process with distal margin moderately oblique.

not produced as a sharply raised ridge, and without dorsal groove; its tip directed laterally and ending in an obsolete terminal knob. (20) Distal border of sternal facet shallowly concave.

SCAPULA. (21) Glenoid facet oval in dorsal view. (22) Dorsal depression just mediad to glenoid facet shallowly excavated. (23) Bridge between acromion process and glenoid facet about one-third width of glenoid facet. (24) Acromion process with its apex rounded and moderately deflected.

HUMERUS. (25) Pneumatic fossa a moderately long ellipse without inner shelf. (26) Median crest weakly developed, but elevated throughout. (27) Capital groove deeply excavated, its internal margin strongly elevated. (28) Margin between head and internal tuberosity moderately concave. (29) Head about as long as broad in anconal view. (30) Ridge along medial border of fossa II slightly swollen, elongate, its apex acute. (31) Fossa II well developed. (32) Latissimus ridge originating on lateral edge of shaft, but swinging in onto anconal face proximally. (33) External tuberosity moderately inflated. (34) Bicipital crest arising gently from shaft, pointed, its distal border lacking a groove. (35) Deltoid crest moderately developed, slightly inflected, its summit knoblike. (36) Entepicondyle produced slightly beyond level of internal condyle. (37) Entepicondylar prominence moderately produced, its pit placed on internal face. (38) Depression for M. brachialis anticus deeply excavated. (39) Distal border of external condyle rounded in anconal view.

ULNA. (40) Olecranon process strongly produced, its apex pointed. (41) External cotyla moderately elongate, rounded throughout, its distal border sloping gently into shaft and deeply notched by proximal radial impression. (42) Impression for M. brachialis anticus represented by an unexcavated scar, its borders indistinct. (43) Height at middle of shaft 85 percent of height just distal to external cotyla. (44) Distal radial impression obsolete. (45) Notch between carpal tuberosity and internal condyle well developed. (46) External condyle well produced, arising abruptly from shaft, its ventral border flattened.

CARPOMETACARPUS. (47) Metacarpal I moderately pointed terminally. (48) Ridge separating anterior carpal fossa from excavated area above pisiform process produced and extending well onto base of metacarpal I. (49) Pisiform process round in internal view, moderately reflected dorsad, thus produced slightly above dorsal rim of inner carpal trochlea. (50) Ligamental attachment of pisiform process produced and moderately swollen proximally, flattened distally, with proximal portion connected to pisiform process by bony bridge. (51) Internal carpal trochlea with its proximal border shallowly concave, its

ventral border without notch. (52) Intermetacarpal tubercle extending slightly beyond, but not ankylosing with metacarpal III, distally located with a small space between its posterior border and junction of metacarpals II and III. (53) Tubercle on internal proximal face of metacarpal III elongate and weakly produced. (54) Only one moderately developed tubercle on external proximal face of metacarpal III. (55) Metacarpal III slightly bowed.

PELVIS. (56) Width of pelvis through antitrochanters 47 percent length of innominate from anterior edge of ilium to ischial angle. (57) Pectineal process obsolete, only moderately produced beyond acetabular border, its apex pointed. (58) Depression on medial side of pectineal process deeply excavated, but without foramen. (59) Posterior iliac crest without prominence. (60) Ridge originating on posterior iliac crest at level of ilio-ischiac fenestra, continuing ventrad and posteriad towards posterior border of ilium with prominence sharply arising from its posterior portion. (61) Dorsal face of postacetabular ilium moderately broad anteriad, narrowing abruptly posteriad to form acute apex of short, broad, dorsal roof of posterior process. (62) Caudal face of postacetabular ilium enlarged, triangular, and vertical in position, its posterodorsal apex forming posteromedial wall of posterior process. (63) Lateral face of postacetabular ilium with its posterodorsal apex acute and forming shortened lateral wall of posterior process. (64) Renal bar moderately slender; both bar and posterior process excavated by renal depression. (65) Ischium at angle of about 160 degrees to ventral edge of posterior iliac crest. (66) Width through transverse process of fourth synsacral vertebra 60 percent of length of synsacrum from centrum of first synsacral vertebra through transverse process of fourth synsacral vertebra.

FEMUR. (67) Distal width 14 percent of length. (68) Head moderately enlarged, neither bent dorsally nor rotated posteriorly. (69) Neck only moderately long. (70) Iliac facet without compression, posterior border convex. (71) Dorsal crest of trochanter compressed and reflected, its dorsal border rounded. (72) Trochanteric ridge 27 percent length of femur. (73) Distal depth 97 percent of distal width. (74) Internal condyle wide, its anterior border moderately produced throughout. (75) External condyle compressed and rounded anteriorly.

TIBIOTARSUS. (76) Depth of inner cnemial crest about 45 percent of its length. (77) Outer cnemial crest decurved. (78) Interarticular tubercle weakly produced. (79) Area between external articular surface and outer cnemial crest moderately concave in dorsal view. (80) Posterior margin between external and internal articular surface with

a distinct notch. (81) Area just anterior to ridge from proximal internal ligamental attachment without deeply excavated depression. (82) Internal ligamental prominence on internal condyle moderately produced. (83) Face of internal condyle moderately excavated, its border moderately elevated. (84) Dorsal border of supratendinal bridge straight.

TARSOMETATARSUS. (85) Distal width 17 percent of length. (86) Proximal depth 86 percent of proximal width. (87) Intercotylar prominence much deflected, its apex pointed. (88) Posterior intercotylar area weakly excavated as a triangular depression. (89) Area surrounding posterior opening of inner proximal foramen deeply excavated. (90) Hypotarsus with 2 well-developed and 1 obsolete calcaneal ridges, 2 calcaneal grooves, and 2 closed calcaneal canals. (91) Anterior face of shaft extensively excavated by anterior metatarsal groove. (92) Depth of middle trochlea 59 percent of distal width. (93) Trochlea for digit II only slightly inflected. (94) Wing of trochlea for digit IV depressed dorsoventrally, thus entire trochlea much deeper than long.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 65 percent. (96) Ulna/humerus 87 percent. (97) Tarsometatarsus/femur 76 percent. (98) Tarsometatarsus/tibiotarsus 59 percent. (99) Humerus/femur 82 percent. (100) Humerus/tibiotarsus 64 percent. (101) Ulna/femur 72 percent. (102) Ulna/tibiotarsus 55 percent. (103) Ulna/tarsometatarsus 94 percent. (104) Carpometacarpus/femur 44 percent. (105) Carpometacarpus/tibiotarsus 34 percent. (106) Carpometacarpus/tarsometatarsus 58 percent. (107) Tarsometatarsus/humerus 93 percent. (108) Ilium/sternum 41 percent. (109) Height of sternal carina/ilium 41 percent.

Oreortyx BAIRD, 1858

The monotypic genus *Oreortyx* occurs from Washington to northern Baja California. Measurements of *O. picta* (Douglas, 1829) are given in table 1.

ROSTRUM. (1) Relatively long and shallow. (2) Nasal fossae elliptical.

STERNUM. (3) Height of carina through sternal plate 29 to 31 percent length of sternum. (4) Dorsal lip of coracoidal sulcus projected well beyond ventral lip. (5) Depressions on anterior portion of sternal plate deep and moderately pneumatic. (6) Base of posterior lateral process less than one-half width of sternal plate at its middle.

CORACOID. (7) Entire proximal end straight above procoracoid process. (8) Head broadly rounded, moderately depressed, and moderately reflected. (9) Brachial tuberosity with slight dorsal and ventral

overhang. (10) Furcular facet moderately inflated. (11) Bicipital attachment well developed, margin between it and head concave. (12) Shaft wide proximally, distal portion of its ventral surface concave medially. (13) Procoracoid process with its apex rounded. (14) Dorsal intermuscular line swinging out to medial surface of shaft, distal half sharply raised. (15) Ventral intermuscular line terminating at tip of sterno-coracoidal process. (16) Dorsal face weakly excavated distally, without fossa. (17) Tubercle for ligamentum sterno-coracoideum dorsale well developed, but irregular in outline. (18) Internal distal angle with distinct irregular tubercle extending obliquely to above lateral end of sternal facet. (19) Sterno-coracoidal process with distal margin slightly oblique, not produced as a sharply raised ridge, and without dorsal groove; its tip directed laterally and ending in a terminal knob. (20) Distal border of sternal facet deeply concave.

SCAPULA. (21) Glenoid facet oval in dorsal view. (22) Dorsal depression just mediad to glenoid facet shallowly to moderately excavated. (23) Bridge between acromion process and glenoid facet about one-half width of glenoid facet. (24) Acromion process with its apex acute and slightly deflected.

HUMERUS. (25) Pneumatic fossa a moderately long oval or ovaloid, without inner shelf. (26) Median crest strongly developed, elevated only at its middle. (27) Capital groove moderately excavated, its internal margin moderately elevated. (28) Margin between head and internal tuberosity moderately concave. (29) Head broader than long in anconal view. (30) Ridge along medial border of fossa II much swollen, elongate, its apex acute. (31) Fossa II well developed. (32) Latissimus ridge originating on lateral edge of shaft, but swinging in onto anconal face proximally. (33) External tuberosity much inflated. (34) Bicipital crest arising gently from shaft, pointed, its distal border lacking a groove. (35) Deltoid crest moderately developed, slightly inflected, its summit knoblike. (36) Entepicondyle at level of internal condyle. (37) Entepicondylar prominence moderately produced, its pit placed on internal face. (38) Depression of M. brachialis anticus shallowly excavated. (39) Distal border of external condyle rounded in anconal view.

ULNA. (40) Olecranon process strongly produced, its apex pointed. (41) External cotyla much elongated, rounded throughout, its distal border sloping gently into shaft and only slightly notched by proximal radial impression. (42) Impression for M. brachialis anticus excavated, its borders distinct. (43) Height at middle of shaft 64 to 70 percent of height just distal to external cotyla. (44) Distal radial impression obsolete. (45) Notch between carpal tuberosity and internal condyle

well developed. (46) External condyle moderately produced, arising gently from shaft, rounded throughout.

CARPOMETACARPUS. (47) Metacarpal I sharply pointed terminally. (48) Ridge separating anterior carpal fossa from excavated area above pisiform process produced, and extending well onto base of metacarpal I. (49) Pisiform process ovaloid in internal view, slightly reflected dorsad, thus below level of dorsal rim of inner carpal trochlea. (50) Ligamental attachment of pisiform process produced and much swollen proximally, flattened distally, with proximal portion connected to pisiform process by bony bridge. (51) Internal carpal trochlea with proximal border distinctly concave and ventral border slightly notched. (52) Intermetacarpal tubercle extending slightly beyond, but not ankylosing with metacarpal III, distally placed with a small space between its posterior border and junction of metacarpals II and III. (53) Tubercle on internal proximal face of metacarpal III elongate and moderately produced. (54) One strongly developed tubercle on external proximal face of metacarpal III. (55) Metacarpal III slightly bowed.

PELVIS. (56) Width of pelvis through antitrochanters 60 to 63 percent of length of innominate from anterior edge of ilium to ischial angle. (57) Pectineal process obsolete, only moderately produced beyond acetabular border, its apex pointed. (58) Depression on medial side of pectineal process shallowly excavated, without foramen. (59) Posterior iliac crest without prominence. (60) Ridge originating on posterior iliac crest at level of ilio-ischiac fenestra, and continuing ventrad and posteriad toward posterior border of ilium with prominence weakly arising from its posterior portion. (61) Dorsal face of postacetabular ilium much broadened anteriad, narrowing abruptly posteriad to form acute apex of short, broad, dorsal roof of posterior process. (62) Caudal face of postacetabular ilium enlarged, broadly triangular, vertical in position, its posterodorsal apex forming posteromedial wall of posterior process. (63) Lateral face of postacetabular ilium with posterodorsal apex acute, forming shortened lateral wall of posterior process. (64) Renal bar obsolete, both bar and posterior process excavated by renal depression. (65) Ischium at angle of about 160 degrees to ventral edge of posterior iliac crest. (66) Width through transverse process of fourth synsacral vertebra 67 to 85 percent length of synsacrum from centrum of first synsacral vertebra through transverse process of fourth synsacral vertebra.

FEMUR. (67) Distal width about 17 percent length. (68) Head moderately enlarged, neither bent dorsally nor rotated posteriorly. (69) Neck only moderately long. (70) Iliac facet without compression,

posterior border convex. (71) Dorsal crest of trochanter compressed and reflected, its dorsal border rounded. (72) Trochanteric ridge 23 to 25 percent length of femur. (73) Distal depth 76 to 83 percent of distal width. (74) Internal condyle moderately wide, its anterior border much produced throughout. (75) External condyle compressed, rounded anteriorly.

TIBIOTARSUS. (76) Depth of inner cnemial crest 65 to 74 percent of its length. (77) Outer cnemial crest straight. (78) Interarticular tubercle strongly produced. (79) Area between external articular surface and outer cnemial crest moderately concave in dorsal view. (80) Posterior margin between external and internal articular surface with a distinct notch. (81) Area just anterior to ridge from proximal internal ligamental attachment without deeply excavated depression. (82) Internal ligamental prominence on internal condyle moderately produced. (83) Face of internal condyle moderately excavated, its border moderately elevated. (84) Dorsal border of supratendinal bridge usually straight.

TARSOMETATARSUS. (85) Distal width 17 to 18 percent of length. (86) Proximal depth 91 to 98 percent of proximal width. (87) Intercotylar prominence moderately deflected, its apex usually pointed. (88) Posterior intercotylar area usually unexcavated, but may be weakly excavated as a triangular depression. (89) Area surrounding posterior opening of inner proximal foramen shallowly excavated. (90) Hypotarsus with 2 well-developed and 1 obsolete calcaneal ridges, 2 calcaneal grooves, and usually 1, sometimes 2, closed calcaneal canals. (91) Anterior metatarsal groove reduced or absent. (92) Depth of middle trochlea 50 to 53 percent of distal width. (93) Trochlea for digit II moderately inflected. (94) Wing of trochlea for digit IV depressed dorsoventrally, thus entire trochlea much deeper than long.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 64 to 67 percent. (96) Ulna/humerus 92 to 94 percent. (97) Tarsometatarsus/femur 75 to 82 percent. (98) Tarsometatarsus/tibiotarsus 58 percent. (99) Humerus/femur 83 to 89 percent. (100) Humerus/tibiotarsus 58 to 61 percent. (101) Ulna/femur 78 to 82 percent. (102) Ulna/tibiotarsus 55 to 58 percent. (103) Ulna/tarsometatarsus 95 to 110 percent. (104) Carpometacarpus/femur 47 to 50 percent. (105) Carpometacarpus/tibiotarsus 33 to 35 percent. (106) Carpometacarpus/tarsometatarsus 57 to 66 percent. (107) Tarsometatarsus/humerus 85 to 99 percent. (108) Ilium/sternum 65 to 69 percent. (109) Height of sternal carina/ilium 45 to 46 percent.

Callipepla Wagler, 1832

The single species, *Callipepla squamata* (Vigors, 1830) occurs in the southwestern United States and northern Mexico. Measurements are given in table 1.

Rostrum. (1) Relatively long and shallow. (2) Nasal fossae elliptical.

Sternum. (3) Height of carina through sternal plate 30 to 31 percent length of sternum. (4) Dorsal lip of coracoidal sulcus projected well beyond ventral lip. (5) Depressions on anterior portion of sternal plate obsolete to deep, slightly to moderately pneumatic. (6) Base of posterior lateral process less than one-half width of sternal plate at its middle.

Coracoid. (7) Entire proximal end straight above procoracoid process. (8) Head narrowly rounded, moderately compressed, moderately inflected. (9) Brachial tuberosity with slight dorsal and ventral overhang. (10) Furcular facet moderately inflated. (11) Bicipital attachment well developed, margin between it and head concave. (12) Shaft wide proximally, distal portion of its ventral surface usually concave medially. (13) Procoracoid process with apex acute. (14) Dorsal intermuscular line swinging out to medial surface of shaft, distal half sharply raised. (15) Ventral intermuscular line terminating at tip of sterno-coracoidal process. (16) Dorsal face weakly excavated distally, without fossa. (17) Tubercle for ligamentum sterno-coracoideum dorsale obsolete, but rounded. (18) Internal distal angle with distinct irregular tubercle extending obliquely to above lateral end of sternal facet. (19) Sterno-coracoidal process with distal margin slightly oblique, not produced as a sharply raised ridge, without dorsal groove; its tip directed laterally and ending in a terminal knob. (20) Distal border of sternal facet usually deeply concave.

Scapula. (21) Glenoid facet oval in dorsal view. (22) Dorsal depression just mediad to glenoid facet unexcavated, shallowly excavated, or moderately excavated. (23) Bridge between acromion process and glenoid facet about one-half width of glenoid facet. (24) Acromion process with its apex rounded, slightly deflected.

Humerus. (25) Pneumatic fossa a moderately long oval or ovaloid, without inner shelf. (26) Median crest usually weakly developed, elevated only at its middle. (27) Capital groove moderately excavated, its internal margin moderately elevated. (28) Margin between head and internal tuberosity moderately concave. (29) Head broader than long in anconal view. (30) Ridge along medial border of fossa II moderately swollen, elongate, its apex acute. (31) Fossa II well developed.

(32) Latissimus ridge originating on lateral edge of shaft, but swinging in onto anconal face proximally. (33) External tuberosity moderately inflated. (34) Bicipital crest arising gently from shaft, narrowly rounded, its distal border lacking a groove. (35) Deltoid crest moderately developed, slightly inflected, its summit knoblike. (36) Entepicondyle at level of internal condyle. (37) Entepicondylar prominence moderately produced, its pit on palmar face. (38) Depression of M. brachialis anticus usually shallowly excavated. (39) Distal border of external condyle rounded in anconal view.

Ulna. (40) Olecranon process strongly produced, its apex pointed. (41) External cotyla moderately elongate, rounded throughout, its distal border sloping gently into shaft, only slightly notched by proximal radial impression. (42) Impression for M. brachialis anticus excavated, its borders distinct. (43) Height at middle of shaft 63 to 66 percent of height just distal to external cotyla. (44) Distal radial impression obsolete. (45) Notch between carpal tuberosity and internal condyle well developed. (46) External condyle well produced, arising abruptly from shaft, rounded throughout.

Carpometacarpus. (47) Metacarpal I moderately pointed terminally. (48) Ridge separating anterior carpal fossa from excavated area above pisiform process produced, extending well onto base of metacarpal I. (49) Pisiform process round or ovaloid in internal view, slightly reflected dorsad, thus usually below, occasionally at level of dorsal rim of inner carpal trochlea. (50) Ligamental attachment of pisiform process produced and much swollen proximally, flattened distally, with proximal portion connected to pisiform process by bony bridge. (51) Internal carpal trochlea with proximal border deeply notched, its ventral border without notch. (52) Intermetacarpal tubercle extending to, but not ankylosing with metacarpal III, distally placed with a small space between its posterior border and junction of metacarpals II and III. (53) Tubercle on internal proximal face of metacarpal III obsolete. (54) One strongly developed tubercle on external proximal face of metacarpal III. (55) Metacarpal III slightly bowed.

Pelvis. (56) Width of pelvis through antitrochanters 58 to 62 percent of length of innominate from anterior edge of ilium to ischial angle. (57) Pectineal process obsolete, only moderately produced beyond acetabular border, its apex pointed. (58) Depression on medial side of pectineal process shallowly excavated, without foramen. (59) Posterior iliac crest without prominence. (60) Ridge originating on posterior iliac crest at level of ilio-ischiac fenestra, continuing ventrad and posteriad toward posterior border of ilium with prominence

weakly arising from its posterior portion. (61) Dorsal face of postacetabular ilium moderately broad anteriad, narrowing abruptly posteriad to form acute apex of short, broad, dorsal roof of posterior process. (62) Caudal face of postacetabular ilium enlarged, triangular, vertical in position, its posterodorsal apex forming posteromedial wall of posterior process. (63) Lateral face of postacetabular ilium with its posterodorsal apex acute, forming shortened lateral wall of posterior process. (64) Renal bar slender, both bar and posterior process excavated by renal depression. (65) Ischium at angle of about 160 degrees to ventral edge of posterior iliac crest. (66) Width through transverse process of fourth synsacral vertebra 71 to 80 percent of length of synsacrum from centrum of first synsacral vertebra through transverse process of fourth synsacral vertebra.

FEMUR. (67) Distal width 17 to 18 percent of length. (68) Head moderately enlarged, neither bent dorsally nor rotated posteriorly. (69) Neck only moderately long. (70) Iliac facet without compression, posterior border convex. (71) Dorsal crest of trochanter compressed and reflected, its dorsal border rounded. (72) Trochanter ridge 24 percent length of femur. (73) Distal depth 76 to 82 percent of distal width. (74) Internal condyle moderately wide, its anterior border much produced throughout. (75) External condyle compressed and rounded anteriorly.

TIBIOTARSUS. (76) Depth of inner cnemial crest 64 to 73 percent of its length. (77) Outer cnemial crest usually straight. (78) Interarticular tubercle moderately produced. (79) Area between external articular surface and outer cnemial crest moderately concave in dorsal view. (80) Posterior margin between external and internal articular surfaces with distinct notch. (81) Area just anterior to ridge from proximal internal ligamental attachment without deeply excavated depression. (82) Internal ligamental prominence on internal condyle moderately produced. (83) Face of internal condyle moderately excavated, its border moderately elevated. (84) Dorsal border of supratendinal bridge straight.

TARSOMETATARSUS. (85) Distal width 15 to 18 percent of length. (86) Proximal depth 95 to 98 percent of proximal width. (87) Intercotylar prominence moderately deflected, its apex usually pointed. (88) Posterior intercotylar area weakly excavated as a triangular depression. (89) Area surrounding posterior opening of inner proximal foramen shallowly excavated. (90) Hypotarsus with 2 well-developed and 1 obsolete calcaneal ridges, 2 calcaneal grooves, and 2 closed calcaneal canals. (91) Anterior face of shaft moderately excavated by

anterior metatarsal groove. (92) Depth of middle trochlea 52 to 59 percent of distal width. (93) Trochlea for digit II only slightly inflected. (94) Wing of trochlea for digit IV depressed dorsoventrally, thus entire trochlea much deeper than long.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 67 to 69 percent. (96) Ulna/humerus 92 percent. (97) Tarsometatarsus/femur 79 to 82 percent. (98) Tarsometatarsus/tibiotarsus 59 percent. (99) Humerus/femur 85 to 89 percent. (100) Humerus/tibiotarsus 63 to 65 percent. (101) Ulna/femur 78 to 82 percent. (102) Ulna/tibiotarsus 58 to 59 percent. (103) Ulna/tarsometatarsus 95 to 102 percent. (104) Carpometacarpus/femur 47 to 48 percent. (105) Carpometacarpus/tibiotarsus 34 to 35 percent. (106) Carpometacarpus/tarsometatarsus 58 to 61 percent. (107) Tarsometatarsus/humerus 89 to 96 percent. (108) Ilium/sternum 66 to 69 percent. (109) Height of sternal carina/ilium 43 to 47 percent.

Colinus GOLDFUSS, 1820

The genus *Colinus* occurs in the United States east of the Rockies, on Cuba and the Isle of Pines, and through Mexico and Central America to Colombia and Venezuela. Of the four living species, table 1 includes measurements of *C. virginianus* (Linnaeus, 1758), *C. nigrogularis* (Gould, 1843), and *C. leucopogon* (Lesson, 1842).

ROSTRUM. (1) Relatively long and shallow. (2) Nasal fossae elliptical.

STERNUM. (3) Height of carina through sternal plate 25 to 32 percent length of sternum. (4) Dorsal lip of coracoidal sulcus projected well beyond ventral lip. (5) Depressions on anterior portion of sternal plate usually shallow and nonpneumatic. (6) Base of posterior lateral process less than one-half width of sternal plate at its middle.

CORACOID. (7) Entire proximal end straight above procoracoid process. (8) Head narrowly rounded, moderately compressed, moderately reflected or inflected. (9) Brachial tuberosity with slight dorsal and ventral overhang. (10) Furcular facet weakly or moderately inflated. (11) Bicipital attachment well developed, margin between it and head concave. (12) Shaft wide proximally, distal portion of its ventral surface concave medially. (13) Procoracoid process with apex acute or rounded. (14) Dorsal intermuscular line swinging out to medial surface of shaft, distal half sharply raised. (15) Ventral intermuscular line terminating at tip of sterno-coracoidal process. (16) Dorsal face moderately excavated distally, without distinct fossa. (17) Tubercle for ligamentum sterno-coracoideum dorsale obsolete or well developed, irregular in shape or rounded. (18) Internal distal angle

without distinct tubercle or ridge on dorsal face. (19) Sterno-coracoidal process with distal margin slightly oblique, not produced as sharply raised ridge, without dorsal groove; its tip directed laterally and ending in a terminal knob. (20) Distal border of sternal facet usually deeply concave.

SCAPULA. (21) Glenoid facet oval in dorsal view. (22) Dorsal depression just mediad to glenoid facet moderately to deeply excavated. (23) Bridge between acromion process and glenoid facet from less than one-third to about one-half width of glenoid facet. (24) Acromion process with apex rounded, usually moderately deflected.

HUMERUS. (25) Pneumatic fossa short to long, elliptical, oval, or ovaloid, without inner shelf. (26) Median crest moderately to strongly developed, elevated only at middle. (27) Capital groove usually moderately excavated, its internal margin usually moderately elevated. (28) Margin between head and internal tuberosity moderately concave. (29) Head broader than long in anconal view. (30) Ridge along medial border of fossa II slightly to moderately swollen, elongate, its apex acute. (31) Fossa II well developed. (32) Latissimus ridge originating on lateral edge of shaft, but swinging in onto anconal face proximally. (33) External tuberosity moderately inflated. (34) Bicipital crest arising gently from shaft, usually narrowly rounded, its dorsal border lacking a groove. (35) Deltoid crest moderately developed, slightly inflected, its summit flattened or knoblike. (36) Entepicondyle usually at level of internal condyle. (37) Entepicondylar prominence moderately produced, its pit on internal face. (38) Depression of M. brachialis anticus usually moderately excavated. (39) Distal border of external condyle rounded in anconal view.

ULNA. (40) Olecranon process strongly produced, its apex pointed. (41) External cotyla moderately elongate, rounded throughout, its distal border sloping gently into shaft, only slightly notched by proximal radial impression. (42) Impression for M. brachialis anticus excavated, its borders distinct. (43) Height at middle of shaft 62 to 71 percent of height just distal to external cotyla. (44) Distal radial impression obsolete. (45) Notch between carpal tuberosity and internal condyle well developed. (46) External condyle well produced, arising abruptly from shaft, rounded throughout.

CARPOMETACARPUS. (47) Metacarpal I moderately pointed or rounded terminally. (48) Ridge separating anterior carpal fossa from excavated area above pisiform process produced, extending well onto base of metacarpal I. (49) Pisiform process round, ovaloid, oval, or elliptical in internal view, slightly reflected dorsad, thus usually below or occasionally at level of dorsal rim of inner carpal trochlea.

(50) Ligamental attachment of pisiform process produced and much swollen proximally, flattened distally, with proximal portion usually connected to pisiform process by bony bridge. (51) Internal carpal trochlea with proximal border shallowly concave or slightly notched, its ventral border without notch. (52) Intermetacarpal tubercle extending to or slightly beyond, but usually not ankylosing with metacarpal III, distally placed with a small space between its posterior border and junction of metacarpals II and III. (53) Tubercle on internal proximal face of metacarpal III obsolete. (54) One strongly developed tubercle on external proximal face of metacarpal III. (55) Metacarpal III slightly bowed.

PELVIS. (56) Width of pelvis through antitrochanters 44 to 51 percent of length of innominate from anterior edge of ilium to ischial angle. (57) Pectineal process obsolete, only moderately produced beyond acetabular border, its apex usually pointed. (58) Depression on medial side of pectineal process shallowly excavated, without foramen. (59) Posterior iliac crest without prominence. (60) Ridge originating on posterior iliac crest at level of ilio-ischiac fenestra, continuing ventrad and posteriad toward posterior border of ilium with prominence sharply arising from its posterior portion. (61) Dorsal face of postacetabular ilium moderately broad anteriad, narrowing abruptly posteriad to form acute apex of short, broad, dorsal roof of posterior process. (62) Caudal face of postacetabular ilium enlarged, triangular, vertical in position, its posterodorsal apex forming posteromedial wall of posterior process. (63) Lateral face of postacetabular ilium with posterodorsal apex acute, forming shortened lateral wall of posterior process. (64) Renal bar slender, both bar and posterior process excavated by renal depression. (65) Ischium at angle of about 160 degrees to ventral edge of posterior iliac crest. (66) Width through transverse processes of fourth synsacral vertebra 57 to 68 percent of length of synsacrum from centrum of first synsacral vertebra through transverse process of fourth synsacral vertebra.

FEMUR. (67) Distal width 15 to 18 percent of length. (68) Head moderately enlarged, neither bent dorsally nor rotated posteriorly. (69) Neck only moderately long. (70) Iliac facet without compression, posterior border convex. (71) Dorsal crest of trochanter depressed and deflected or compressed and reflected, its dorsal border flat or rounded. (72) Trochanteric ridge 21 to 25 percent length of femur. (73) Distal depth 78 to 90 percent of distal width. (74) Internal condyle moderately wide, its anterior border much produced throughout. (75) External condyle compressed, rounded anteriorly.

TIBIOTARSUS. (76) Depth of inner cnemial crest 54 to 69 percent

of its length. (77) Outer cnemial crest usually straight. (78) Interarticular tubercle usually moderately produced. (79) Area between external articular surface and outer cnemial crest moderately concave in dorsal view. (80) Posterior margin between external and internal articular surface with distinct notch. (81) Area just anterior to ridge from proximal internal ligamental attachment without deeply excavated depression. (82) Internal ligamental prominence on internal condyle moderately produced. (83) Face of internal condyle moderately excavated, its border moderately elevated. (84) Dorsal border of supratendinal bridge oblique or straight.

TARSOMETATARSUS. (85) Distal width 16 to 19 percent of length. (86) Proximal depth 93 to 100 percent of proximal width. (87) Intercotylar prominence moderately deflected, its apex usually pointed. (88) Posterior intercotylar area weakly excavated as a triangular depression. (89) Area surrounding posterior opening of inner proximal foramen shallowly excavated. (90) Hypotarsus with 2 well-developed and 1 obsolete calcaneal ridges, 2 calcaneal grooves, and 2 closed calcaneal canals. (91) Anterior face of shaft usually moderately excavated by anterior metatarsal groove. (92) Depth of middle trochlea 52 to 60 percent of distal width. (93) Trochlea for digit II only slightly inflected. (94) Wing of trochlea for digit IV depressed dorsoventrally, thus entire trochlea much deeper than long.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 63 to 69 percent. (96) Ulna/humerus 86 to 91 percent. (97) Tarsometatarsus/femur 73 to 83 percent. (98) Tarsometatarsus/tibiotarsus 57 to 61 percent. (99) Humerus/femur 82 to 88 percent. (100) Humerus/tibiotarsus 62 to 66 percent. (101) Ulna/femur 72 to 79 percent. (102) Ulna/tibiotarsus 53 to 59 percent. (103) Ulna/tarsometatarsus 92 to 104 percent. (104) Carpometacarpus/femur 43 to 47 percent. (105) Carpometacarpus/tibiotarsus 33 to 35 percent. (106) Carpometacarpus/tarsometatarsus 55 to 62 percent. (107) Tarsometatarsus/humerus 86 to 98 percent. (108) Ilium/sternum 66 to 75 percent. (109) Height of sternal carina/ilium 37 to 45 percent.

SPECIFIC VARIATION IN *Colinus*

In this section when two of the three species agree in a particular character, the usual condition is mentioned first, followed by the exception shown in the third species.

CORACOID. (8) Head usually moderately reflected (moderately inflected in *C. nigrogularis*). (10) Furcular facet moderately inflated (weakly inflated in *C. nigrogularis*). (13) Procoracoid process with apex usually rounded (acute in *C. nigrogularis*). (17) Tubercle for ligamen-

tum sterno-coracoideum dorsale usually obsolete and irregular in shape (well developed and round in *C. leucopogon*).

SCAPULA. (23) Bridge between acromion process and glenoid facet usually about one-half width of glenoid facet (less than one-third width in *C. nigrogularis*).

HUMERUS. (25) Pneumatic fossa usually moderately long, occasionally short (very long in *C. nigrogularis*). (26) Median crest moderately developed (usually strongly developed in *C. virginianus*). (30) Ridge along medial border of fossa II moderately swollen (slightly swollen in *C. nigrogularis*). (35) Deltoid crest with apex flattened (usually knoblike in *C. virginianus*).

CARPOMETACARPUS. (47) Metacarpal I usually moderately pointed terminally (rounded terminally in *C. leucopogon*).

FEMUR. (71) Dorsal crest of trochanter usually depressed and deflected, its dorsal border usually flat (usually compressed and reflected, dorsal border usually round in *C. leucopogon*).

TIBIOTARSUS. (84) Dorsal border of supratendinal bridge usually oblique (straight in *C. leucopogon*).

INTERMEMBRAL PROPORTIONS. The species of *Colinus* are not separable on intermembral proportions.

REMARKS. The skeletons of Recent species of *Colinus* are similar. *Colinus virginianus* resembles *C. leucopogon* in 6 of 12 characters, *C. nigrogularis* in 4 characters, and is unique in 2 characters (these are subject to some individual variation). *Colinus nigrogularis* resembles *C. virginianus* in 4 of 12 characters, *C. leucopogon* in 2 characters, and is unique in 6 characters. *C. leucopogon* resembles *C. virginianus* in 6 of 12 characters, *C. nigrogularis* in 2 characters and is unique in 4 characters.

Colinus virginianus averages largest, *C. leucopogon* smaller, and *C. nigrogularis* smallest (table 1).

SUBSPECIFIC VARIATION IN *Colinus virginianus*

United States populations of Recent *Colinus virginianus* show a gradual decrease in mean skeletal size from north to south (table 2).

No qualitative skeletal differences separate the subspecies of *Colinus virginianus*, although one qualitative character appears to follow a north-south gradient. The Mexican samples are too small to indicate trends.

A north-south decrease in mean size occurs in United States bobwhites. The Michigan individuals of *C. v. virginianus* are largest, and the Illinois individuals second largest in each of 20 measurements. Northern Florida bobwhites, representing intergrades between *C. v.*

virginianus and *C. v. floridanus*, are third largest in 19 of 20 measurements, whereas the peninsular subspecies *C. v. floridanus* is the smallest in 19 of 20 measurements.

The available sample of the Mexican races of *C. virginianus* is too small to show size ranges adequately, but both *C. v. insignis* from Chiapas and *C. v. coyolcos* from Oaxaca are smaller than *C. v. virginianus* from Michigan and Illinois in all 20 measurements taken.

The development of the median crest of the humerus appears to show a north-south gradient in the subspecies of *C. virginianus* and thus is the only qualitative character that may be associated with a definite trend. In *C. v. virginianus* from Michigan, 85 percent of 20 specimens have the median crest strongly developed; 15 percent have it moderately or weakly developed. In *C. v. virginianus* from southern Illinois, 71 percent of 38 specimens have the median crest strongly developed; 29 percent have it moderately or weakly developed. In intergrades between *C. v. virginianus* and *C. v. floridanus* from northern Florida, 38 percent of 13 specimens have the median crest strongly developed; in 62 percent it is moderately or weakly developed. In *C. v. floridanus* from peninsular Florida, 29 percent of 7 specimens have the median crest strongly developed; 71 percent have it moderately or weakly developed. In *C. v. insignis* from Chiapas, Mexico, 40 percent of 5 specimens have the median crest strongly developed; 60 percent are moderately developed. One specimen of *C. v. coyolcos* from Oaxaca, Mexico, has the median crest strongly developed.

Lophortyx Bonaparte, 1838

The genus *Lophortyx* occurs in the western United States and western Mexico. Table 1 includes measurements of the three recognized species, *L. californica* (Shaw, 1798), *L. gambelii* Gambel, 1843 and *L. douglasii* (Vigors, 1829).

Rostrum. (1) Relatively long and shallow. (2) Nasal fossae elliptical.

Sternum. (3) Height of carina through sternal plate 28 to 31 percent length of sternum. (4) Dorsal lip of coracoidal sulcus projected well beyond ventral lip. (5) Depressions on anterior sternal plate obsolete or deep, slightly to moderately pneumatic. (6) Base of posterior lateral process less than one-half width of sternal plate at its middle.

Coracoid. (7) Entire proximal end straight above procoracoid process. (8) Head narrowly rounded, moderately compressed, moderately inflected. (9) Brachial tuberosity with slight dorsal and ventral overhang. (10) Furcular facet weakly inflated. (11) Bicipital

attachment well developed, margin between it and head concave. (12) Shaft narrow or wide proximally, distal portion of ventral surface convex or concave medially. (13) Procoracoid process with apex rounded. (14) Dorsal intermuscular line swinging out to medial surface of shaft, distal half sharply raised. (15) Ventral intermuscular line terminating at tip of sterno-coracoidal process. (16) Dorsal face weakly or moderately excavated distally, without fossa. (17) Tubercle for ligamentum sterno-coracoideum dorsale obsolete or well developed, round. (18) Internal distal angle without distinct tubercle or ridge on dorsal face. (19) Sterno-coracoidal process with distal margin slightly oblique, not produced as sharply raised ridge, without dorsal groove; its tip directed laterally and ending in terminal knob. (20) Distal border of sternal facet deeply to very deeply concave.

Scapula. (21) Glenoid facet oval in dorsal view. (22) Dorsal depression just mediad to glenoid facet shallowly to moderately excavated. (23) Bridge between acromion process and glenoid facet about one-half or more width of glenoid facet. (24) Acromion process with apex rounded and usually slightly deflected.

Humerus. (25) Pneumatic fossa a short to moderately long oval or ellipse, without inner shelf. (26) Median crest weak to strongly developed, elevated throughout or only at its middle. (27) Capital groove moderately excavated, its internal margin moderately elevated. (28) Margin between head and internal tuberosity moderately concave. (29) Head as broad or broader than long in anconal view. (30) Ridge along medial border of fossa II moderately swollen, elongate, its apex acute. (31) Fossa II well developed. (32) Latissimus ridge originating on lateral edge of shaft, but swinging in onto anconal face proximally. (33) External tuberosity moderately inflated. (34) Bicipital crest arising gently from shaft, narrowly rounded, its distal border lacking a groove. (35) Deltoid crest moderately developed, slightly inflected, its summit usually flattened. (36) Entepicondyle produced slightly beyond internal condyle. (37) Entepicondylar prominence moderately produced, its pit on internal face. (38) Depression of M. brachialis anticus moderately excavated. (39) Distal border of external condyle rounded in anconal view.

Ulna. (40) Olecranon process strongly produced, its apex pointed. (41) External cotyla moderately elongate, rounded throughout, its distal border sloping gently into shaft, usually only slightly notched by proximal radial impression. (42) Impression for M. brachialis anticus excavated, its borders distinct. (43) Height at middle of shaft 61 to 72 percent of height just distal to external cotyla. (44) Distal radial impression obsolete. (45) Notch between carpal tuberosity and in-

ternal condyle well developed. (46) External condyle well produced, arising gently from shaft, rounded throughout.

CARPOMETACARPUS. (47) Metacarpal I moderately pointed or rounded terminally. (48) Ridge separating anterior carpal fossa from excavated area above pisiform process produced, extending well onto base of metacarpal I. (49) Pisiform process ovaloid in internal view, slightly or moderately reflected dorsad, thus below, at, or slightly above level of dorsal rim of inner carpal trochlea. (50) Ligamental attachment of pisiform process produced and much swollen proximally, flattened distally, with proximal portion usually connected to pisiform process by bony bridge. (51) Internal carpal trochlea with proximal border usually slightly notched, its ventral border without notch. (52) Intermetacarpal tubercle extending to and sometimes ankylosing with metacarpal III, distally placed with a small space between its posterior border and junction of metacarpals II and III. (53) Tubercle on internal proximal face of metacarpal III obsolete. (54) One strongly developed tubercle on external proximal face of metacarpal III. (55) Metacarpal III slightly bowed.

PELVIS. (56) Width of pelvis through antitrochanters 54 to 57 percent of length of innominate from anterior edge of ilium to ischial angle. (57) Pectineal process obsolete, only moderately produced beyond acetabular border, its apex pointed. (58) Depression on medial side of pectineal process shallowly excavated, without foramen. (59) Posterior iliac crest without prominence. (60) Ridge originating on posterior iliac crest at level of ilio-ischiac fenestra, continuing ventrad and posteriad toward posterior border of ilium with prominence sharply arising from posterior portion. (61) Dorsal face of postacetabular ilium moderately broad anteriad, narrowing abruptly posteriad to form acute apex of short, broad, dorsal roof of posterior process. (62) Caudal face of postacetabular enlarged, triangular, vertical in position, its posterodorsal apex forming posteromedial wall of posterior process. (63) Lateral face of postacetabular ilium with posterodorsal apex acute, forming shortened lateral wall of posterior process. (64) Renal bar slender, with both bar and posterior process excavated by renal depression. (65) Ischium at angle of about 160 degrees to ventral edge of posterior iliac crest. (66) Width through transverse process of fourth synsacral vertebra 67 to 76 percent of length of synsacrum from centrum of first synsacral vertebra through transverse process of fourth synsacral vertebra.

FEMUR. (67) Distal width 17 to 18 percent of length. (68) Head moderately or much enlarged, neither bent dorsally nor rotated posteriorly. (69) Neck only moderately long. (70) Iliac facet without

compression, posterior border convex. (71) Dorsal crest of trochanter usually compressed and reflected, its dorsal border rounded. (72) Trochanteric ridge 24 to 25 percent length of femur. (73) Distal depth 77 to 85 percent of distal width. (74) Internal condyle moderately wide, its anterior border much produced throughout. (75) External condyle compressed, rounded anteriorly.

TIBIOTARSUS. (76) Depth of inner cnemial crest 58 to 67 percent of its length. (77) Outer cnemial crest straight or decurved. (78) Interarticular tubercle moderately produced. (79) Area between external articular surface and outer cnemial crest moderately concave in dorsal view. (80) Posterior margin between external and internal articular surfaces with distinct notch. (81) Area just anterior to ridge from proximal internal ligamental attachment without deeply excavated depression. (82) Internal ligamental prominence on internal condyle moderately produced. (83) Face of internal condyle moderately excavated, its border moderately elevated. (84) Dorsal border of supratendinal bridge usually straight.

TARSOMETATARSUS. (85) Distal width 18 to 20 percent of length. (86) Proximal depth 93 to 100 percent of proximal width. (87) Intercotylar prominence moderately deflected, its apex pointed. (88) Posterior intercotylar area usually weakly excavated as a triangular depression. (89) Area surrounding posterior opening of inner proximal foramen shallowly excavated. (90) Hypotarsus with 2 well-developed and 1 obsolete calcaneal ridges, 2 calcaneal grooves, and 2 closed calcaneal canals. (91) Anterior metatarsal groove usually reduced. (92) Depth of middle trochlea about 51 to 57 percent of distal width. (93) Trochlea for digit II only slightly inflected. (94) Wing of trochlea for digit IV depressed dorsoventrally, thus entire trochlea much deeper than long.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 60 to 66 percent. (96) Ulna/humerus 86 to 89 percent. (97) Tarsometatarsus/femur 76 to 82 percent. (98) Tarsometatarsus/tibiotarsus 57 to 59 percent. (99) Humerus/femur 79 to 85 percent. (100) Humerus/tibiotarsus 58 to 65 percent. (101) Ulna/femur 68 to 74 percent. (102) Ulna/tibiotarsus 50 to 56 percent. (103) Ulna/tarsometatarsus 87 to 97 percent. (104) Carpometacarpus/femur 37 to 45 percent. (105) Carpometacarpus/tibiotarsus 31 to 35 percent. (106) Carpometacarpus/tarsometatarsus 54 to 60 percent. (107) Tarsometatarsus/humerus 89 to 99 percent. (108) Ilium/sternum 66 to 70 percent. (109) Height of sternal carina/ilium 42 to 45 percent.

SPECIFIC VARIATION IN *Lophortyx*

In this section when two of the three species agree in a particular character, this condition is mentioned first, followed in parentheses by the condition shown by the third species.

STERNUM. (5) Depressions on anterior portion of sternal plate deep (obsolete in *L. californica*); slightly to moderately pneumatic in *L. douglasii*, slightly pneumatic in *L. californica*, moderately pneumatic in *L. gambelii*.

CORACOID. (12) Shaft wide proximally (narrow proximally in *L. californica*) distal portion of ventral surface concave medially (convex medially in *L. gambelii*). (16) Dorsal face weakly excavated distally (moderately excavated distally in *L. douglasii*). (17) Tubercle for ligamentum sterno-coracoideum dorsale well developed (obsolete in *L. californica*). (20) Distal border of sternal facet deeply concave (very deeply concave in *L. gambelii*).

SCAPULA. (22) Dorsal depression just mediad to glenoid facet shallowly to moderately excavated in *L. douglasii*, shallowly excavated in *L. californica*, moderately excavated in *L. gambelii*. (23) Bridge between acromion process and glenoid facet about one-half width of glenoid facet (more than one-half width of glenoid facet in *L. gambelii*).

HUMERUS. Combined proximal width, middle shaft width, and distal width, 58 to 59 percent of length (60 to 63 percent of length in *L. californica*). Proximal width 27 percent of length (28 to 30 percent of length in *L. californica*). (26) Median crest strongly developed, elevated only at its middle (weak and elevated throughout in *L. douglasii*). (29) Head broader than long in anconal view (as broad as long in *L. gambelii*).

ULNA. (43) Height at middle of shaft 67 to 72 percent of height just distal to external cotyla (61 percent of height in *L. gambelii*).

CARPOMETACARPUS. Proximal width through pisiform process 65 to 67 percent of proximal height through metacarpal I (61 to 62 percent of proximal height in *L. californica*). (47) Metacarpal I rounded terminally (moderately pointed in *L. californica*). (49) Pisiform process slightly reflected dorsad, thus below level of dorsal rim of inner carpal trochlea (moderately reflected dorsad, thus at or slightly above dorsal rim of inner carpal trochlea in *L. gambelii*). (52) Intermetacarpal tubercle usually extending to and ankylosing with metacarpal III (extending to, but not ankylosing with metacarpal III in *L. douglasii*).

FEMUR. (68) Head moderately large (much enlarged in *L. gambelii*).

TIBIOTARSUS. Proximal depth 76 to 77 percent of proximal width (72 to 73 percent of proximal width in *L. californica*). (77) Outer cnemial crest straight or slightly decurved in *L. californica*, straight in *L. douglasii*, decurved in *L. gambelii*.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 60 to 63 percent (66 percent in *L. douglasii*). Femur/tibiotarsus 72 to 74 percent (76 to 77 percent in *L. douglasii*). (97) Tarsometatarsus/femur 76 to 79 percent (82 percent in *L. gambelii*). (99) Humerus/femur 83 to 85 percent (79 to 80 percent in *L. californica*). (100) Humerus/tibiotarsus 58 to 60 percent (64 to 65 percent in *L. douglasii*). (102) Ulna/tibiotarsus 50 to 53 percent (55 to 56 percent in *L. douglasii*). (103) Ulna/tarsometatarsus 87 to 90 percent (97 percent in *L. douglasii*). (104) Carpometacarpus/femur 45 percent (37 to 42 percent in *L. californica*). (105) Carpometacarpus/tibiotarsus 31 to 32 percent (34 to 35 percent in *L. douglasii*). (106) Carpometacarpus/tarsometatarsus 54 to 56 percent (59 to 60 percent in *L. douglasii*). (107) Tarsometatarsus/humerus 98 to 99 percent (89 to 90 percent in *L. douglasii*).

REMARKS. On the basis of the samples studied, the skeletons of Recent species of *Lophortyx* show more interspecific differences than do those of Recent species of *Colinus*. *Lophortyx californica* resembles *L. gambelii* in 11 of 30 characters, *L. douglasii* in 8 characters, and is unique in 11 characters. *Lophortyx gambelii* resembles *L. californica* in 11 of 30 characters, *L. douglasii* in 10 characters, and is unique in 9 characters. *L. douglasii* resembles *L. californica* in 8 of 30 characters, *L. gambelii* in 10 characters, and is unique in 12 characters.

Lophortyx californica and *L. gambelii* are similar in size, but *L. douglasii* averages somewhat smaller in most measurements (table 1).

Odontophorus VIEILLOT, 1816

The genus *Odontophorus* is confined to tropical America. Of the 16 species recognized, *O. gujanensis* (Gmelin, 1789), *O. stellatus* (Gould, 1843), and *O. guttatus* (Gould, 1838) were examined; their measurements are given in table 1.

ROSTRUM. (1) Relatively long and shallow. (2) Nasal fossae elliptical.

STERNUM. (3) Height of carina through sternal plate 29 to 33 percent length of sternum. (4) Dorsal lip of coracoidal sulcus projected slightly or well beyond ventral lip. (5) Depressions on anterior portion of sternal plate obsolete and nonpneumatic. (6) Base of posterior lateral process less than one-half width of sternal plate at middle.

CORACOID. (7) Entire proximal end straight above procoracoid process. (8) Head narrowly rounded, moderately compressed, moderately reflected or inflected. (9) Brachial tuberosity with slight or moderate dorsal, and slight ventral overhang. (10) Furcular facet much inflated. (11) Bicipital attachment well developed, margin between it and head concave. (12) Shaft wide proximally, distal portion of ventral surface concave medially. (13) Procoracoid process with apex rounded. (14) Dorsal intermuscular line swinging out to medial surface of shaft, distal two-thirds or three-fourths sharply raised. (15) Ventral intermuscular line terminating at tip of sterno-coracoidal process. (16) Dorsal face moderately or deeply excavated distally, without fossa. (17) Tubercle for ligamentum sterno-coracoideum dorsale obsolete and irregular in shape. (18) Internal distal angle without distinct tubercle or ridge on dorsal face. (19) Sterno-coracoidal process with distal margin slightly oblique, not produced as sharply raised ridge, without dorsal groove; its tip directed laterally and ending in a terminal knob. (20) Distal border of sternal facet shallowly or deeply concave.

SCAPULA. (21) Glenoid facet oval or elliptical in dorsal view. (22) Dorsal depression just mediad to glenoid facet shallowly to deeply excavated. (23) Bridge between acromion process and glenoid facet usually about one-half width of glenoid facet. (24) Acromion process with apex rounded, slightly or moderately deflected.

HUMERUS. (25) Pneumatic fossa short to moderately long, oval or elliptical, without inner shelf, or with perforated inner shelf extending from external bicipital surface to medial bar. (26) Median crest strongly or very strongly developed, elevated throughout. (27) Capital groove moderately excavated, its internal margin moderately elevated. (28) Margin between head and internal tuberosity moderately concave. (29) Head broader than long in anconal view. (30) Ridge along medial border of fossa II moderately swollen, elongate, its apex acute. (31) Fossa II obsolete. (32) Latissimus ridge originating on lateral edge of shaft, but swinging in onto anconal face proximally. (33) External tuberosity slightly, moderately, or much inflated. (34) Bicipital crest arising gently from shaft, rounded, its distal border lacking a groove. (35) Deltoid crest moderately or strongly developed, slightly inflected, its summit knoblike. (36) Entepicondyle produced slightly beyond level of internal condyle. (37) Entepicondylar prominence much produced, its pit on internal face. (38) Depression of M. brachialis anticus moderately excavated. (39) Distal border of external condyle rounded in anconal view.

ULNA. (40) Olecranon process strongly produced, its apex pointed. (41) External cotyla moderately elongate, rounded throughout or flattened dorsally, its distal border sloping gently or precipitously into shaft, slightly or deeply notched by proximal radial impression. (42) Impression for M. brachialis anticus excavated, its borders distinct. (43) Height at middle of shaft 65 to 72 percent of height just distal to external cotyla. (44) Distal radial impression obsolete or moderately excavated. (45) Notch between carpal tuberosity and internal condyle well developed. (46) External condyle well produced, arising abruptly from shaft, rounded throughout.

CARPOMETACARPUS. (47) Metacarpal I moderately pointed terminally. (48) Ridge separating anterior carpal fossa from excavated area above pisiform process produced, extending well onto base of metacarpal I. (49) Pisiform process ovaloid in internal view, slightly reflected dorsad, thus slightly below level of dorsal rim of inner carpal trochlea. (50) Ligamental attachment of pisiform process produced, moderately or much swollen proximally, flattened distally, with proximal portion either connected to pisiform process by bony bridge or separated from pisiform process by shallow sulcus. (51) Internal carpal trochlea with proximal border usually slightly notched, its ventral border without notch. (52) Intermetacarpal tubercle extending to but not ankylosing with metacarpal III, distally placed with a small space between its posterior border and junction of metacarpals II and III. (53) Tubercle on internal proximal face of metacarpal III obsolete. (54) One strongly developed tubercle on external proximal face of metacarpal III. (55) Metacarpal III slightly bowed.

PELVIS. (56) Width of pelvis through antitrochanters 51 to 53 percent of length of innominate from anterior edge of ilium to ischial angle. (57) Pectineal process obsolete, only slightly produced beyond acetabular border as a minute point. (58) Depression on medial side of pectineal process obsolete, without foramen. (59) Posterior iliac crest usually without prominence. (60) Ridge originating on posterior iliac crest at level of ilio-ischiac fenestra, continuing ventrad and posteriad toward posterior border of ilium with prominence weakly or sharply arising from posterior portion; or pelvis without this ridge or prominence. (61) Dorsal face of postacetabular ilium moderately broad anteriad, narrowing posteriad to form rounded or pointed apex of moderately or much elongated, narrow, dorsal roof of posterior process. (62) Caudal face of postacetabular ilium obsolete, triangular, horizontal in position, forming ventral floor of posterior process. (63) Lateral face of postacetabular ilium with posterodorsal apex acute, forming moderately or much elongated lateral wall of posterior proc-

ess. (64) Renal bar broad, bar, but not posterior process, excavated by renal depression. (65) Ischium at angle of about 160 degrees to ventral edge of posterior iliac crest. (66) Width through transverse processes of fourth synsacral vertebra 71 to 79 percent length of synsacrum from centrum of first synsacral vertebra through transverse process of fourth synsacral vertebra.

FEMUR. (67) Distal width 17 to 19 percent of length. (68) Head moderately enlarged, neither bent dorsally nor rotated posteriorly. (69) Neck only moderately long. (70) Iliac facet without compression, posterior border convex. (71) Dorsal crest of trochanter depressed and deflected, its dorsal border flat. (72) Trochanteric ridge 21 to 26 percent length of femur. (73) Distal depth 83 to 85 percent of distal width. (74) Internal condyle moderately wide, its anterior border much produced throughout. (75) External condyle compressed, rounded anteriorly.

TIBIOTARSUS. (76) Depth of inner cnemial crest 58 to 68 percent of its length. (77) Outer cnemial crest straight. (78) Interarticular tubercle moderately or strongly produced. (79) Area between external articular surface and outer cnemial crest moderately or deeply concave in dorsal view. (80) Posterior margin between external and internal articular surface with distinct notch. (81) Area just anterior to ridge for proximal internal ligamental attachment without deeply excavated depression. (82) Internal ligamental prominence on internal condyle moderately produced. (83) Face of internal condyle moderately excavated, its border moderately elevated. (84) Dorsal border of supratendinal bridge usually straight.

TARSOMETATARSUS. (85) Distal width 17 to 18 percent of length. (86) Proximal depth 96 to 100 percent of proximal width. (87) Intercotylar prominence moderately deflected, its apex pointed. (88) Posterior intercotylar area moderately excavated as triangular depression. (89) Area surrounding posterior opening of inner proximal foramen usually deeply excavated. (90) Hypotarsus with 2 well-developed and 1 obsolete calcaneal ridges, 2 calcaneal grooves, and 1 or 2 closed calcaneal canals. (91) Anterior metatarsal groove reduced. (92) Depth of middle trochlea 54 to 57 percent of distal width. (93) Trochlea for digit II only slightly inflected. (94) Wing of trochlea for digit IV depressed anteroposteriorly, thus entire trochlea slightly longer than deep.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 64 to 68 percent. (96) Ulna/humerus 96 to 102 percent. (97) Tarsometatarsus/femur 84 to 87 percent. (98) Tarsometatarsus/tibiotarsus 63 to 65 percent. (99) Humerus/femur 82 to 86 percent. (100) Humerus/tibiotarsus 61 to

64 percent. (101) Ulna/femur 80 to 85 percent. (102) Ulna/tibiotarsus 60 to 62 percent. (103) Ulna/tarsometatarsus 92 to 99 percent. (104) Carpometacarpus/femur 45 to 49 percent. (105) Carpometacarpus/tibiotarsus 33 to 36 percent. (106) Carpometacarpus/tarsometatarsus 51 to 58 percent. (107) Tarsometatarsus/humerus 99 to 101 percent. (108) Ilium/sternum 71 to 76 percent. (109) Height of sternal carina/ilium 41 to 44 percent.

Specific Variation in *Odontophorus*

When two of three species agree in a particular character, this condition is mentioned first, followed by the condition shown by the third species.

Sternum. (3) Height of carina through sternal plate 32 to 33 percent length of sternum (29 percent length of sternum in *O. guttatus*). (4) Dorsal lip of coracoidal sulcus projected well beyond ventral lip (projected only slightly beyond ventral lip in *O. gujanensis*).

Coracoid. (8) Head moderately reflected (moderately inflected in *O. guttatus*). (9) Brachial tuberosity with moderate dorsal overhang (slight dorsal overhang in *O. gujanensis*). (14) Dorsal intermuscular line with distal three-fourths sharply raised (with distal two-thirds sharply raised in *O. guttatus*). (16) Dorsal face deeply excavated distally (moderately excavated distally in *O. stellatus*). (20) Distal border of sternal facet shallowly concave (deeply concave in *O. guttatus*).

Scapula. (21) Glenoid facet oval in dorsal view (elliptical in *O. guttatus*). (22) Dorsal depression just mediad to glenoid facet moderately or deeply excavated (shallowly excavated in *O. stellatus*). (24) Acromion process with apex only slightly deflected (moderately deflected in *O. guttatus*).

Humerus. (25) Pneumatic fossa oval, without inner shelf (elliptical, with perforated inner shelf extending from external bicipital surface to medial bar in *O. gujanensis*). (26) Median crest strongly developed (very strongly developed in *O. gujanensis*). (33) External tuberosity slightly inflated in *O. guttatus*, moderately inflated in *O. stellatus*, much inflated in *O. gujanensis*. (35) Deltoid crest moderately developed (strongly developed in *O. gujanensis*).

Ulna. (41) External cotyla rounded throughout (flattened dorsally in *O. guttatus*), its distal border sloping gently into shaft (sloping precipitously in *O. guttatus*), only slightly notched by proximal radial impression (deeply notched in *O. gujanensis*). (44) Distal radial impression obsolete (moderately excavated in *O. gujanensis*).

Carpometacarpus. (50) Ligamental attachment of pisiform proc-

ess much swollen proximally (moderately swollen proximally in *O. gujanensis*).

PELVIS. (60) Ridge originating on posterior iliac crest at level of ilio-ischiac fenestra, continuing ventrad and posteriad toward posterior border of ilium with prominence sharply arising from its posterior portion in *O. guttatus* (prominence weakly arising in *O. stellatus*, sharply arising, or without ridge and prominence in *O. gujanensis*). (61) Dorsal face of postacetabular ilium much elongated and narrow, its apex pointed (moderately elongated and narrow, its apex rounded in *O. stellatus*). (63) Lateral face of postacetabular ilium much elongated (moderately elongate in *O. guttatus*).

TIBIOTARSUS. (76) Depth of inner cnemial crest 65 to 68 percent of its length (58 percent of its length in *O. gujanensis*). (78) Interarticular tubercle moderately produced (strongly produced in *O. stellatus*). (79) Area between external articular surface and outer cnemial crest deeply concave in dorsal view (moderately concave in *O. gujanensis*).

TARSOMETATARSUS. (90) Hypotarsus with 1 closed calcaneal canal in *O. stellatus*, 1 or 2 in *O. gujanensis*, 2 in *O. guttatus*.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 67 to 68 percent (64 percent in *O. guttatus*). Carpometacarpus/humerus 57 percent (54 percent in *O. guttatus*). (98) Tarsometatarsus/tibiotarsus 63 percent (65 percent in *O. guttatus*). (99) Humerus/femur 84 to 86 percent (82 percent in *O. guttatus*). (101) Ulna/femur 83 to 85 percent (80 percent in *O. guttatus*). (103) Ulna/tarsometatarsus 98 to 99 percent (92 percent in *O. guttatus*). (104) Carpometacarpus/femur 47 to 49 percent (45 percent in *O. guttatus*). (105) Carpometacarpus/tibiotarsus 36 percent (33 percent in *O. guttatus*). (106) Carpometacarpus/tarsometatarsus 55 to 58 percent (51 percent in *O. guttatus*). (108) Ilium/sternum 74 to 76 percent (71 percent in *O. guttatus*).

REMARKS. As in skeletons of Recent *Lophortyx*, those of *Odontophorus* show more interspecific differences than do those of Recent species of *Colinus*. *Odontophorus guttatus* differs from *O. gujanensis* and *O. stellatus* in many intermembral ratios, and thus has more unique characters. *Odontophorus gujanensis* resembles *O. stellatus* in 19 of 33 characters, *O. guttatus* in 3 characters, and is unique in 11 characters. *Odontophorus stellatus* resembles *O. gujanensis* in 19 of 33 characters, *O. guttatus* in 10 characters, and is unique in 4 characters. *O. guttatus* resembles *O. stellatus* in 10 of 33 characters, *O. gujanensis* in 3 characters, and is unique in 20 characters.

According to the small available sample, the skeletons of *O. gujanensis* and *O. guttatus* are similar in size and slightly larger than *O. stellatus*.

Dactylortyx Ogilvie-Grant, 1893

The single species of this genus, *Dactylortyx thoracicus* (Gambel, 1848) is confined to Mexico and northern Central America, mainly in the mountains. Measurements are given in table 1.

Rostrum. (1) Relatively long and shallow. (2) Nasal fossae elliptical.

Sternum. (3) Height of carina through sternal plate 31 to 34 percent length of sternum. (4) Dorsal lip of coracoidal sulcus even with or projecting only slightly beyond ventral lip. (5) Depressions on anterior part of sternal plate shallow or obsolete, nonpneumatic. (6) Base of posterior lateral process less than one-half width of sternal plate at its middle.

Coracoid. (7) Entire proximal end straight above procoracoid process. (8) Head narrowly rounded, moderately compressed, moderately inflected. (9) Brachial tuberosity with slight dorsal and ventral overhang. (10) Furcular facet moderately inflated. (11) Bicipital attachment well developed, margin between it and head concave. (12) Shaft wide proximally, distal portion of ventral surface concave medially. (13) Procoracoid process with apex rounded. (14) Dorsal intermuscular line swinging out to medial surface of shaft, distal three-fourths sharply raised. (15) Ventral intermuscular line terminating at tip of sterno-coracoid process. (16) Dorsal face deeply excavated distally, without fossa. (17) Tubercle for ligamentum sterno-coracoideum dorsale usually obsolete, always irregular in shape. (18) Internal distal angle without distinct tubercle or ridge. (19) Sterno-coracoidal process with distal margin slightly oblique, not produced as a sharply raised ridge, without dorsal groove; its tip directed laterally and ending in a terminal knob. (20) Distal border of sternal facet deeply concave.

Scapula. (21) Glenoid facet oval in dorsal view. (22) Dorsal depression just mediad to glenoid facet shallowly excavated. (23) Bridge between acromion process and glenoid facet about one-half width of glenoid facet. (24) Acromion process with apex rounded, slight to moderate deflection.

Humerus. (25) Pneumatic fossa a short to moderately long ellipse or ovaloid, without inner shelf. (26) Median crest strongly developed, elevated only at its middle. (27) Capital groove moderately excavated, its internal margin moderately elevated. (28) Margin between head and internal tuberosity moderately concave. (29) Head broader than long in anconal view. (30) Ridge along medial border of fossa II much swollen, shortened, its apex rounded. (31) Fossa II well de-

veloped. (32) Latissimus ridge originating on lateral edge of shaft, but swinging in onto anconal face proximally. (33) External tuberosity moderately inflated. (34) Bicipital crest arising gently from shaft, pointed, its distal border lacking a groove. (35) Deltoid crest moderately developed, slightly inflected, its summit knoblike. (36) Entepicondyle usually at level of internal condyle. (37) Entepicondylar prominence much produced, its pit usually on internal face. (38) Depression of M. brachialis anticus shallowly excavated. (39) Distal border of external condyle rounded in anconal view.

Ulna. (40) Olecranon process strongly produced, its apex truncated. (41) External cotyla moderately elongate, rounded throughout, its distal border sloping gently into shaft, only slightly notched by proximal radial impression. (42) Impression for M. brachialis anticus excavated, its borders distinct. (43) Height at middle of shaft 71 percent of height just distal to external cotyla. (44) Distal radial impression obsolete. (45) Notch between carpal tuberosity and internal condyle well developed. (46) External condyle moderately produced, usually arising abruptly from shaft, usually rounded throughout.

Carpometacarpus. (47) Metacarpal I usually rounded terminally. (48) Ridge separating anterior carpal fossa from excavated area above pisiform process produced, extending well onto base of metacarpal I. (49) Pisiform process ovaloid in internal view, slightly reflected dorsad, thus below level of dorsal rim of inner carpal trochlea. (50) Ligamental attachment of pisiform process produced and much swollen proximally, flattened distally, with proximal portion connected to pisiform process by bony bridge. (51) Internal carpal trochlea with proximal border slightly notched, its ventral border without notch. (52) Intermetacarpal tubercle extending to but not ankylosing with metacarpal III, proximally placed with only a minute space between its posterior border and junction of metacarpals II and III. (53) Tubercle on internal proximal face of metacarpal III obsolete. (54) One moderately developed tubercle on external proximal face of metacarpal III. (55) Metacarpal III slightly bowed.

Pelvis. (56) Width of pelvis through antitrochanters 55 to 58 percent length of innominate from anterior edge of ilium to ischial angle. (57) Pectineal process absent, or obsolete and only slightly produced beyond acetabular border as a minute point. (58) Depression on medial side of pectineal process absent. (59) Posterior iliac crest with prominence moderately produced from just posterior to ilio-ischiac fenestra. (60) No ridge or prominence ventral to posterior iliac crest. (61) Dorsal face of postacetabular ilium moderately broadened anteriad, narrowing gently posteriad to form truncated apex of moderately

long, narrow, dorsal roof of posterior process. (62) Caudal face of postacetabular ilium obsolete, rectangular, horizontal in position, forming ventral floor of posterior process. (63) Lateral face of postacetabular ilium with its posterodorsal apex acute, forming elongate lateral wall of posterior process. (64) Renal bar broad, bar, but not posterior process, excavated by renal depression. (65) Ischium at angle of about 160 degrees to ventral edge of posterior iliac crest. (66) Width through transverse process of fourth synsacral vertebra 88 to 93 percent of length of synsacrum from centrum of first synsacral vertebra through transverse process of fourth synsacral vertebra.

FEMUR. (67) Distal width 19 percent of length. (68) Head much enlarged, neither bent dorsally nor rotated posteriorly. (69) Neck only moderately long. (70) Iliac facet without compression, with posterior border convex. (71) Dorsal crest of trochanter compressed and reflected, its dorsal border rounded. (72) Trochanteric ridge 15 to 18 percent length of femur. (73) Distal depth 81 to 84 percent of distal width. (74) Internal condyle narrow, its anterior border usually weakly produced throughout. (75) External condyle compressed, rounded anteriorly.

TIBIOTARSUS. (76) Depth of inner cnemial crest 42 to 48 percent of its length. (77) Outer cnemial crest straight. (78) Interarticular tubercle weakly produced. (79) Area between external articular surface and outer cnemial crest deeply concave in dorsal view. (80) Posterior margin between external and internal articular surface with distinct notch. (81) Area just anterior to ridge for proximal internal ligamental attachment without deeply excavated depression. (82) Area of internal ligamental attachment on internal condyle not produced as a prominence. (83) Face of internal condyle moderately excavated, its border moderately elevated. (84) Dorsal border of supratendinal bridge straight.

TARSOMETATARSUS. (85) Distal width 19 to 21 percent of length. (86) Proximal depth 88 to 94 percent of proximal width. (87) Intercotylar prominence only slightly deflected, its apex usually pointed. (88) Posterior intercotylar area moderately excavated as a triangular depression. (89) Area surrounding posterior opening of inner proximal foramen moderately excavated. (90) Hypotarsus with 2 well-developed and 1 weakly developed calcaneal ridges, 2 calcaneal grooves, and 2 closed calcaneal canals. (91) Anterior metatarsal groove reduced or obsolete. (92) Depth of middle trochlea 45 to 50 percent of distal width. (93) Trochlea for digit II moderately inflected. (94) Wing of trochlea for digit IV depressed dorsoventrally, thus entire trochlea much deeper than long.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 72 to 73 percent. (96) Ulna/humerus 98 to 100 percent. (97) Tarsometatarsus/femur 81 to 82 percent. (98) Tarsometatarsus/tibiotarsus 59 to 60 percent. (99) Humerus/femur 90 to 91 percent. (100) Humerus/tibiotarsus 66 to 67 percent. (101) Ulna/femur 88 to 91 percent. (102) Ulna/tibiotarsus 65 to 66 percent. (103) Ulna/tarsometatarsus 109 to 111 percent. (104) Carpometacarpus/femur 48 to 50 percent. (105) Carpometacarpus/tibiotarsus 35 to 36 percent. (106) Carpometacarpus/tarsometatarsus 59 to 62 percent. (107) Tarsometatarsus/humerus 90 percent. (108) Ilium/sternum 70 to 78 percent. (109) Height of sternal carina/ilium 40 to 49 percent.

Cyrtonyx GOULD, 1844

The genus *Cyrtonyx* is confined to the mountains of the southwestern United States, Mexico, and northern Central America. Three species are recognized, of which only *C. montezumae* (Vigors, 1830) was examined; its measurements are given in table 1.

ROSTRUM. (1) Relatively long and shallow. (2) Nasal fossae elliptical.

STERNUM. (3) Height of carina through sternal plate 28 to 32 percent length of sternum. (4) Dorsal lip of coracoidal sulcus usually projected well beyond ventral lip. (5) Depressions on anterior part of sternal plate shallow and nonpneumatic. (6) Base of posterior lateral process less than one-half width of sternal plate at its middle.

CORACOID. (7) Entire proximal end straight above procoracoid process. (8) Head narrowly rounded, moderately compressed, moderately inflected. (9) Brachial tuberosity with slight dorsal and ventral overhang. (10) Furcular facet obsolete. (11) Bicipital attachment well developed, margin between it and head concave. (12) Shaft wide proximally, distal portion of ventral surface usually convex medially. (13) Procoracoid process with its apex rounded. (14) Dorsal intermuscular line swinging out to medial surface of shaft, distal half sharply raised. (15) Ventral intermuscular line terminating at tip of sterno-coracoid process. (16) Dorsal face deeply excavated distally, without fossa. (17) Tubercle for ligamentum sterno-coracoideum dorsale usually well developed and rounded. (18) Internal distal angle without distinct tubercle or ridge on dorsal face. (19) Sterno-coracoidal process with distal margin slightly oblique, not produced as a sharply raised ridge, without dorsal groove; its tip directed laterally and ending in a terminal knob. (20) Distal border of sternal facet deeply concave.

SCAPULA. (21) Glenoid facet oval in dorsal view. (22) Dorsal depression just mediad to glenoid facet obsolete to shallowly excavated. (23) Bridge between acromion process and glenoid facet about one-half width of glenoid facet. (24) Acromion process with apex rounded, strongly deflected.

HUMERUS. (25) Pneumatic fossa a moderately long ellipse or ovaloid, without inner shelf. (26) Median crest strongly developed, elevated only at its middle. (27) Capital groove moderately excavated, its internal margin moderately elevated. (28) Margin between head and internal tuberosity moderately concave. (29) Head broader than long in anconal view. (30) Ridge along medial border of fossa II moderately swollen, elongate, its apex acute. (31) Fossa II well developed. (32) Latissimus ridge originating on lateral edge of shaft, but swinging in onto anconal face proximally. (33) External tuberosity moderately inflated. (34) Bicipital crest arising gently from shaft, pointed, its distal border lacking a groove. (35) Deltoid crest moderately developed, slightly inflected, its summit knoblike. (36) Entepicondyle produced slightly beyond level of internal condyle. (37) Entepicondylar prominence moderately produced, its pit on palmar face. (38) Depression of M. brachialis anticus shallowly excavated. (39) Distal border of external condyle rounded in anconal view.

ULNA. (40) Olecranon process strongly produced, its apex pointed. (41) External cotyla moderately elongate, rounded throughout, its distal border sloping gently into shaft, only slightly notched by proximal radial impression. (42) Impression for M. brachialis anticus excavated, its borders distinct. (43) Height at middle of shaft 60 to 63 percent of height just distal to external cotyla. (44) Distal radial impression obsolete. (45) Notch between carpal tuberosity and internal condyle well developed. (46) External condyle moderately produced, usually arising abruptly from shaft, usually rounded throughout.

CARPOMETACARPUS. (47) Metacarpal I usually moderately pointed terminally. (48) Ridge separating anterior carpal fossa from excavated area above pisiform process produced, extends well onto base of metacarpal I. (49) Pisiform process oval or ovaloid in internal view, slightly reflected dorsad, thus usually below, occasionally at level of dorsal rim of inner carpal trochlea. (50) Ligamental attachment of pisiform process produced and moderately swollen proximally, flattened distally, proximal portion connected to pisiform process by bony bridge. (51) Internal carpal trochlea with proximal border shallowly concave, its ventral border without notch. (52) Intermetacarpal tubercle not reaching or barely extending to metacarpal III, distally placed with small space between its posterior border and junction of metacarpals II

and III. (53) Tubercle on internal proximal face of metacarpal III elongate and moderately produced. (54) One obsolete to weakly developed tubercle on external proximal face of metacarpal III. (55) Metacarpal III slightly bowed.

PELVIS. (56) Width of pelvis through antitrochanters 50 to 54 percent length of innominate from anterior edge of ilium to ischial angle. (57) Pectineal process obsolete, only slightly produced beyond acetabular border as a minute point. (58) Depression on medial side of pectineal process obsolete, without foramen. (59) Posterior iliac crest with prominence strongly produced from just posterior to ilio-ischiac fenestra. (60) No ridge or prominence ventral to posterior iliac crest. (61) Dorsal face of postacetabular ilium narrow anteriad, further narrowing gently posteriad to form pointed apex of much elongated, narrow, dorsal roof of posterior process. (62) Caudal face of postacetabular ilium, obsolete, narrowly triangular, horizontal in position, forming ventral floor of posterior process. (63) Lateral face of postacetabular ilium with its posterodorsal apex much pointed, forming much elongated lateral wall of posterior process. (64) Renal bar broad, bar, but not posterior process, excavated by renal depression. (65) Ischium at angle of about 145 degrees to ventral edge of posterior iliac crest. (66) Width through transverse processes of fourth synsacral vertebra 67 to 71 percent of length of synsacrum from centrum of first synsacral vertebra through transverse process of fourth synsacral vertebra.

FEMUR. (67) Distal width 17 to 19 percent of length. (68) Head moderately enlarged, neither bent dorsally nor rotated posteriorly. (69) Neck short. (70) Iliac facet without compression, posterior border convex. (71) Dorsal crest of trochanter depressed and deflected, its dorsal border flat. (72) Trochanteric ridge 23 to 25 percent length of femur. (73) Distal depth 75 to 79 percent of distal width. (74) Internal condyle moderately wide, its anterior border usually weakly produced throughout. (75) External condyle compressed, rounded anteriorly.

TIBIOTARSUS. (76) Depth of inner cnemial crest 37 to 46 percent of its length. (77) Outer cnemial crest usually straight. (78) Interarticular tubercle weakly produced. (79) Area between external articular surface and outer cnemial crest moderately concave in dorsal view. (80) Posterior margin between external and internal articular surface with distinct notch. (81) Area just anterior to ridge for proximal internal ligamental attachment without deeply excavated depression. (82) Internal ligamental prominence on internal condyle moderately produced. (83) Face of internal condyle moderately excavated, its

border moderately elevated. (84) Dorsal border of supratendinal bridge straight.

TARSOMETATARSUS. (85) Distal width 21 to 22 percent of length. (86) Proximal depth 95 to 98 percent of proximal width. (87) Intercotylar prominence moderately deflected, its apex pointed. (88) Posterior intercotylar area usually moderately excavated as a triangular depression. (89) Area surrounding posterior opening of inner proximal foramen moderately excavated. (90) Hypotarsus with 2 well-developed and 1 obsolete calcaneal ridges, 2 calcaneal grooves, and 2 closed calcaneal canals. (91) Anterior face of shaft usually moderately excavated by anterior metatarsal groove. (92) Depth of middle trochlea 46 to 58 percent of distal width. (93) Trochlea for digit II moderately inflected. (94) Wing of trochlea for digit IV depressed dorsoventrally, thus entire trochlea much deeper than long.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 78 to 81 percent. (96) Ulna/humerus 93 to 94 percent. (97) Tarsometatarsus/femur 70 to 73 percent. (98) Tarsometatarsus/tibiotarsus 53 to 56 percent. (99) Humerus/femur 95 to 101 percent. (100) Humerus/tibiotarsus 72 to 75 percent. (101) Ulna/femur 88 to 93 percent. (102) Ulna/tibiotarsus 68 to 71 percent. (103) Ulna/tarsometatarsus 126 to 133 percent. (104) Carpometacarpus/femur 50 to 52 percent. (105) Carpometacarpus/tibiotarsus 38 to 40 percent. (106) Carpometacarpus/tarsometatarsus 71 to 74 percent. (107) Tarsometatarsus/humerus 70 to 74 percent. (108) Ilium/sternum 72 to 76 percent. (109) Height of sternal carina/ilium 38 to 41 percent.

Rhynchortyx OGILVIE-GRANT, 1893

The monotypic genus *Rhynchortyx* occurs in the tropical lowlands from Honduras to Ecuador. Measurements of *R. cinctus* (Salvin, 1876) are given in table 1.

ROSTRUM. (1) Short and deep. (2) Nasal fossae round.

STERNUM. (3) Height of carina through sternal plate 35 percent length of sternum. (4) Dorsal lip of coracoidal sulcus projected only slightly beyond ventral lip. (5) Depressions on anterior portion of sternal plate deep and pneumatic. (6) Base of posterior lateral process less than one-half width of sternal plate at its middle.

CORACOID. (7) Entire proximal end straight above procoracoid process. (8) Head broadly rounded, much depressed, moderately inflected. (9) Brachial tuberosity with slight dorsal and obsolete ventral overhang. (10) Furcular facet obsolete. (11) Bicipital attachment weakly developed, margin between it and head straight. (12) Shaft

wide proximally, distal portion of ventral surface convex medially. (13) Procoracoid process with apex rounded. (14) Dorsal intermuscular line swinging out to medial surface of shaft, distal half sharply raised. (15) Ventral intermuscular line terminating at tip of sterno-coracoid process. (16) Dorsal face weakly excavated distally, without fossa. (17) Tubercle for ligamentum sterno-coracoideum dorsale obsolete, irregular in shape. (18) Internal distal angle with distinct but weakly developed dorsal ridge extending obliquely to above lateral end of sternal facet. (19) Sterno-coracoidal process with distal margin moderately oblique, produced as a sharply raised ridge, without dorsal groove; its tip directed laterally and ending in a terminal knob. (20) Distal border of sternal facet deeply concave.

Scapula. (21) Glenoid facet oval in dorsal view. (22) Dorsal depression just mediad to glenoid facet obsolete. (23) Bridge between acromion process and glenoid facet more than one-half width of glenoid facet. (24) Acromion process with apex truncated, slightly deflected.

Humerus. (25) Pneumatic fossa a moderately long ellipse, without inner shelf. (26) Median crest strongly developed, elevated only at its middle. (27) Capital groove moderately excavated, its internal margin moderately elevated. (28) Margin between head and internal tuberosity, moderately concave. (29) Head broader than long in anconal view. (30) Ridge along medial border of fossa II moderately swollen, elongate, its apex acute. (31) Fossa II well developed. (32) Latissimus ridge originating on lateral edge of shaft but swinging in onto anconal face proximally. (33) External tuberosity moderately inflated. (34) Bicipital crest arising abruptly from shaft, rounded, a shallow groove in its distal margin. (35) Deltoid crest moderately developed, slightly inflected, its summit knoblike. (36) Entepicondyle at level of internal condyle. (37) Entepicondylar prominence much produced, its pit on palmar face. (38) Scar for M. brachialis anticus without excavation. (39) Distal border of external condyle rounded in anconal view.

Ulna. (40) Olecranon process weakly produced, its apex rounded. (41) External cotyla moderately elongate, rounded throughout, its distal border sloping gently into shaft, deeply notched by proximal radial impression. (42) Impression for M. brachialis anticus excavated, its borders distinct. (43) Height at middle of shaft 61 percent of height just distal to external cotyla. (44) Distal radial impression obsolete. (45) Notch between carpal tuberosity and internal condyle well developed. (46) External condyle weakly produced, arising gently from shaft, rounded throughout.

CARPOMETACARPUS. (47) Metacarpal I moderately pointed terminally. (48) Ridge separating anterior carpal fossa from excavated area above pisiform process produced, extending well onto base of metacarpal I. (49) Pisiform process elliptical in internal view, slightly reflected dorsad, thus below level of dorsal rim of inner carpal trochlea. (50) Ligamental attachment of pisiform process weakly produced and only slightly swollen proximally, flattened distally, proximal portion connected to pisiform process by bony bridge. (51) Internal carpal trochlea with proximal border shallowly concave, its ventral border without notch. (52) Intermetacarpal tubercle extending to but not ankylosing with metacarpal III, distally placed with a small space between posterior border and junction of metacarpals II and III. (53) Tubercle on internal proximal face of metacarpal III elongate and moderately produced. (54) One obsolete tubercle on external proximal face of metacarpal III. (55) Metacarpal III slightly bowed.

PELVIS. (56) Width of pelvis through antitrochanters 59 percent length of innominate from anterior edge of ilium to ischial angle. (57) Pectineal process obsolete, only slightly produced beyond acetabular border as a minute point. (58) Depression on medial side of pectineal process obsolete, without foramen. (59) Posterior iliac crest with prominence weakly produced from just posterior to ilio-ischiac fenestra. (60) Without ridge or prominence ventral to posterior iliac crest. (61) Dorsal face of postacetabular ilium moderately broadened anteriad, narrowing gently posteriad to form truncated apex of moderately long, narrow, dorsal roof of posterior process. (62) Caudal face of postacetabular ilium obsolete, rectangular, horizontal in position, forming ventral floor of posterior process. (63) Lateral face of postacetabular ilium with posterodorsal apex truncated, forming moderately elongate lateral wall of posterior process. (64) Renal bar broad, bar slightly excavated, but posterior process unexcavated by renal depression. (65) Ischium at angle of about 160 degrees to ventral edge of posterior iliac crest. (66) Width through transverse processes of fourth synsacral vertebra 92 percent length of synsacrum from centrum of first synsacral vertebra through transverse process of fourth synsacral vertebra.

FEMUR. (67) Distal width 18 percent of length. (68) Head moderately enlarged, bent dorsally, but without posterior rotation. (69) Neck moderately long. (70) Iliac facet without compression, posterior border convex. (71) Dorsal crest of trochanter obsolete, its dorsal border flat. (72) Trochanteric ridge 12 percent length of femur. (73) Distal depth 71 percent of distal width. (74) Internal condyle moderately wide, its anterior border much produced throughout. (75) External condyle compressed, rounded anteriorly.

TIBIOTARSUS. (76) Depth of inner cnemial crest 75 percent of its length. (77) Outer cnemial crest decurved. (78) Interarticular tubercle moderately produced. (79) Area between external articular surface and outer cnemial crest moderately concave in dorsal view. (80) Posterior margin between external and internal articular surface with distinct notch. (81) Area just anterior to ridge for proximal internal ligamental attachment without deeply excavated depression. (82) Area of internal ligamental attachment on internal condyle not produced as a prominence. (83) Face of internal condyle weakly excavated, its border weakly elevated. (84) Dorsal border of supratendinal bridge oblique.

TARSOMETATARSUS. (85) Distal width 16 percent of length. (86) Proximal depth 95 percent of proximal width. (87) Intercotylar prominence depressed, without deflection, its apex broadly rounded. (88) Posterior intercotylar area unexcavated. (89) Area surrounding posterior opening of inner proximal foramen shallowly excavated. (90) Hypotarsus with 3 well-developed calcaneal ridges, 2 calcaneal grooves, and 1 closed calcaneal canal. (91) Anterior face of shaft extensively excavated by anterior metatarsal groove. (92) Depth of middle trochlea 56 percent of distal width. (93) Trochlea for digit II only slightly inflected. (94) Wing of trochlea for digit IV depressed dorsoventrally, thus entire trochlea much deeper than long.

INTERMEMBRAL PROPORTIONS. (95) Wing/leg 67 percent. (96) Ulna/humerus 98 percent. (97) Tarsometatarsus/femur 88 percent. (98) Tarsometatarsus/tibiotarsus 63 percent. (99) Humerus/femur 85 percent. (100) Humerus/tibiotarsus 61 percent. (101) Ulna/femur 87 percent. (102) Ulna/tibiotarsus 62 percent. (103) Ulna/tarsometatarsus 99 percent. (104) Carpometacarpus/femur 48 percent. (105) Carpometacarpus/tibiotarsus 34 percent. (106) Carpometacarpus/tarsometatarsus 55 percent. (107) Tarsometatarsus/humerus 103 percent. (108) Ilium/sternum 68 percent. (109) Height of sternal carina/ilium 52 percent.

SUMMARY OF GENERIC CHARACTERS

Important osteological characters of the New World quails are of four main types: (1) Characters of the pelvis that tend to divide the New World quails into two major groups. An example is the poorly developed, slender, renal bar in *Dendrortyx, Philortyx, Oreortyx, Callipepla, Colinus,* and *Lophortyx,* and the well-developed, broad renal bar in *Odontophorus, Dactylortyx, Cyrtonyx,* and *Rhynchortyx.* (2) Primitive characters that are apparently holdovers from less highly

evolved groups (Holman, MS). An example is the indistinct fossa II of the humerus in *Dendrortyx* and *Odontophorus*. (3) Characters that are unique in certain genera, as the short, deep rostrum with round nasal fossae in *Rhynchortyx*. (4) Characters that are not unique, but may be used in combination with other characters for generic definition.

When a character occurs in most but not all individuals of the genus, the condition is modified by "usually." Characters that hold in some genera, but vary specifically or show much individual variation in other genera, are listed as "variable." Characters that show much individual variation in all genera, and ratios that would probably overlap in larger series, are omitted from the following section.

ROSTRUM. The rostrum is relatively long and shallow and the nasal fossae are elliptical in most New World quails. In *Rhynchortyx* the rostrum is much shorter and deeper, and its nasal fossae are round.

STERNUM. The dorsal lip of the coracoidal sulcus projects well beyond the ventral lip in most genera. In *Dactylortyx* the dorsal lip projects only slightly beyond the ventral lip, and in *Rhynchortyx* the dorsal lip lies even with or projected only slightly beyond the ventral lip. The character is variable in *Cyrtonyx* and *Odontophorus*.

The depressions on the anterior portion of the sternal plate are deep and very pneumatic in *Rhynchortyx*, deep and moderately pneumatic in *Oreortyx*, deep and slightly pneumatic in *Philortyx*, shallow and slightly pneumatic in *Dendrortyx*, usually shallow and nonpneumatic in *Colinus*, shallow and nonpneumatic in *Cyrtonyx*, shallow or obsolete and nonpneumatic in *Dactylortyx*, obsolete and nonpneumatic in *Odontophorus*, and variable in *Callipepla* and *Lophortyx*.

The base of the posterior lateral process is narrow and less than one-half the width of the sternal plate at its middle in most genera, but it is wide and more than one-half the width of the sternal plate at its middle in *Dendrortyx*.

CORACOID. The entire proximal end is straight above the level of the procoracoid process in most species, but it is bent ventrad above the level of the procoracoid process in *Dendrortyx*.

The head is narrowly rounded and moderately compressed in most genera, but it is pointed and much compressed in *Philortyx*, broadly rounded and much depressed in *Dendrortyx* and *Rhynchortyx*, and broadly rounded and moderately depressed in *Oreortyx*.

The head is moderately inflected in *Callipepla*, *Lophortyx*, *Dactylortyx*, *Cyrtonyx*, and *Rhynchortyx*, and much inflected in *Dendror-*

tyx, but it is moderately reflected in *Oreortyx*, much reflected in *Philortyx*, and variable in *Colinus* and *Odontophorus*.

The brachial tuberosity has a slight dorsal and ventral overhang in most genera, but it has a moderate dorsal and slight ventral overhang in *Dendrortyx*, a slight dorsal and obsolete ventral overhang in *Rhynchortyx*, an obsolete dorsal and slight ventral overhang in *Philortyx*, and is variable in *Odontophorus*.

The furcular facet is obsolete in *Rhynchortyx* and *Cyrtonyx*, weakly inflated in *Dendrortyx*, *Philortyx*, and *Lophortyx*, moderately inflated in *Oreortyx*, *Callipepla*, and *Dactylortyx*, much inflated in *Odontophorus*, and variable in *Colinus*.

The bicipital attachment is well developed, with the margin between it and the head concave in most genera, but in *Rhynchortyx* it is weakly developed and with the margin between it and the head straight.

The procoracoid process has its apex rounded in most genera, but it is acute in *Philortyx* and *Callipepla*, and it is variable in *Colinus*.

The dorsal intermuscular line swings out to the medial surface of the shaft in most genera, but the line swings out to the lateral border of the shaft in *Dendrortyx*. The distal half of the dorsal intermuscular line is sharply raised in most forms, but the sharply raised portion is confined to the distal three-fourths in *Dactylortyx*, the distal two-thirds or three-fourths in *Odontophorus*, and only the distal one-fifth in *Dendrortyx*.

The ventral intermuscular line terminates at the tip of the sterno-coracoidal process in most genera. It terminates in the middle of the distal border of the sterno-coracoidal process in *Dendrortyx*.

The dorsal face is weakly excavated distally in *Dendrortyx*, *Philortyx*, *Oreortyx*, *Callipepla*, and *Rhynchortyx*, moderately excavated distally in *Colinus*, deeply excavated distally in *Cyrtonyx* and *Dactylortyx*, and variable in *Lophortyx* and *Odontophorus*. The dorsal face lacks a distinct fossa in most genera, but has a distinct, round, deep fossa below the tubercle for the ligamentum sterno-coracoideum dorsale and above the external end of the sternal facet in *Dendrortyx*.

The tubercle for the ligamentum sterno-coracoideum dorsale is obsolete and irregular in shape in *Rhynchortyx* and *Odontophorus*, obsolete and rounded in *Dendrortyx* and *Callipepla*, well developed but irregular in shape in *Oreortyx*, well developed and rounded in *Philortyx*, and variable in the other genera.

The internal distal angle is without a distinct tubercle or ridge in most Odontophoridae. It has a distinct but irregular tubercle that

extends obliquely to above the lateral end of the sternal facet in *Oreortyx* and *Callipepla*. In *Philortyx* and *Rhynchortyx* it has a distinct oblique ridge; this structure is weakly developed in the latter genus.

The sterno-coracoidal process has its distal margin slightly oblique, neither produced as a sharply raised ridge, nor grooved dorsally, and its tip is directed laterally and possesses a terminal knob in most New World quails. *Philortyx* differs in that the distal margin of the sterno-coracoidal process is moderately oblique, *Rhynchortyx* in that the distal margin is moderately oblique and produced as a sharply raised ridge, and *Dendrortyx* in that the distal margin is strongly oblique, grooved dorsally, with the tip of the sterno-coracoidal process directed proximally and without a terminal knob.

The distal border of the sternal facet is deeply concave in *Oreortyx, Rhynchortyx,* and *Dactylortyx,* usually deeply concave in *Colinus,* shallowly concave in *Philortyx,* very shallowly concave in *Dendrortyx,* and variable in the other genera.

SCAPULA. The glenoid facet is oval in dorsal view in most forms, but it is elliptical in dorsal view in *Dendrortyx* and variable in *Odontophorus.*

The bridge between the acromion process and glenoid facet is about one-half the width of the glenoid facet in most genera, but about one-third the width in *Philortyx,* and variable in *Colinus, Lophortyx,* and *Odontophorus.*

The acromion process has its apex rounded in most genera, but it is acute in *Dendrortyx* and *Oreortyx,* and truncated in *Rhynchortyx.* The amount of deflection of the acromion process shows much intrageneric variation, but it is much more strongly deflected in *Cyrtonyx* than in the other forms.

The shape of the pneumatic fossa shows much variation within genera, but only one species, *Odontophorus gujanensis,* has a perforated inner shelf that extends from the external bicipital surface to the medial bar.

The median crest is strongly to very strongly developed in *Odontophorus,* strongly developed in *Dendrortyx, Oreortyx, Cyrtonyx, Rhychortyx,* and *Dactylortyx,* moderately to strongly developed in *Colinus,* usually weakly developed in *Callipepla,* weakly developed in *Philortyx,* and variable in *Lophortyx.* The median crest is elevated only at its middle in most genera, but is elevated throughout in *Dendrortyx, Philortyx,* and *Odontophorus,* and variable in *Lophortyx.*

The capital groove is moderately excavated and its internal margin is moderately elevated in most New World quails, but it is deeply

excavated with its internal margin strongly elevated in *Dendrortyx* and *Philortyx*.

The margin between the head and internal tuberosity is moderately concave in most genera, but is only slightly concave in *Dendrortyx*.

The head is broader than long in most genera, but it is about as long as broad in *Dendrortyx* and *Philortyx* and is variable in *Lophortyx*.

The ridge along the medial border of fossa II is moderately swollen in *Callipepla, Lophortyx, Odontophorus, Cyrtonyx,* and *Rhynchortyx,* slightly to moderately swollen in *Colinus,* slightly swollen in *Dendrortyx* and *Philortyx,* and much swollen in *Oreortyx* and *Dactylortyx*. The ridge along the medial border of fossa II is elongate and pointed in most genera, but it is short and rounded in *Dactylortyx*.

Fossa II is well developed in most forms but is obsolete in *Dendrortyx* and *Odontophorus*.

The latissimus ridge originates on the lateral edge of the shaft and swings onto the anconal face proximally in most New World quails, but the ridge extends along the lateral edge of the shaft throughout its length in *Dendrortyx*.

The external tuberosity is moderately inflated in most forms, but it is much inflated in *Oreortyx* and variable in *Odontophorus*.

The bicipital crest arises gently from the shaft in most odontophorids but arises abruptly from the shaft in *Rhynchortyx*. The bicipital crest is pointed in *Philortyx, Oreortyx, Cyrtonyx,* and *Dactylortyx,* usually narrowly rounded in *Colinus,* narrowly rounded in *Callipepla* and *Lophortyx,* and rounded in *Dendrortyx, Rhynchortyx,* and *Odontophorus*. The bicipital crest lacks a groove in its distal margin in most forms, but has a shallow groove in *Rhynchortyx*.

The deltoid crest is moderately developed in most forms, but it is much developed in *Dendrortyx,* and variable in *Odontophorus*. The deltoid crest is slightly inflected in most forms but is much inflected in *Dendrortyx*. The summit of the deltoid crest is knoblike in most, but it is usually flattened in *Lophortyx,* and variable in *Colinus*.

The entepicondyle is at the level of the internal condyle in *Dendrortyx, Oreortyx, Callipepla,* and *Rhynchortyx,* usually at the same level in *Colinus* and *Dactylortyx,* and produced slightly beyond the internal condyle in *Philortyx, Lophortyx, Odontophorus,* and *Cyrtonyx*.

The entepicondylar prominence is weakly produced in *Dendrortyx,* moderately produced in *Philortyx, Oreortyx, Callipepla, Colinus, Lophortyx,* and *Cyrtonyx,* and much produced in *Odontophorus, Dactylor-*

tyx, and *Rhynchortyx*. The pit of the entepicondylar prominence is placed on the internal face of the humerus in most forms, but it is on the palmar face in *Callipepla*, *Cyrtonyx*, and *Rhynchortyx*.

The depression for the M. brachialis anticus is deeply excavated in *Dendrortyx* and *Philortyx*, usually moderately excavated in *Colinus*, moderately excavated in *Lophortyx* and *Odontophorus*, usually shallowly excavated in *Callipepla*, shallowly excavated in *Oreortyx*, *Cyrtonyx*, and *Dactylortyx*, and represented by an unexcavated scar in *Rhynchortyx*.

The distal border of the external condyle is usually rounded in anconal view, but it is flat in *Dendrortyx*.

ULNA. The olecranon process is usually strongly produced, but is weakly produced in *Rhynchortyx*. The apex of the olecranon process is pointed in most forms, but it is rounded in *Dendrortyx* and *Rhynchortyx*, and truncated in *Dactylortyx*.

The external cotyla is moderately elongate in most genera, but it is much elongated in *Oreortyx*, and shortened in *Dendrortyx*. The external cotyla is rounded throughout, and its distal border slopes gently into the shaft in most forms, but it is flattened dorsally with its distal border sloping precipitously into the shaft in *Dendrortyx*, and it is variable in *Odontophorus*. The external cotyla is slightly notched by the proximal radial impression in *Oreortyx*, *Callipepla*, *Colinus*, *Cyrtonyx*, and *Dactylortyx*, usually slightly notched in *Colinus*, deeply notched in *Dendrortyx*, *Philortyx*, and *Rhynchortyx*, and is variable in *Odontophorus*.

The impression for the M. brachialis anticus is excavated with its borders distinct in most genera, but it is represented by an unexcavated scar with indistinct borders in *Philortyx*.

The height at the middle of the shaft usually ranges from 60 to 72 percent of the height of the shaft just distal to the external cotyla, with much overlap of ranges between genera. This ratio is 83 percent in *Dendrortyx* and 85 percent in *Philortyx*.

The distal radial impression is obsolete in most genera, well excavated in *Dendrortyx*, and variable in *Odontophorus*.

The notch between the carpal tuberosity and internal condyle is well developed in most forms, but it is obsolete in *Dendrortyx*.

The external condyle is well produced in *Philortyx*, *Callipepla*, *Colinus*, *Lophortyx*, and *Odontophorus*, moderately produced in *Oreortyx*, *Cyrtonyx*, and *Dactylortyx*, and weakly produced in *Dendrortyx* and *Rhynchortyx*. The external condyle arises abruptly from the shaft in most forms, usually arises abruptly from the shaft in *Cyrtonyx*,

but arises gently from the shaft in *Oreortyx, Lophortyx,* and *Rhynchortyx.* The external condyle is rounded throughout in most genera, usually rounded in *Cyrtonyx* and *Dactylortyx,* but has its ventral border flattened in *Dendrortyx* and *Philortyx.*

CARPOMETACARPUS. Metacarpal I is moderately pointed terminally in *Dendrortyx, Philortyx, Callipepla, Odontophorus,* and *Rhynchortyx,* usually moderately pointed terminally in *Cyrtonyx,* sharply pointed terminally in *Oreortyx,* usually rounded terminally in *Dactylortyx,* and variable in *Colinus* and *Lophortyx.*

The ridge that separates the anterior carpal fossa from the excavated area above the pisiform process is produced and extends well onto the base of metacarpal I in most odontophorids, but it is weak and extends only slightly onto the base of metacarpal I in *Dendrortyx.*

The pisiform process is ovaloid in internal view in *Oreortyx, Lophortyx, Dactylortyx,* and *Odontophorus,* elliptical in *Rhynchortyx,* round in *Dendrortyx* and *Philortyx,* and variable in *Callipepla, Colinus,* and *Cyrtonyx.* The pisiform process is slightly reflected dorsad and thus is below the level of the dorsal rim of the inner carpal trochlea in *Oreortyx, Rhynchortyx, Dactylortyx,* and *Odontophorus,* slightly reflected dorsad and usually below, but occasionally at the level of the inner carpal trochlea in *Callipepla, Colinus,* and *Cyrtonyx,* moderately reflected dorsad and thus produced slightly above the dorsal rim of the inner carpal trochlea in *Philortyx,* much reflected dorsad and produced well above the dorsal rim of the inner carpal trochlea in *Dendrortyx,* and variable in *Lophortyx.*

The ligamental attachment of the pisiform process is produced and much swollen proximally and flattened distally in most species. *Odontophorus* differs in that the ligamental attachment is moderately or much swollen proximally, *Cyrtonyx* in that it is moderately swollen proximally, and *Rhynchortyx* in that it is weakly produced and only slightly swollen proximally, and *Dendrortyx* in that the ligamental attachment of the pisiform process is produced throughout and moderately swollen proximally and distally. The proximal portion of the ligamental attachment of the pisiform process is connected to the pisiform process by a bony bridge in most genera; the attachment is usually connected by a bony bridge in *Colinus,* separated from the pisiform process by a shallow sulcus in *Dendrortyx,* and variable in *Odontophorus.*

The proximal border of the internal carpal trochlea is shallowly concave in *Dendrortyx, Philortyx, Rhynchortyx, Cyrtonyx,* and *Dactylortyx,* distinctly concave in *Oreortyx,* usually slightly notched in

Lophortyx and *Odontophorus*, deeply notched in *Callipepla*, and variable in *Colinus*. The ventral border of the internal carpal trochlea is without a notch in most genera, but it has a slight notch in *Dendrortyx* and *Oreortyx*.

The intermetacarpal tubercle extends to or slightly beyond metacarpal III without ankylosing with it in most New World quails; it extends to and sometimes ankyloses with metacarpal III in *Lophortyx*, extends to and ankyloses with metacarpal III in *Dendrortyx*, and does not reach or barely extends to metacarpal III in *Cyrtonyx*. The intermetacarpal tubercle is relatively distally placed and has a small space between its posterior border and junction of metacarpals II and III in most genera, but it is more proximally placed and with only a minute space between its posterior border and junction of metacarpals II and III in *Dactylortyx*.

The tubercle on the internal proximal surface of metacarpal III is obsolete in most forms, but it is elongate and weakly produced in *Philortyx*, and elongate and moderately produced in *Oreortyx*, *Cyrtonyx*, and *Rhynchortyx*.

The external proximal face of metacarpal III has a single strongly developed tubercle in *Oreortyx*, *Callipepla*, *Colinus*, *Lophortyx*, and *Odontophorus*, a single moderately developed tubercle in *Philortyx* and *Dactylortyx*, a single obsolete to weakly developed tubercle in *Cyrtonyx*, a single obsolete tubercle in *Rhynchortyx*, and one moderately developed and one obsolete tubercle in *Dendrortyx*.

Metacarpal III is slightly bowed in most forms, but is moderately bowed in *Dendrortyx*.

PELVIS. The pelvis of *Dendrortyx*, *Philortyx*, and *Colinus* is relatively narrow, and the ratio of the width of the pelvis through the antitrochanters divided by the length of the innominate from the anterior edge of the ilium to the ischial angle ranges from 44 to 51 percent. The pelvis of *Oreortyx*, *Callipepla*, and *Rhynchortyx* is relatively wide, the ratio being 59 percent in *Rhynchortyx*, 58 to 62 percent in *Callipepla*, and 60 to 63 percent in *Oreortyx*. The remaining genera are poorly separable on this character.

The pectineal process is moderately produced beyond the acetabular border with its apex pointed in *Philortyx*, *Oreortyx*, *Callipepla*, and *Lophortyx*, usually pointed in *Colinus*, but rounded in *Dendrortyx*. The pectineal process is only slightly produced beyond the acetabular border as a minute point in *Odontophorus*, *Cyrtonyx*, and *Rhynchortyx*, and in *Dactylortyx* it is usually absent or at most, represented by a minute point.

The depression on the medial side of the pectineal process is deeply excavated and perforated by a foramen in *Dendrortyx,* deeply excavated and without a foramen in *Philortyx,* and shallowly excavated and without a foramen in *Oreortyx, Callipepla, Colinus,* and *Lophortyx.* The depression on the medial side of the pectineal process is obsolete and without a foramen in *Odontophorus, Cyrtonyx,* and *Rhynchortyx,* and absent in *Dactylortyx.*

The posterior iliac crest lacks a prominence in most genera. A prominence is weakly produced just posterior to the ilio-ischiac fenestra in *Rhynchortyx,* moderately produced in *Dactylortyx,* and strongly produced in *Cyrtonyx.*

A ridge originates on the posterior iliac crest at the level of the ilio-ischiac fenestra, continues ventrad and posteriad towards the posterior border of the ilium, and has a prominence arising from its posterior portion in most species. The prominence arises sharply in *Dendrortyx, Philortyx, Lophortyx,* and *Colinus,* but it is weak in *Oreortyx* and *Callipepla.* The ridge and prominence are absent in *Dactylortyx, Cyrtonyx,* and *Rhynchortyx. Odontophorus* is variable in this character.

The dorsal face of the postacetabular ilium is moderately broad anteriad and narrows abruptly posteriad to form the acute apex of the short, broad, dorsal roof of the posterior process in *Dendrortyx, Philortyx, Callipepla, Colinus,* and *Lophortyx.* It is much broadened anteriad, and narrows abruptly posteriad to form the acute apex of the short, broad, dorsal roof of the posterior process in *Oreortyx.* In *Dactylortyx* and *Rhynchortyx* the dorsal face of the postacetabular ilium is moderately broadened anteriad and narrows abruptly posteriad to form the truncated apex of the moderately long, narrow, dorsal roof of the posterior process. *Cyrtonyx* has the dorsal face of the postacetabular ilium narrow anteriad, and it gradually further narrows posteriad to form the pointed apex of the much elongated, narrow, dorsal roof of the posterior process. *Odontophorus* is variable in this character.

The caudal face of the postacetabular ilium is enlarged, triangular, and vertical in position, and its posterodorsal apex forms the posteromedial wall of the posterior process in *Dendrortyx, Philortyx, Callipepla, Colinus,* and *Lophortyx. Oreortyx* differs only in that the caudal face is broadly triangular. The caudal face of the postacetabular ilium is obsolete, horizontal in position, and forms the ventral floor of the posterior process in *Odontophorus, Dactylortyx, Cyrtonyx,* and *Rhynchortyx.* It is rectangular in shape in *Dactylortyx* and *Rhynchortyx,* triangular in *Odontophorus,* and narrowly triangular in *Cyrtonyx.*

The lateral face of the postacetabular ilium generally has an acute posterodorsal apex, but it is much pointed in *Cyrtonyx* and truncated in *Rhynchortyx*. It forms the shortened lateral wall of the posterior process in most genera, but is moderately elongate in *Rhynchortyx*, elongate in *Dactylortyx*, moderately to much elongated in *Odontophorus*, and much elongated in *Cyrtonyx*.

The renal bar is slender, and both the bar and the posterior process are excavated by the renal depression in *Dendrortyx*, *Callipepla*, *Colinus*, and *Lophortyx*. It is moderately slender in *Philortyx*, obsolete in *Oreortyx*, and both the renal bar and the posterior process are excavated by the renal depression in these genera. The renal bar is broad; the bar, but not the posterior process, is excavated by the renal depression in *Odontophorus*, *Dactylortyx*, and *Cyrtonyx*. The bar is broad but only slightly excavated in *Rhynchortyx*.

The ischium lies at an angle of about 160 degrees to the ventral edge of the posterior iliac crest in most genera, but it lies at an angle of about 145 degrees to the ventral edge of the posterior iliac crest in *Cyrtonyx*.

The synsacrum of *Dendrortyx* is long and narrow with a 55 percent ratio for the width through the transverse processes of the fourth synsacral vertebra divided by the length of the synsacrum from the centrum of the first synsacral vertebra through the transverse process of the fourth synsacral vertebra. The synsacra of *Rhynchortyx* and *Dactylortyx* are much shorter and wider, with the ratio 88 to 93 percent in *Dactylortyx* and 92 percent in *Rhynchortyx*. The other genera have the synsacrum shorter and wider than *Dendrortyx*, and longer and narrower than *Rhynchortyx* and *Dactylortyx*, but are poorly separable among themselves.

FEMUR. The head is moderately enlarged in most forms, but it is much enlarged in *Dactylortyx* and is variable in *Lophortyx*. The head is neither bent dorsally nor rotated posteriorly in most genera, but it is bent dorsally but without posterior rotation in *Rhynchortyx*, and bent dorsally and rotated posteriorly in *Dendrortyx*.

The neck is only moderately long in most forms, but it is long in *Dendrortyx*, and short in *Cyrtonyx*.

The iliac facet is without compression, and its dorsal border is flat in most genera, but it is compressed with its posterior border straight in *Dendrortyx*.

The dorsal crest of the trochanter is compressed and reflected with its dorsal border rounded in *Philortyx*, *Oreortyx*, *Callipepla*, *Dactylortyx*, usually compressed and reflected with the dorsal border rounded

in *Lophortyx*, depressed and deflected with its dorsal border flat in *Dendrortyx*, *Odontophorus*, and *Cyrtonyx*, obsolete and flattened in *Rhynchortyx*, and variable in *Colinus*.

The trochanteric ridge is normally about 20 to 25 percent of the length of the femur, but the ratio is only 12 percent in *Rhynchortyx*.

The distal depth is about 80 to 90 percent of the distal width in most genera, but the ratio is 71 percent in *Rhynchortyx*, and 97 percent in *Philortyx*.

The internal condyle is moderately wide and has its anterior border much produced throughout in most forms. *Cyrtonyx* differs only in that the anterior border of the internal condyle is weakly produced throughout. *Dactylortyx* differs in that the internal condyle is narrow and usually has its anterior border weakly produced throughout, whereas in *Philortyx* the anterior border of the condyle is very wide, and its border is moderately produced throughout.

The external condyle is ordinarily compressed and rounded anteriorly, but it is depressed and flattened in *Dendrortyx*.

TIBIOTARSUS. The depth of the inner cnemial crest is usually well over 50 percent of its length, but the ratio is 42 to 48 percent in *Dactylortyx*, 45 percent in *Philortyx*, and 37 to 46 percent in *Cyrtonyx*.

The outer cnemial crest is straight in *Oreortyx*, *Odontophorus*, and *Dactylortyx*, usually straight in *Callipepla*, *Colinus*, and *Cyrtonyx*, decurved in *Dendrortyx*, *Philortyx*, and *Rhynchortyx*, and variable in *Lophortyx*.

The interarticular tubercle is weakly produced in *Philortyx*, *Dactylortyx*, *Cyrtonyx*, moderately produced in *Dendrortyx*, *Callipepla*, *Lophortyx*, and *Rhynchortyx*, usually moderately produced in *Colinus*, moderately or strongly produced in *Odontophorus*, and strongly produced in *Oreortyx*.

The area between the external articular surface and outer cnemial crest, normally moderately concave in dorsal view, is moderately or deeply concave in *Odontophorus* and very deeply concave in *Dactylortyx*.

The posterior margin between the external and internal articular surface has a distinct notch in most genera, but it is weakly notched in *Dendrortyx*.

In most species the area just anterior to the ridge for the proximal internal ligamental attachment lacks the deeply excavated depression present in *Dendrortyx*.

The area of the internal ligamental attachment on the internal condyle is moderately produced as a prominence in most genera,

strongly produced in *Dendrortyx*, and lacks a prominence in *Dactylortyx* and *Rhynchortyx*.

The face of the internal condyle is moderately excavated with its border moderately elevated in most genera, but it is well excavated with its border highly elevated in *Dendrortyx*, and weakly excavated with a slightly elevated border in *Rhynchortyx*.

The dorsal border of the supratendinal bridge is straight in *Philortyx*, *Callipepla*, *Dactylortyx*, and *Cyrtonyx*, usually straight in *Oreortyx*, *Lophortyx*, and *Odontophorus*, oblique in *Dendrortyx* and *Rhynchortyx*, and variable in *Colinus*.

Tarsometatarsus. The intercotylar prominence is moderately deflected in most species, but it is much deflected in *Philortyx*, only slightly deflected in *Dactylortyx*, and depressed and without deflection in *Rhynchortyx*. The apex of the intercotylar prominence is pointed in *Dendrortyx*, *Philortyx*, *Lophortyx*, *Odontophorus*, and *Cyrtonyx*, usually pointed in *Oreortyx*, *Callipepla*, *Colinus*, and *Dactylortyx*, and broadly rounded in *Rhynchortyx*.

The posterior intercotylar area is moderately excavated as a triangular depression in *Dendrortyx*, *Odontophorus*, and *Dactylortyx*, usually moderately excavated as a triangular depression in *Cyrtonyx*, weakly excavated as a triangular depression in *Philortyx*, *Colinus*, and *Callipepla*, usually weakly excavated as a triangular depression in *Lophortyx*, unexcavated in *Rhynchortyx*, and usually unexcavated in *Oreortyx*.

The area surrounding the posterior opening of the inner proximal foramen is shallowly excavated in *Oreortyx*, *Callipepla*, *Colinus*, *Lophortyx*, and *Rhynchortyx*, moderately excavated in *Dactylortyx* and *Cyrtonyx*, deeply in *Dendrortyx* and *Philortyx*, and very deeply in *Odontophorus*.

The hypotarsus has 2 well developed and 1 obsolete calcaneal ridges in most genera, but there are 2 well developed and 1 weakly developed calcaneal ridges in *Dactylortyx*, and 3 well developed calcaneal ridges in *Rhynchortyx*. The hypotarsus has 2 closed calcaneal canals in most forms, but there is only 1 closed calcaneal canal in *Dendrortyx* and *Rhynchortyx*, usually 1 in *Oreortyx*, and the condition is variable in *Odontophorus*.

The anterior face of the shaft is extensively excavated by the anterior metatarsal groove in *Dendrortyx*, *Philortyx*, and *Rhynchortyx*, moderately excavated by the anterior metatarsal groove in *Callipepla*, usually moderately excavated in *Colinus* and *Cyrtonyx*, usually reduced in *Lophortyx*, reduced in *Odontophorus*, reduced or obsolete in *Dactylortyx*, and reduced or absent in *Oreortyx*.

The trochlea for digit II is only slightly inflected in most genera, but is moderately inflected in *Oreortyx, Dactylortyx,* and *Cyrtonyx.*

The wing of the trochlea for digit IV is depressed dorsoventrally with the entire trochlea much deeper than long in most genera, but in *Dendrortyx* and *Odontophorus* the wing is depressed anteroposteriorly, and the entire trochlea is longer than deep.

INTERMEMBRAL PROPORTIONS. The ratio of the combined length of the bones of the wing (humerus, ulna, carpometacarpus) divided by the combined length of the bones of the leg (femur, tibiotarsus, tarsometatarsus) divides the New World quails into three groups. *Dendrortyx* has a relatively short wing with a ratio of 52 percent. *Cyrtonyx* and *Dactylortyx* have relatively long wings; this ratio is 78 to 81 percent in *Cyrtonyx* and 72 to 73 percent in *Dactylortyx.* The other forms are intermediate; the ratio ranges from 60 to 69 percent, with considerable overlap among genera.

The ulna is more than 95 percent of the length of the humerus in *Odontophorus, Dactylortyx,* and *Rhynchortyx.* The other forms range from 86 to 94 percent in this ratio with much overlap.

The tarsometatarsus is more than 85 percent of the length of the femur in *Dendrortyx* and *Rhynchortyx* and 84 to 87 percent in *Odontophorus.* The other forms range from 70 to 83 percent in this ratio with much overlap among genera.

The tarsometatarsus is 63 percent or more of the length of the tibiotarsus in *Dendrortyx, Odontophorus,* and *Rhynchortyx.* The other forms range from 53 to 61 percent in this ratio with considerable overlap among genera.

The humerus is 71 percent of the length of the femur in *Dendrortyx,* but 90 to 91 percent in *Dactylortyx,* and 95 to 100 percent in *Cyrtonyx.* The other forms are intermediate with considerable overlap.

The humerus is 51 percent of the length of the tibiotarsus in *Dendrortyx* and 72 to 75 percent in *Cyrtonyx.* The other forms are intermediate with much overlap in the ratio among genera.

The ulna is 63 percent of the length of the femur in *Dendrortyx,* 87 percent in *Rhynchortyx,* 88 to 91 percent in *Dactylortyx,* and 89 to 93 percent in *Cyrtonyx.* The other forms are intermediate with considerable overlap.

The ulna is 45 percent of the length of the tibiotarsus in *Dendrortyx,* 65 to 66 percent in *Dactylortyx,* and 68 to 71 percent in *Cyrtonyx.* The others are intermediate with much overlap among genera.

The ulna is 72 percent of the length of the tarsometatarsus in

Dendrortyx and 126 to 133 percent in *Cyrtonyx*. The others are intermediate with considerable overlap among genera.

The carpometacarpus is 27 percent of the length of the tibiotarsus in *Dendrortyx*, and 38 to 40 percent in *Cyrtonyx*. The other forms are intermediate with much overlap.

The carpometacarpus is 42 percent of the length of the tarsometatarsus in *Dendrortyx*, and 71 to 74 percent in *Cyrtonyx*. The other forms are intermediate with much overlap among genera.

The tarsometatarsus is 124 percent of the length of the humerus in *Dendrortyx*, but only 70 to 74 percent in *Cyrtonyx*. The others are intermediate with considerable overlap.

The ilium is 89 percent of the length of the sternum in *Dendrortyx*, whereas this ratio ranges from 65 to 78 percent in the other forms, with much overlap among genera.

The height of the sternal carina is 34 percent of the length of the ilium in *Dendrortyx*, and 52 percent in *Rhynchortyx*. The other forms are intermediate with much overlap.

Major Relationships

The New World quails may be divided into two distinct groups on the basis of striking differences in pelvic structures (figs. 1 and 2), referred to here as the Dendrortyx group, and the Odontophorus group. The genera in each of the two groups are:

Dendrortyx group	Odontophorus group
Dendrortyx	*Odontophorus*
Philortyx	*Dactylortyx*
Oreortyx	*Cyrtonyx*
Callipepla	*Rhynchortyx*
Colinus	
Lophortyx	

Differences in the two basic pelvic types are: 1) In the *Dendrortyx* type the pectineal process is moderately produced beyond the acetabular border. In the *Odontophorus* type the pectineal process is represented only by a minute point or is absent. 2) In the *Dendrortyx* type the depression on the medial side of the pectineal process is distinct. The depression is obsolete or absent in the *Odontophorus* type. 3) In the *Dendrortyx* type the posterior iliac crest is without a prominence. A prominence is usually produced from the posterior iliac crest in the *Odontophorus* type. 4) In the *Dendrortyx* type a ridge originates on the posterior iliac crest at the level of the ilio-ischiac fenestra, continues ventrad and posteriad toward the posterior border of the ilium, and has a prominence that arises from its posterior por-

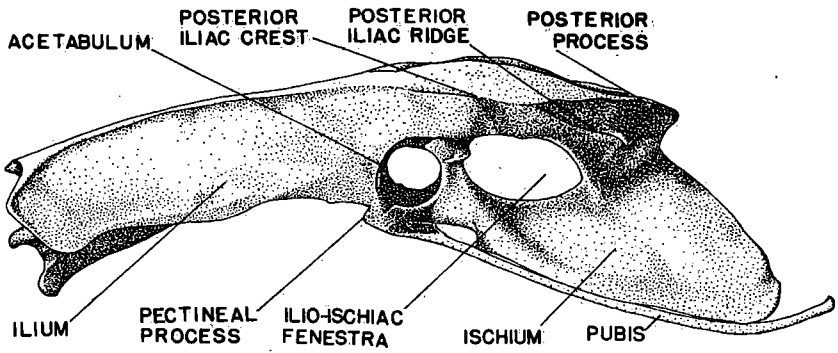
tion. In the *Odontophorus* type the ridge and prominence are absent, except in one specimen of *Odontophorus gujanensis*. 5) The dorsal face of the postacetabular ilium is relatively short and broad in the *Dendrortyx* type. In the *Odontophorus* type the dorsal face is relatively long and narrow. 6) In the *Dendrortyx* type the caudal face of the postacetabular ilium is enlarged, triangular, vertical in position, and its posterodorsal apex forms the posteromedial wall of the posterior process. In the *Odontophorus* type the caudal face of the postacetabular ilium is obsolete, variable in shape, horizontal in position, and forms the ventral floor of the posterior process. 7) The lateral face of the postacetabular ilium is relatively short in the *Dendrortyx* type. In the *Odontophorus* type the lateral face is relatively long. 8) In the *Dendrortyx* type the renal bar is poorly developed or obsolete, always slender, and both the bar and the posterior process are excavated by the renal depression. In the *Odontophorus* type the renal bar is well developed and broad, and the bar, but not the posterior process, is excavated by the renal depression.

The Dendrortyx Group

Dendrortyx. This genus appears to be the most primitive, as well as the most aberrant genus of the New World quails.

Numerous characters of *Dendrortyx* are suggestive of those in less advanced gallinaceous families as outlined by Holman (MS). The dorsal intermuscular line of the coracoid is sharply raised only along its distal fifth. The ventral intermuscular line of the coracoid terminates in the middle of the distal border of the sterno-coracoidal process. The dorsal face of the coracoid has a round deep fossa below the tubercle for the ligamentum sterno-coracoideum dorsale and above the external end of the sternal facet. This is probably a remnant of the deep pneumatic fossa found in this position in several less advanced families. The tip of the sterno-coracoidal process of the coracoid lacks a terminal knob. The depression on the medial side of the pectineal process of the pelvis is perforated by a foramen. The fossa II of the humerus is indistinct. The hypotarsus has only 1 closed calcaneal canal.

At the same time *Dendrortyx* is the most aberrant genus of the Odontophoridae, for it has 30 unique characters excluding intermembral proportions, and 41 unique characters including these proportions. The distinctive intermembral proportions in *Dendrortyx* reflect the fact that the leg bones are long in comparison with the wing bones, the ilium long in comparison with the sternum, and the height of the sternal carina low in comparison with the length of the ilium.



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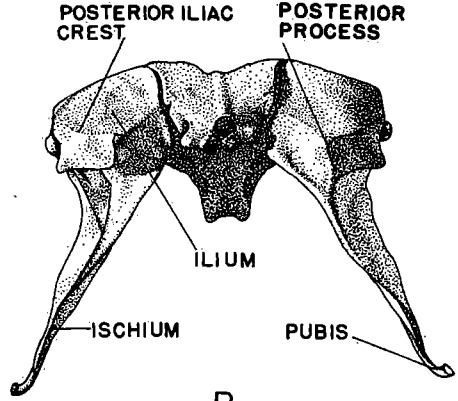

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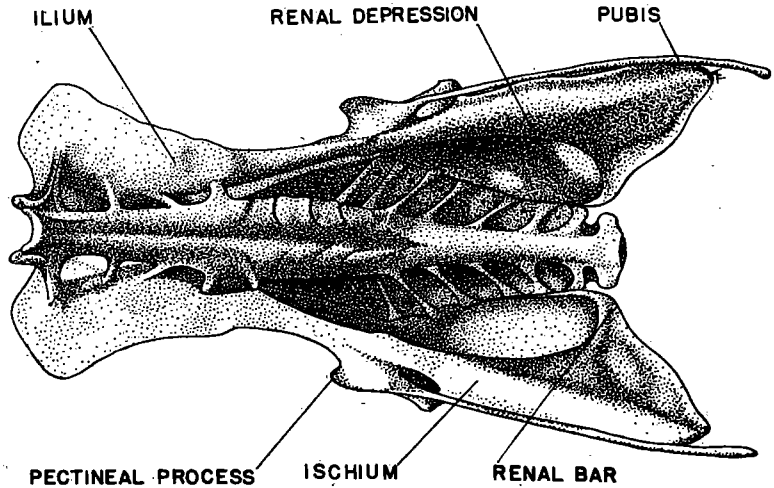
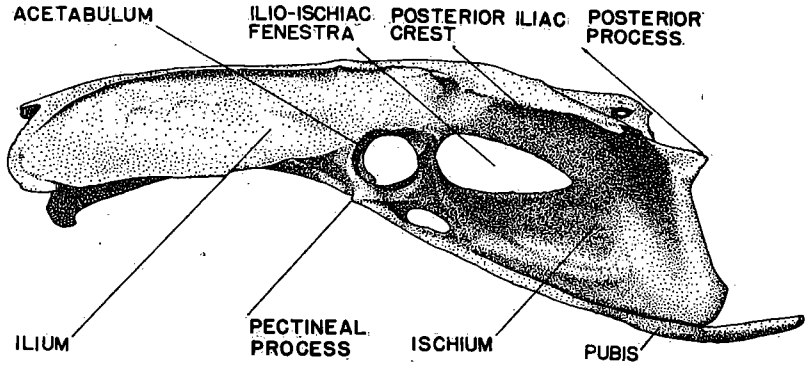
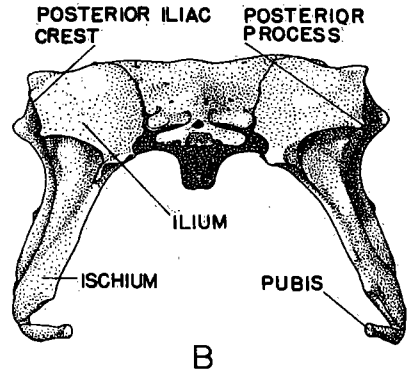


C

FIGURE 1. *Dendrortyx*-type pelvis drawn from *Colinus virginianus floridanus*. (A) lateral view, (B) posterior view, (C) ventral view.





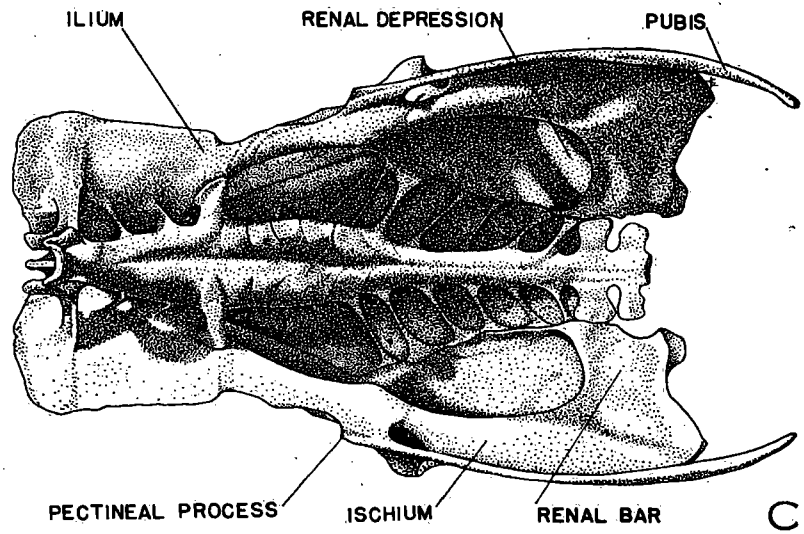


FIGURE 2. *Odontophorus*-type pelvis drawn from *Dactylortyx thoracicus taylori*. (A) lateral view, (B) posterior view, (C) ventral view.

Dendrortyx has the largest measurements in the Dendrortyx group.

Philortyx. *Philortyx* is possibly the closest living relative of *Dendrortyx*, with which it shares the four following skeletal characters: The capital groove of the humerus is deeply excavated and has its internal margin strongly elevated. The height of the middle of the shaft of the ulna is about 85 percent of the height of the shaft just distal to the external cotyla. The pisiform process of the carpometacarpus is round in internal view. The external condyle of the ulna has its ventral border flattened. *Philortyx* has 8 unique characters but, aside from its small size, it does not show striking skeletal modifications.

Oreortyx. This genus appears to show more relationships to *Colinus*, *Lophortyx*, and especially to *Callipepla* (on characters of the scapula and in pelvic proportions), than it does to *Dendrortyx* and *Philortyx*. *Oreortyx* has 6 unique characters, but other than its relatively large measurements, it shows no particularly noteworthy skeletal modifications.

Callipepla, Colinus, and *Lophortyx.* The genera of this complex often cannot be separated on the basis of individual bones. Their skeletal structure is so similar that *Callipepla, Colinus,* and *Lophortyx* must have diverged relatively recently. Subgeneric rather than generic designations might better reflect their taxonomic status, were it not for their strongly differing external morphology.

Other studies support this view. Bailey (1928) reports a hybrid *Callipepla squamata* × *Lophortyx gambelii*. Sibley (1960) states that species of *Colinus, Lophortyx,* and *Callipepla* hybridize in various combinations and reports that *Callipepla, Colinus,* and *Lophortyx* share a characteristic egg-white protein profile different from that of *Oreortyx*.

The Odontophorus Group

Odontophorus. This genus appears to be the most primitive of the Odontophorus group. Several important characters of *Odontophorus* are found in less advanced gallinaceous families (Holman, MS). The pneumatic fossa of the humerus has a perforated inner shelf that extends from the external bicipital surface to the medial bar in *Odontophorus gujanensis*. Fossa II of the humerus is indistinct. The hypotarsus has only one closed calcaneal canal in *Odontophorus stellatus*.

Some noteworthy characters occur on the pelvis of certain specimens of *Odontophorus*. The posterior iliac crest of the pelvis has a

prominence in all *Odontophorus* studied, with the exception of one individual of *Odontophorus gujanensis*. A ridge originates on the posterior iliac crest at the level of the ilio-ischiac fenestra, continues ventrad and posteriad toward the posterior border of the ilium, and has a prominence that arises from its posterior surface in one individual of *Odontophorus gujanensis*.

These characters have interesting implications for they are associated with the *Dendrortyx*-type pelvis and are not found in any other genus in the Odontophorus group. *Dendrortyx* certainly appears to be the most primitive genus of New World quails, and thus it seems likely that the *Dendrortyx*-type pelvis evolved earlier than the *Odontophorus* type. Therefore the occasional occurrence of these characters in a primitive genus of the Odontophorus group is not surprising.

Further substantiating the primitive nature of *Odontophorus* are the three characters it shares with *Dendrortyx* only, namely: large size, an indistinct fossa II of the humerus, the wing of the trochlea for digit IV is depressed anteroposteriorly and the entire trochlea is longer than deep.

Odontophorus is a rather generalized form with much specific variation and with only 2 unique characters.

Dactylortyx. This genus has 10 unique characters but still does not show as many skeletal modifications as the following two genera. Perhaps the most important skeletal modifications in *Dactylortyx* are the tendency toward the loss of the pectineal process with the complete loss of the depression on the medial side of the pectineal process and the elongation of the bones of the wing in comparison with the bones of the leg. *Dactylortyx* is relatively large. It appears to be more closely related to *Cyrtonyx*, somewhat more distantly related to *Rhynchortyx*, and most distantly related to *Odontophorus* on the basis of several qualitative characters as well as on intermembral proportions.

Cyrtonyx. This form has 15 unique characters. Important skeletal modifications include the strong deflection of the acromion process of the scapula, the weak development of the intermetacarpal tubercle of the carpometacarpus, the narrow angle of the ischium to the ventral edge of the posterior iliac crest, and, as in *Dactylortyx*, the elongation of the bones of the wing in comparison to the bones of the leg. *Cyrtonyx* also is relatively large. It appears most closely related to *Dactylortyx*, somewhat more distantly related to *Rhynchortyx*, and most distantly to *Odontophorus*.

Rhynchortyx. This most aberrant genus of the Odontophorus group has 25 unique characters. Important skeletal modifications include the short, deep, rostrum and the development of a third distinct calcaneal ridge on the hypotarsus. *Rhynchortyx* has the smallest measurements of any genus in the Odontophorus group. In several qualitative characters, as well as on intermembral proportions, it appears more closely related to *Cyrtonyx* and *Dactylortyx* than to *Odontophorus*.

Remarks

In summary *Dendrortyx* appears to be at once the most primitive and aberrant genus of the Odontophoridae. *Philortyx* is possibly its closest relative. *Oreortyx* is closely related to *Colinus*, *Lophortyx*, and especially to *Callipepla*. *Callipepla*, *Colinus*, and *Lophortyx* are so similar that on osteological grounds alone they could be merged in a single genus.

Odontophorus appears to be the most primitive genus in the Odontophorus group. *Dactylortyx* and *Cyrtonyx* show several similarities and appear closer to *Rhynchortyx* than to *Odontophorus*. *Rhynchortyx* is the most aberrant genus of the Odontophorus group.

On the basis of the present study, the following rearrangement is proposed:

Sequence of genera in Peters (1934)	Proposed sequence of genera
	Group 1
Dendrortyx	*Dendrortyx*
Oreortyx	*Philortyx*
Callipepla	*Oreortyx*
Lophortyx	*Callipepla*
Philortyx	*Colinus*
Colinus	*Lophortyx*
Odontophorus	Group 2
Dactylortyx	*Odontophorus*
Cyrtonyx	*Dactylortyx*
Rhynchortyx	*Cyrtonyx*
	Rhynchortyx

FOSSIL RECORD OF NEW WORLD QUAILS

American quails are reported from Oligocene to Recent times, but the single Oligocene form is indeterminate at the generic and specific levels. Modern genera are first recorded from the Miocene, and modern species first appear in the Pleistocene.

Tertiary Forms

ODONTOPHORIDAE, INDETERMINATE

HORIZON AND LOCALITY. Oligocene: silts of Orellan age in the Cedar Creek facies of the White River formation. From SW¼ sec. 12, T. 11 N., R. 54 W., Logan County, Colorado (Tordoff, 1951b).

MATERIAL. Distal end of a tarsometatarsus (Univ. Kansas Nat. His. Mus.).

REMARKS. Tordoff (1951b) states that though the Oligocene fossil is smaller than *Colinus* and *Lophortyx*, it most closely resembles these genera. Some American genera of quails (and even some gallinaceous families) are difficult to differentiate on the basis of the distal portion of the tarsometatarsus, and the reported affinities of the Oligocene fragment should be regarded with some caution.

Miortyx A. H. Miller, 1944

The genus is known from a single species recorded from the Lower Miocene of South Dakota.

Miortyx teres A. H. MILLER, 1944

HORIZON AND LOCALITY. Lower Miocene: late Arikareean stage of Rosebud formation. From Flint Hill quarry, Bennett County, South Dakota (A. H. Miller, 1944).

MATERIAL. Type, proximal three-fourths of right humerus (Univ. California Mus. Paleont. 34453). Referred specimen, distal end of left tibiotarsus.

DIAGNOSIS. "Proximal end of humerus similar to that of *Oreortyx* but decidedly larger; capital groove sharply defined and narrower, especially at margin of head; contour of head more smoothly rounded, less indented by capital groove; ligamental furrow on palmar surface deeper; tubercle on middle of deltoid crest proportionately larger."

MEASUREMENTS. "Type, greatest width of head of humerus perpendicular to axis of upper part of shaft, 12.9 mm.; least width of shaft, in mediolateral direction, 5.0."

REMARKS. A. H. Miller (1944) points out: "The most distinctive feature of *Miortyx* is the rounded contour of the head with consequent

shallow depression between the articular surface of the head and the internal tuberosity. *Dendrortyx* of Central America approaches, but by no means equals *Miortyx* with respect to lesser indentation of the head contour by the capital groove."

In the living Odontophoridae fossa II of the humerus is usually well developed. *Dendrortyx* and *Odontophorus* are apparently less specialized exceptions in which fossa II is obsolete. The drawing of the type specimen of *Miortyx teres* (A. H. Miller, 1944: 94, fig. 7) indicates that fossa II, though not obsolete, is rather weakly developed.

Cyrtonyx Gould, 1844

The genus is reported from the upper Miocene of California and Nebraska, and from the Pleistocene of Aramberri, Nuevo Leon, Mexico.

Cyrtonyx cooki Wetmore, 1934

Horizon and locality. Upper Miocene: upper Sheep Creek beds. From 17 miles south of Agate, Sioux County, Nebraska (Wetmore, 1934).

Material. Type, distal half of left humerus (collection of Harold J. Cook, HC 647).

Diagnosis. "Distal end of humerus similar to that of *Cyrtonyx montezumae mearnsi* Nelson, but about one-fourth larger; ectepicondyle relatively reduced."

Measurements. Greatest transverse breadth across condyles 9.5 mm.; least transverse breadth of shaft 4.6 mm.

Remarks. Wetmore (1934) reports that the fossil is a northward extension of *Cyrtonyx*, which occurs today from central Arizona and central Texas southward into Guatamala.

Cyrtonyx tedfordi L. Miller, 1952

Horizon and locality. Upper Miocene: Barstow formation, Lake bed horizon. From near middle of SE¼ NW¼ sec. 15, T. 11 N., R. 2 W., near the town of Barstow, California (L. Miller, 1952).

Material. Type, right carpometacarpus (Univ. California Mus. Paleont. 42223).

Diagnosis. "Very similar to male of *Cyrtonyx montezumae mearnsi*, but much stouter, and with intermetacarpal tubercle much less developed."

Remarks. This fossil needs restudy. The photograph of the type carpometacarpus (L. Miller, 1952: 299, fig. 2) shows the following characters: Pisiform process reduced, and at the level of its ligamental attachment. Intermetacarpal tubercle obsolete, represented only by

a minute point. Carpal trochlea with its external rim continuing distad beyond ligamental notch. These are strong characters of the family Cracidae and do not occur in any living genus of American quails. Possibly this fossil may represent a small cracid.

Colinus Goldfuss, 1820

The genus is reported from the late Pliocene of Arizona and Kansas, the Pleistocene of Florida and Texas, and prehistoric deposits from caves in Yucatan, Florida, Texas, and Tennessee.

Colinus sp.

HORIZON AND LOCALITY. Upper Pliocene. From sec. 22, T. 17 S., R. 20 E., about two miles south of Benson, Arizona (Wetmore, 1924).

MATERIAL. Distal portion of tarsometatarsus (U. S. Natl. Mus.).

REMARKS. The fossil has a smaller and narrower middle trochlea than *Callipepla* and a lower distal foramen than either *Colinus virginianus* or *Lophortyx gambelii* (Wetmore, 1924).

Colinus hibbardi WETMORE, 1944

HORIZON AND LOCALITY. Upper Pliocene: Rexroad formation. From Locality 3, Rexroad fauna, Meade County, Kansas (Wetmore, 1944).

MATERIAL. Type, distal portion of right tarsometatarsus, with most of the outer trochlea missing (Univ. Kansas Mus. Vert. Paleont. 3981). Referred specimens, distal end of right humerus and distal end of badly worn left humerus.

DIAGNOSIS. "Distal end of tarsometatarsus (figs. 4 and 5) similar to that of modern *Colinus virginianus* (Linnaeus) but decidedly larger, shaft stronger, and more heavily lined by the tendinal grooves."

MEASUREMENTS. Type: "Transverse breadth of shaft below center, 3.1 mm.; transverse breadth across trochlea (approximate), 7 mm.; transverse breadth of middle trochlea, 2.9 mm."

REMARKS. Wetmore (1944) reports that the type tarsometatarsus shows more angular development of the posterior side of the middle trochlea than in *Lophortyx*, stouter form throughout than in *Callipepla*, and larger trochlea than in *Cyrtonyx*. The referred humerus (Univ. Kansas Mus. Vert. Paleont. 3997) shows similarities to *Colinus virginianus*, but the brachial depression is larger, and the ridge that borders it is longer and extends farther up the shaft. In size it is similar to adult male *Cyrtonyx montezumae mearnsi*, but the trochlea are definitely smaller. The radial trochlea is larger than in *Callipepla*. All of the above fossils are larger than *Colinus virginianus*.

Tordoff (1951a) reports on 32 bones of *Colinus hibbardi* from the type locality. Fossil elements include 5 vertebrae, 3 sterna, 7 coracoids, 1 humerus, 5 ulnae, 7 carpometacarpi, and 4 tarsometatarsi. Tordoff finds that the fossils are similar to the bones of Recent *Colinus virginianus* but larger, and the wing bones are longer in relation to the leg bones. Subjective differences include the following characters: Ventral intermuscular line of coracoid less prominent and less sharply defined than in Recent *C. virginianus*. Shaft of humerus straighter and heavier, and brachial depression larger. Impression of M. brachialis anticus on ulna deeper and more sharply outlined. Intercotylar prominence of tarsometatarsus more nearly round, depression just over posterior edge of internal cotyla more angular and sharply marked, and the ridge leading proximad from the outer proximal foramen more sharply defined.

ODONTOPHORIDAE, INDETERMINATE

HORIZON AND LOCALITY. Upper Pliocene. From sec. 25, T. 18 S., R. 21 E., about 14 miles southeast of Benson, Arizona (Wetmore, 1924).

MATERIAL. Proximal end of humerus (U. S. Natl. Mus.).

REMARKS. Wetmore notes that this fragment is large as in *Oreortyx*, but has characters resembling *Colinus*. It seems possible that the specimen represents *C. hibbardi*.

Lophortyx Bonaparte, 1838

The genus is reported from the middle Pliocene of Oregon, the Pleistocene of California, and from archaeological sites in California and Arizona.

Lophortyx shotwelli BRODKORB, 1958

HORIZON AND LOCALITY. Middle Pliocene: Hemphillian stage. From tuffaceous sandstone on the east bank of McKay Reservoir, about five miles south of Pendleton, Umatilla County, Oregon (Brodkorb, 1958).

MATERIAL. Type, proximal portion of left humerus (Univ. Oregon Mus. Nat. Hist. F-3611). Referred material, proximal portion of left humerus, and distal portion of two left humeri.

REMARKS. Through the kindness of the University of Oregon Museum of Natural History the type material was made available for study. A description based on this re-examination is as follows: Humerus with 1) greatest proximal width 9.8 mm. in type specimen (re-

ferred specimen broken). 2) Greatest distal width of humerus 7.3 mm. 3) Pneumatic fossa moderately elongate, elliptical, reduced in its distal extent, and with a vestigial, perforated, inner shelf. 4) Median crest strongly developed, elevated throughout. 5) Capital groove moderately excavated with its internal margin moderately elevated. 6) Margin between head and internal tuberosity moderately concave. 7) Head about as long as broad in anconal view. 8) Ridge along medial border of fossa II moderately swollen, elongate, and with its apex acute. 9) Fossa II well developed. 10) Latissimus ridge originating on lateral edge of shaft, but swinging in onto anconal face proximally. 11) External tuberosity weakly inflated. 12) Bicipital crest arising gently from shaft, narrowly rounded, with its distal border lacking a groove. 13) Deltoid crest moderately developed, slightly inflected, and with its summit flattened in type specimen (knoblike in referred specimen). 14) Entepicondyle at level of internal condyle. 15) Entepicondylar prominence moderately produced, with its pit placed on internal face. 16) Depression of M. brachialis anticus moderately excavated.

Several of the above characters are noteworthy. Perhaps most interesting is the vestigial, perforated, inner shelf of the pneumatic fossa of the humerus. A complete imperforate inner shelf is present in most other families of the Galliformes, but has been lost in all living New World quails with the exception of *Odontophorus gujanensis*, which retains a perforated inner shelf. *Lophortyx shotwelli* differs from all Recent species of *Lophortyx* in characters 3, 4, 11, and 14 above, and shares character 7 with Recent *Dendrortyx*, *Philortyx*, and *Lophortyx douglasii* only.

Pleistocene Forms

Dendrortyx Gould, 1844

The genus is reported from the Pleistocene of Nuevo Leon, Mexico, and tentatively from a prehistoric deposit in a Yucatan cave (Eisher, 1953).

?*Dendrortyx*

Horizon and locality. Pleistocene. From San Josecito Cavern, province of Aramberri, state of Nuevo Leon, Mexico (L. Miller, 1943).

Material. A single femur (Univ. California Mus. Paleont.).

Remarks. L. H. Miller reports this femur as larger and heavier than that of a Recent specimen of *Dendrortyx leucophrys nicaraguae*, but refers it only tentatively to this genus.

Oreortyx Baird, 1858

Reported from the late Pleistocene of California, and from the Quaternary (probably prehistoric) of a New Mexico cave.

Oreortyx picta (DOUGLAS, 1829)

HORIZON AND LOCALITY. (a) Late Pleistocene. From Potter Creek Cave, Shasta County, California (L. Miller, 1911). (b) Late Pleistocene. From Samwel Cave, Shasta County, California (L. Miller, 1912). (c) Late Pleistocene. From Hawver Cave, Eldorado County, California (L. Miller, 1911).

MATERIAL. (a) Potter Creek Cave; 2 bones. (b) Samwel Cave; not specified. (c) Hawver Cave; 14 bones. Bones from the above localities are at the University of California Museum of Paleontology.

Neortyx, new genus
Figure 3

TYPE OF GENUS. *Neortyx peninsularis*, new species.

DIAGNOSIS. Differs from living genera of New World quails as follows. 1) Femur with proximal end narrow throughout, with head and trochanter small, but with shaft expanding abruptly into enlarged distal end (living genera have proximal end wider throughout, with head and trochanter larger, and with shaft expanding less abruptly into less enlarged distal end). 2) Anterior border of external condyle extending well onto distal portion of shaft as a strong ridge (anterior border of external condyle ends more abruptly on distal portion of shaft as a weak ridge in living genera). 3) Internal lip of external condyle reflected (deflected in living genera). 4) Dorsolateral border of iliac facet short (longer in living genera).

Closest to more specialized genera of the Dendrortyx group in having 1) head neither bent dorsad nor rotated posteriad, thus differing from *Dendrortyx* and *Rhynchortyx*. 2) Neck moderately long, thus differing from *Dendrortyx*. 3) Iliac facet without compression, with posterior border convex, thus differing from *Dendrortyx*. 4) Dorsal crest of trochanter broken. 5) Trochanteric ridge 24 percent of length of shaft, thus differing from *Rhynchortyx* and *Dactylortyx*. 6) Distal depth 83 percent of distal width, thus differing from *Philortyx* and *Rhynchortyx*. 7) Internal condyle moderately wide, and with its anterior border much produced throughout, thus differing from *Philortyx*, *Cyrtonyx*, and *Dactylortyx*. 8) External condyle compressed and rounded anteriorly, thus differing from *Dendrortyx*.

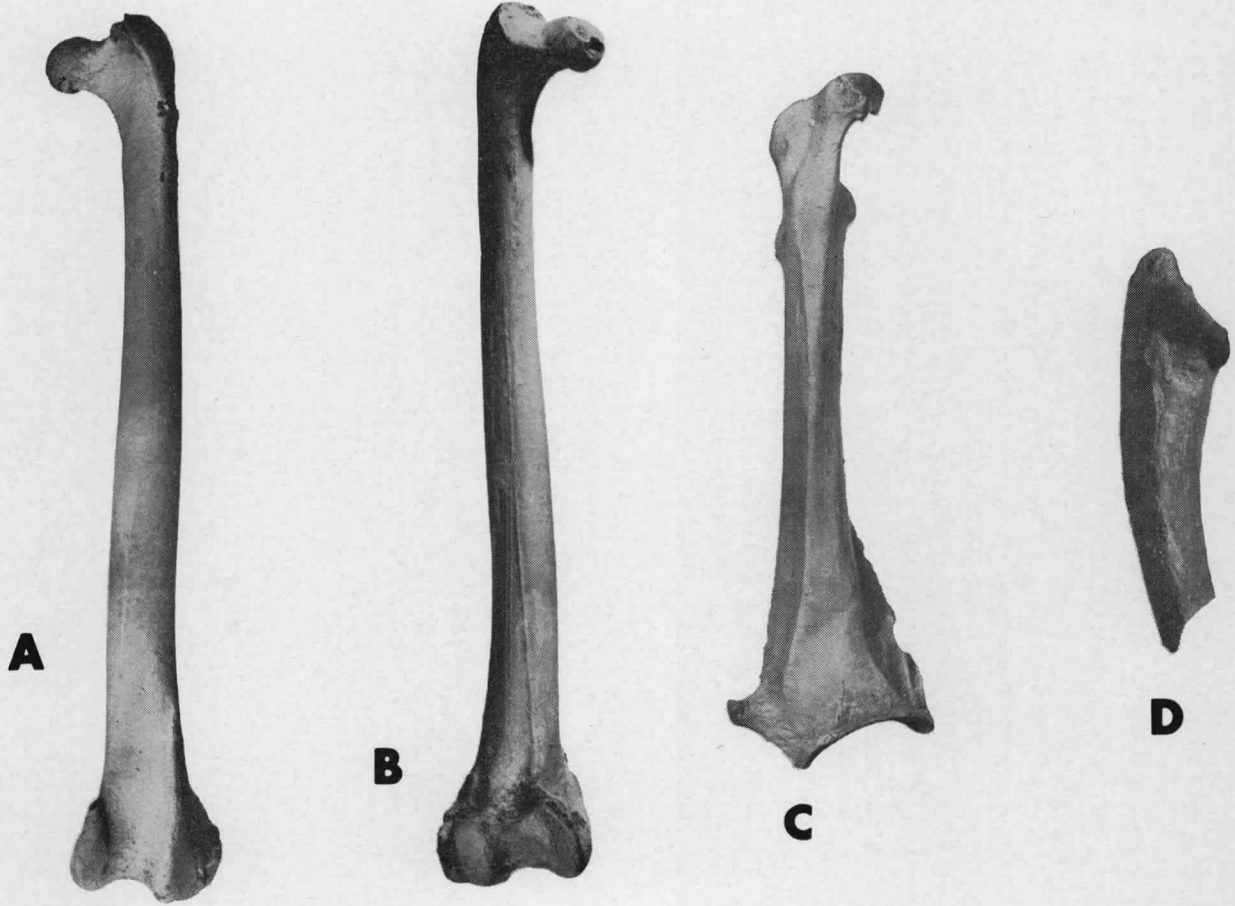


FIGURE 3. Elements of *Neortyx peninsularis*, new genus and species. (A) anterior view of holotype femur, (B) posterior view of holotype femur, (C) referred right coracoid, (D) referred right proximal ulna.

Neortyx peninsularis, NEW SPECIES

HOLOTYPE. Left femur, complete except for broken dorsal crest of trochanter (Brodkorb collection [PB 1224], Univ. Florida). Pleistocene: Arredondo clay equivalent, in pit of Dixie Lime Products Company in the SW corner NW¼ sec. 14, T. 13 S., R. 21 E., Marion County, Florida, 1 mile southeast of the town of Reddick. Collected by Pierce Brodkorb 9 August 1954.

MEASUREMENTS OF HOLOTYPE. Length through articular facet, 45.8 mm., greatest proximal width, 7.5 mm., distal width through condyles, 7.6 mm., greatest proximal width/length 16.4 percent, distal width through condyles/greatest proximal width 101.3 percent, proximal width of shaft/width of shaft just proximad to internal condyle 65.2 percent.

DIAGNOSIS. Femur larger than in *Philortyx fasciatus, Oreortyx picta, Callipepla squamata, Colinus suilium, C. virginianus, C. nigrogularis, C. leucopogon, Lophortyx californica, L. gambelii, L. douglasii, Dactylortyx thoracicus,* and *Cyrtonyx montezumae;* smaller than in *Dendrortyx leucophrys, Odontophorus gujanensis, O. stellatus,* and *O. guttatus* (table 1).

REFERRED MATERIAL. The following elements from the Pleistocene of Reddick, Florida, are referred to the above species. One complete and 2 fragmentary right coracoids (PB 478, 1275, and 1974), and 2 fragmentary right ulnae (PB 935 and 1229).

Coracoid.—Internal distal angle short, rounded terminally, and with its dorsal surface flattened (internal distal angle elongate, pointed terminally, and with its dorsal surface round in living genera). Length 29.0 mm., proximal width 4.3 mm., distal width (two specimens), 8.7-8.8 mm., distal width/length 30.3 percent, proximal width/distal width 48.9 percent, proximal width/length 14.8 percent.

Ulna.—Olecranon process only moderately produced (strongly produced in most living genera, weakly produced in *Rhynchortyx*). Greatest proximal width 6.0-6.3 mm.

REMARKS. This is the second extinct genus of New World quails described and brings the total of extinct and living genera to 12. The type specimen shows several resemblances to *Oreortyx, Callipepla, Colinus,* and *Lophortyx,* but is quite distinct from these forms, as it has four unique characters. The referred elements show two unique characters, but otherwise are similar to birds in the *Callipepla-Colinus-Lophortyx* complex in qualitative characters as well as in size.

Colinus Goldfuss, 1820

Colinus suilium Brodkorb, 1959

Horizon and locality. Pleistocene: Arredondo clay member of Wicomico formation. From Pits I and II in limestone quarry in NW¼ sec. 22, T. 10 S., R. 9 E., near Arredondo, Alachua County, Florida (Brodkorb, 1959).

Material. Holotype, Pit I: complete left humerus, (Brodkorb collection, PB 1291). Paratype, Pit I: complete right humerus (PB 757). Referred material, Pit I: 1 sternum, 2 coracoids, 4 humeri, 3 ulnae, 1 carpometacarpus, 1 synsacrum, 3 tibiotarsi, 3 tarsometatarsi. Pit II: 2 coracoids, 1 scapula, 1 ulna, 4 humeri, 2 femora, 3 tibiotarsi, and 1 tarsometatarsus (Brodkorb collection).

Diagnosis. For the original description see Brodkorb (1959: 276).

Status of the Arredondo clay. The Arredondo clay member of the Wicomico formation consists mainly of blue clay streaked with yellow that weathers to brown. It was deposited under terrestrial conditions of sedimentation and contains fossils of freshwater gastropods and vertebrates. Arredondo clay lies beneath the Wicomico terrace, a reddish-brown marine sand. The exact age of the Wicomico formation is uncertain, but possibly it represents either Yarmouth or Sangamon interglacial deposition (Brodkorb, personal communication). Therefore, the Arredondo clay may represent either Kansas or Illinoian times.

Other localities. Fossil bones assigned to the species *Colinus suilium* from other fossil localities in Florida listed in the next paragraphs are discussed in a later section on variation in fossil *Colinus*:

(a) Williston, Florida.—Pleistocene: Arredondo clay. From sinkhole in Connell and Shultz Limerock Company mine, 0.9 miles north of Seaboard Airline Railroad, Williston, Levy County, Florida (Holman, 1959a and 1959c): 1 rostrum, 1 coracoid, 5 humeri, 1 ulna, 2 carpometacarpi, 4 femora, 3 tibiotarsi, and 1 tarsometatarsus (Brodkorb collection).

(b) Orange Lake, Florida.—Pleistocene: Arredondo clay and Arredondo clay–Wicomico sand contact. From sinkhole in limestone quarry near center of sec. 33, T. 12 S., R. 21 E., Marion County, Florida, 2 miles south of the town of Orange Lake (Holman, 1959b). Arredondo clay: 8 coracoids, 4 scapulae, 9 humeri, 2 ulnae, 1 carpometacarpus, 10 femora, 5 tibiotarsi, 5 tarsometatarsi. Arredondo clay–Wicomico sand contact: 1 femur (Brodkorb collection).

(c) Reddick, Florida.—Pleistocene: Arredondo clay equivalent. From localities A, B, C, and undesignated exact localities (either A or

B) in pit of Dixie Lime Products Company in the SW corner NW¼ sec. 14, T. 13 S., R. 21 E., Marion County, Florida, 1 mile southeast of the town of Reddick (Brodkorb, 1957).

Locality A: 1 sternum, 5 coracoids, 9 humeri, 2 ulnae, 2 femora, 5 tibiotarsi, 2 tarsometatarsi. Locality B: 3 coracoids, 6 humeri, 7 femora, 2 tibiotarsi, 7 tarsometatarsi. Locality C: 1 rostrum, 2 coracoids, 15 humeri, 4 ulnae, 9 carpometacarpi, 1 synsacrum, 8 femora, 4 tibiotarsi, 4 tarsometatarsi. Locality A or B (undesignated): 1 rostrum, 3 sterna, 68 coracoids, 9 scapulae, 138 humeri, 63 ulnae, 30 carpometacarpi, 5 synsacra, 90 femora, 77 tibiotarsi, 61 tarsometatarsi (Brodkorb collection).

The total of 644 bones from Reddick is relatively a tremendous number of individual fossil bird bones. The 74 left humeri from Reddick show that a minimum of 74 individuals is represented.

(d) Haile II, Florida.—Pleistocene: Arredondo clay. From locality II B in NW¼ sec. 25, T. 9 S., R. 13 E., Alachua County, Florida, near the village of Haile (Auffenberg, 1955). A fragmental ulna and tibiotarsus (collection of Howard Hutchison, Univ. Florida).

(e) Oakhurst Quarry, Florida.—Pleistocene. From Oakhurst Limestone Quarry, 2 miles southeast of Ocala Post Office, Marion County, Florida. A single left humerus (Brodkorb collection). As no other extinct vertebrates have been taken from this locality its age is uncertain.

(f) Zuber, Florida.—Pleistocene: Arredondo clay equivalent. Dixie Lime Products Company mine, Zuber, Marion County, Florida. One femur (Brodkorb collection).

(g) Eichelberger Cave, Florida.—Pleistocene (stratigraphy unclear). From Locality A in solution cave in NW corner of sec. 2, T. 17 S., R. 22 E., Marion County, Florida, 2 miles southwest of the town of Belleview (Brodkorb, 1956): 1 humerus, 1 femur, 1 tibiotarsus, and 1 tarsometatarsus (Brodkorb collection).

(h) Lake Monroe, Florida.—Pleistocene. From Locality N, dredged from mouth of Lake Monroe, Volusia County, Florida, associated with extinct Pleistocene vertebrates: 1 humerus.

Specimens from localities (d) through (h) are referred tentatively to *C. suilium* as they show an approach to *C. virginianus* in some respects.

Colinus virginianus (Linnaeus, 1758)

Fossil bones assigned to the species *Colinus virginianus* listed in the next paragraphs are discussed in a later section on variation in fossil *Colinus*.

(a) Kanapaha, Florida.—Pleistocene (stratigraphy unclear). From limestone quarry in sec. 22, R. 19 E., T. 10 S., Alachua County, Florida, about 1.5 miles SW of the village of Arredondo (Brodkorb, 1959): 2 humeri, 1 carpometacarpus, 1 femur, and 1 tibiotarsus (Brodkorb collection). The bones are from tan sand in solution holes in the Ocala limestone, but the relationship of the deposit to the Wicomico terrace is not well marked.

(b) Sabertooth Cave, Florida.—Pleistocene: post-Wicomico. From solution cave in NW¼ SW¼ sec. 33, T. 18 S., R. 18 E., Citrus County, Florida, 1.2 miles NW of the town of Lecanto: 2 humeri, 4 carpometacarpi, 3 femora, 2 tibiotarsi (Brodkorb collection); and 2 humeri, 2 femora, and 1 tarsometatarsus (Holmes collection, see Wetmore, 1931). Holman (1958) reports incorrectly that the fossils lie in matrix derived from the Pamlico terrace. The matrix was derived from the Wicomico terrace.

(c) Seminole Field, Florida.—Pleistocene: post-Wicomico. From Joes Creek, 46th Avenue N., 71st St. N., St. Petersburg, Pinellas County, Florida (Wetmore, 1931): 6 humeri and 1 ulna (Holmes collection, see Wetmore, 1931).

(d) Melbourne, Florida.—Pleistocene: post-Wicomico. From line of contact between strata 1 and 2, Country Club Golf Links, near Melbourne, Brevard County, Florida (Wetmore, 1931). Two humeri collected by J. W. Gidley in 1928 appear to be lost at present.

(e) Vero, Florida.—A heterochronic locality: stratum 2 (with extinct vertebrates), Pleistocene, pre-Pamlico; stratum 3 (without extinct vertebrates), Pleistocene or Recent, post-Pamlico; "West of Bridge," age uncertain. All sites in the center of sec. 35, T. 32 S., R. 39 E., Vero Beach, Indian River County, Florida (Weigel, MS). Stratum 2: 2 humeri, 1 coracoid, and 1 tibiotarsus; stratum 3: 2 humeri, 1 ulna, and 1 tibiotarsus; "West of Bridge": 1 humerus (Brodkorb collection).

(f) Warren's Cave, Florida.—?Prehistoric. From floor of Warren's Cave, 8.5 miles northwest of Gainesville, Alachua County, Florida: 1 scapula, 1 coracoid, and 1 tarsometatarsus (Brodkorb collection).

(g) Friesenhahn Cave, Texas.—Late Pleistocene. From northern Bexar County, Texas (Milstead, 1956): 4 humeri, 1 ulna, and 2 tibiotarsi (Texas Mem. Mus. collection 933-428, 933-447, 933-2186, 933-3042, 933-3199, 933-3041, and 933-3531).

Lophortyx Bonaparte, 1838

Lophortyx californica (Shaw, 1798)

Horizon and locality. (a) Pleistocene. From Rancho La Brea asphalt beds in Los Angeles, Los Angeles County, California (Howard,

1930; Miller and DeMay, 1942). (b) Pleistocene. From Fauna I and Fauna II of asphalt beds, McKittrick, California (L. Miller, 1935). (c) Pleistocene. From asphalt beds of Carpinteria, California (DeMay, 1941). (d) Pleistocene. San Pedro and Palos Verdes formations. San Pedro, California (L. Miller, 1914 and 1930; Howard, 1944 and 1949). (e) Pleistocene. From Hawver Cave, Eldorado County, California (L. Miller, 1911).

MATERIAL. (a) Rancho La Brea: 101 individuals. (b) McKittrick, Fauna I: 3 bones; Fauna II: 93 bones. (c) Carpinteria: 9 individuals, 102 bones. (d) San Pedro, San Pedro formation: 1 coracoid, 2 humeri, 1 tibiotarsus; Palos Verdes formation: 6 bones. (e) Hawver Cave: 17 bones. Fossils from all the above localities are in the University of California Museum of Paleontology. Fossils from localities (a) and (d) are also in the Los Angeles County Museum. *Lophortyx californica* is the most plentiful fossil quail in the western United States.

Cyrtonyx Gould, 1844

Cyrtonyx montezumae (VIGORS, 1830)

HORIZON AND LOCALITY. Pleistocene. From San Josecito Cavern, province of Aramberri, Nuevo Leon, Mexico (L. Miller, 1943).

MATERIAL. Eighty bones, including limb bones, a coracoid, and two crania (Univ. California Mus. Paleontol.)

REMARKS. According to L. Miller (1943) the fossil sample is close to the subspecies *C. montezumae mearnsi.*

Odontophorus Vieillot, 1816

The genus is reported from the Pleistocene of various caves in Brazil, and from a prehistoric site in a Yucatan cave.

Odontophorus gujanensis (GMELIN, 1789)

HORIZON AND LOCALITY. Pleistocene. From four cave deposits (Lapa da Escrivania, Lapa da Marinho, Lapa do Periperi, and Lapa Vermelha) near Lagoa Santa, Minas Geraes, Brazil (Winge, 1887).

MATERIAL. A few bones from each cave (Copenhagen Mus.)

FORMS FROM ARCHAEOLOGICAL SITES

Remains of species of American quails living today are known from several archaeological sites. *Dendrortyx leucophrys* is listed questionably from a cave in Yucatan (Fisher, 1953). *Oreortyx picta* is reported from a cave in New Mexico (Wetmore, 1932b). *Colinus virginianus* is identified from caves in Tennessee and Texas (Shufeldt, 1897; Wet-

more, 1933), and *C. nigrogularis* is reported from a cave in Yucatan (Fisher, 1953). *Lophortyx californica* and *L. gambelii* are listed from Indian sites in California and Arizona (DeMay, 1942; Wetmore, 1932a). *Odontophorus guttatus* is identified questionably from a cave in Yucatan (Fisher, 1953).

Variation in Fossil *Colinus*

Wetmore (1944) named *Colinus hibbardi* from the upper Pliocene of Meade County, Kansas, and Brodkorb (1959) described *Colinus suilium* from the pre-Wicomico Pleistocene of Arredondo, Florida. These species were described on the basis of large size and several qualitative characters. Additional specimens of *C. hibbardi* and *C. suilium* were reported by Tordoff (1951a) and Holman (1959c). As Brodkorb (1960) points out, in all probability these forms are the temporal equivalents of living *Colinus virginianus*, and we are dealing with a continuum. Because the living species of *Colinus* are almost identical to each other in osteological characters and exhibit subspecific variation in size, it is extremely difficult to decide where to draw the taxonomic line between certain fossil populations of *Colinus*. It should be pointed out that the samples of fossil bones from many localities are too small to allow statistically significant analysis.

Qualitative Characters

Coracoid. The head of the coracoid is reflected in the single fossil of *C. hibbardi*, in 63 percent of 62 fossils of *C. suilium* from Arredondo, Orange Lake, and Reddick, in 92 percent of 86 modern specimens of *C. virginianus* and in the 2 specimens of modern *C. nigrogularis*. It is inflected in 2 of 3 specimens of modern *C. leucopogon*.

The procoracoid process is weakly developed in *C. hibbardi* and is stronger in *C. suilium*, *C. virginianus*, *C. nigrogularis*, and *C. leucopogon*.

Scapula. The dorsal depression just mediad to the glenoid facet is deep in 67 percent of 15 fossils of *C. suilium* from Arredondo, Orange Lake, and Reddick, but is shallow in 77 percent of 81 modern specimens of *C. virginianus*. The depression is deep in 1 of 2 specimens of living *C. nigrogularis*, and in 2 of 3 specimens of living *C. leucopogon*.

The bridge between the acromion process and glenoid facet is usually about one-half the width of the glenoid facet in *C. suilium*, *C. virginianus*, and *C. leucopogon*, but is less than one-third the width of the glenoid facet in *C. nigrogularis*.

The acromion process is strongly inflected in 62 percent of 13 fossils of *C. suilium* from Arredondo, Orange Lake, and Reddick. In the

living species the process is only slightly inflected in 72 percent of 80 specimens of *C. virginianus*, in 1 of 2 *C. nigrogularis*, and in 2 of 3 *C. leucopogon*.

HUMERUS. The ridge along the medial border of fossa II is moderately swollen in fossil *C. suilium*, modern *C. virginianus*, and modern *C. leucopogon*, but is only slightly swollen in modern *C. nigrogularis*.

The bicipital crest is pointed in 51 percent of 97 fossils of *C. suilium* from Arredondo, Williston, Orange Lake, and Reddick. It is rounded in 69 percent of 83 specimens of living *C. virginianus*, in the single specimen of *C. nigrogularis*, and in the 3 specimens of living *C. leucopogon*.

The entepicondyle arises abruptly from the shaft in 20 percent of 107 fossils of *C. suilium* from Arredondo, Williston, Orange Lake, and Reddick. The entepicondyle arises gently from the shaft in 97 percent of 77 specimens of modern *C. virginianus* and in the 3 specimens of *C. leucopogon*.

The depression for M. brachialis anticus is large in *C. hibbardi*, and in 2 of 4 fossils of *C. suilium* from Arredondo, but it is small in the living species of *Colinus*.

CARPOMETACARPUS. The process of metacarpal I is pointed in the single fossil of *C. hibbardi*, and in 63 percent of 35 fossils of *C. suilium* from Arredondo, Williston, Orange Lake, and Reddick. It is pointed in 93 percent of 44 specimens of living *C. virginianus*, but is rounded in the 3 specimens of *C. leucopogon*.

The pisiform process is much reflected dorsad and thus produced well above the dorsal rim of the inner carpal trochlea in 25 percent of 32 fossils of *C. suilium* from Arredondo, Orange Lake, and Reddick. The process is slightly reflected dorsad and thus below or at the level of the inner carpal trochlea in all living species.

The notch between the proximal border of the process of metacarpal I is deep in the single fossil of *C. hibbardi* and in 80 percent of 35 fossils of *C. suilium* from Arredondo, Williston, Orange Lake, and Reddick. The notch is slight in 71 percent of 48 specimens of living *C. virginianus* and in 2 of 3 specimens of living *C. leucopogon*.

TIBIOTARSUS. The posterior margin between the external and internal articular surface is deeply notched in 28 percent of 18 fossils of *C. suilium* from Arredondo, Orange Lake, and Reddick. The notch is shallow in all specimens of the 3 living species.

QUANTITATIVE CHARACTERS

Two types of size trends occur in the genus *Colinus*. A geographic decrease in size occurs from north to south, with Michigan quail the

largest, and southern Florida quail the smallest (table 2). A temporal decrease in mean size occurs from late Pliocene to the present.

Colinus hibbardi from the upper Pliocene of Kansas is the largest known *Colinus,* and quail from the Pleistocene of Florida are usually larger than their Recent geographic representatives. Fossils assigned to the species *C. suilium* from Arredondo, Williston, Orange Lake, and Reddick, Florida, are decidedly larger than quail living in those places today (table 3). They average as large or larger than Recent *Colinus virginianus* from Michigan in most measurements (Arredondo, 19 of 20 measurements; Williston, 11 of 12; Orange Lake, 17 of 17; and Reddick, 16 of 20). A few bones tentatively assigned to *C. suilium* from Haile II, Oakhurst Quarry, Eichelberger Cave, and Lake Monroe, Florida, are also similar in size to living *C. v. virginianus* from Michigan, and a single bone from Zuber, Florida, tentatively assigned to *C. suilium,* is similar in size to living *C. v. virginianus* from Illinois.

Fossils assigned to *C. virginianus* from Kanapaha, Saber-tooth Cave, the Vero strata, and Warren's Cave, Florida, are about the size of their Recent geographic representatives. Bones assigned to *C. virginianus* from the Pleistocene of Friesenhahn Cave, Texas, are only slightly larger than Recent bobwhites from northern Florida.

Recent and fossil species of *Colinus* are inseparable on intermembral and intramembral ratios with the exception of one fossil humerus from Oakhurst Quarry near Ocala, Florida, which is slightly shorter and stouter than in other Recent and fossil *Colinus.*

CONCLUSIONS

The American quails form a natural group that has undergone an independent evolution in the New World (Holman, MS). The following hypothetical outline of the course of events is based on the osteology of the living species and on the fossil record.

The families of living Galliformes were differentiated early in the Tertiary period. Fossils representing the Cracidae (*Gallinuloides* Eastman; see Tordoff and Macdonald, 1957), the Phasianidae (*Palaeortyx* Milne-Edwards), and the Tetraonidae (*Palaeophasianus* Shufeldt) are recorded from the Eocene. The Meleagrididae (*Meleagris antiqua* Marsh), and the Odontophoridae (indeterminate odontophorid, Tordoff, 1951b) are represented by Oligocene fossils.

The hypothetical ancestor of the Odontophoridae must have been close to the stock from which the pheasants and grouse arose. It probably was in this stage of skeletal evolution: The size was relatively large, and the rostrum was short and deep. The sternum was charac-

terized by deep notches, long, parallel, anterior lateral processes, moderately pneumatic sternal plate, and reduced dorsal foramen of the manubrial spine. The coracoid had a ventrally overhanging brachial tuberosity, with the dorsal intermuscular line slightly raised distally, and the ventral intermuscular line encroaching on the sterno-coracoidal process, whose tip was without a terminal knob. The scapular blade was elongate and had the beginning of a dorsal groove. The humerus had a moderately large pneumatic fossa with a reduced inner shelf, and fossa II was still indistinct. The carpometacarpus had a moderately produced pisiform process and a well-developed intermetacarpal tubercle that did not reach the level of metacarpal III. The pelvis had a small pneumatic fossa on the anterior portion of the renal depression, and the pectineal process was small. The hypotarsus had only one closed calcaneal canal, and the inner calcaneal ridge was without a distal extension or spur core.

By Oligocene time the two basic types of pelvis had probably become established, since the single known Oligocene fossil already resembled specialized modern forms. By the Miocene fossa II of the humerus was starting to develop, as shown by *Miortyx teres*. A vestige of the inner shelf of the pneumatic fossa of the humerus was still present in the middle Pliocene *Lophortyx shotwelli*.

The Odontophoridae are presently at the following stage of evolution: They are generally the smallest of the Galliformes. The rostrum is relatively short and deep, with this condition reaching its culmination in *Rhynchortyx*. The sternum is deeply notched, with long, narrow, parallel anterior lateral processes; the pneumaticity of the anterior sternal plate and the dorsal manubrial foramen has been lost. The coracoid has an overhanging ventral portion of the brachial tuberosity and a sharply raised dorsal intermuscular line; with one exception the termination of the ventral intermuscular line of the coracoid has shifted to the tip of the sterno-coracoidal process, which now ends in a terminal knob. The scapular blade is long and has a deep dorsal groove. The humerus has a large pneumatic fossa, whose inner shelf is completely lost, except in one species of *Odontophorus*; fossa II is well developed in all genera but *Dendrortyx* and *Odontophorus*. The carpometacarpus has a produced pisiform process, and the intermetacarpal tubercle extends to metacarpal III in all but a few individuals of *Cyrtonyx*. The pelvis has lost the pneumatic fossa in the renal depression, and in the *Odontophorus* group the pectineal process is further reduced or even lost. Finally, the hypotarsus has developed a second closed calcaneal canal in most genera.

In the best known genus, *Colinus*, a progressive trend is evident from late Pliocene time to the present toward reduction in size and gradual change in qualitative characters. *Colinus hibbardi* from the upper Pliocene of Kansas is the most distinct species of *Colinus* on the basis of its large size and qualitative osteological characters. *Colinus suilium* from the pre-Wicomico Pleistocene of Florida is somewhat smaller than *C. hibbardi* and has fewer qualitative osteological characters. Fossils of latest Pleistocene age are identical with living *C. virginianus*, except for their slightly larger size. The change from *C. hibbardi* to *C. suilium* apparently took place during the early Pleistocene. The transition from *C. suilium* to *C. virginianus* occurred in Wicomico time and was probably initiated by the change from a glacial to an interglacial climate.

TABLE 1. MEASUREMENTS (IN MM.) OF LIVING SPECIES OF QUAILS, GIVING MEAN, RANGE, AND SAMPLE SIZE

Recent species	Length of coracoid			Proximal width of coracoid			Distal width of coracoid		
Dendrortyx									
leucophrys	33.10		1	4.90		1	9.60		1
Philortyx									
fasciatus	28.00		1	3.90		1	8.10		1
Oreortyx									
picta	31.78	(31.0-32.3)	4	4.93	(4.6-5.4)	4	10.40	(9.8-11.2)	4
Callipepla									
squamata	28.88	(27.6-30.2)	4	4.53	(4.4-4.9)	4	9.65	(8.9-10.4)	4
Colinus									
virginianus	28.68	(25.7-30.9)	95	4.16	(3.6-4.9)	97	8.58	(7.2-9.9)	95
nigrogularis	25.70	(25.5-25.9)	2	3.70	(3.7-3.7)	2	7.45	(7.4-7.5)	2
leucopogon	27.77	(26.9-28.9)	3	3.83	(3.4-4.2)	3	7.90	(7.8-8.0)	3
Lophortyx									
californica	29.33	(28.6-30.3)	3	4.50	(4.5-4.5)	3	9.03	(8.6-9.4)	3
gambelii	27.90		1	4.50		1	8.40		1
douglasii	27.65	(27.5-27.8)	2	4.35	(4.1-4.6)	2	7.80	(7.5-8.1)	2
Odontophorus									
gujanensis	37.20	(36.9-37.5)	2	5.05	(5.0-5.1)	2	10.75	(10.5-11.0)	2
stellatus	33.90		1	5.20		1	9.60		1
guttatus	35.40		1	4.90		1	9.80		1
Dactylortyx									
thoracicus	31.30	(31.0-31.7)	3	4.80	(4.6-5.0)	3	10.20	(10.0-10.5)	3
Cyrtonyx									
montezumae	30.57	(29.8-31.3)	3	4.36	(4.2-4.6)	3	10.00	(9.5-10.5)	3
Rhynchortyx									
cinctus	29.00		1	4.00		1	9.00		1

Continued

TABLE 1 (continued)

Recent species	Proximal width of scapula			Width of shaft of scapula			Length of humerus		
Dendrortyx									
leucophrys	7.30		1	3.10		1	41.30		1
Philortyx									
fasciatus	6.80		1	2.40		1	33.60		1
Oreortyx									
picta	7.65	(7.3-8.1)	4	3.38	(3.1-3.7)	4	38.42	(36.8-39.7)	4
Callipepla									
squamata	6.80	(6.6-7.0)	4	2.85	(2.7-3.0)	4	35.85	(34.6-37.1)	4
Colinus									
virginianus	6.70	(5.7-7.4)	99	2.62	(2.2-3.0)	97	35.03	(32.0-37.7)	84
nigrogularis	6.05	(6.0-6.1)	2	2.15	(2.1-2.2)	2	——		0
leucopogon	6.33	(6.1-6.6)	3	2.47	(2.2-2.8)	3	33.60	(32.3-34.5)	3
Lophortyx									
californica	6.90	(6.8-7.0)	2	2.80	(2.6-3.0)	2	32.90	(32.5-33.2)	3
gambelii	7.20		1	2.60		1	33.60		1
douglasii	6.85	(6.8-6.9)	2	2.60	(2.5-2.7)	2	33.60	(33.6-33.6)	2
Odontophorus									
gujanensis	8.55	(8.5-8.6)	2	3.25	(3.0-3.5)	2	42.70	(41.8-43.6)	2
stellatus	7.70		1	2.90		1	40.80		1
guttatus	8.20		1	3.00		1	43.50		1
Dactylortyx									
thoracicus	7.70	(7.5-8.0)	3	3.07	(3.0-3.2)	3	38.43	(36.7-39.9)	3
Cyrtonyx									
montezumae	7.00	(6.6-7.3)	3	2.77	(2.7-2.9)	3	40.50	(39.9-41.4)	3
Rhynchortyx									
cinctus	6.20		1	2.70		1	33.00		1

Continued

TABLE 1 (continued)

Recent species	Proximal width of humerus			Midshaft of humerus			Distal width of humerus		
Dendrortyx leucophrys	10.50		1	4.10		1	8.40		1
Philortyx fasciatus	9.00		1	3.30		1	6.70		1
Oreortyx picta	11.05	(11.0-11.1)	4	4.13	(4.0-4.4)	4	8.18	(8.0-8.5)	4
Callipepla squamata	9.65	(9.6-9.7)	4	3.43	(3.2-3.6)	4	7.38	(7.2-7.5)	4
Colinus virginianus	9.32	(8.5-10.2)	94	3.40	(2.7-3.8)	89	6.97	(6.2-7.6)	88
nigrogularis	8.00		1	—		0	—		0
leucopogon	9.00	(8.5-9.3)	3	3.23	(3.1-3.4)	3	6.83	(6.5-7.1)	3
Lophortyx californica	9.47	(9.0-9.8)	3	3.53	(3.5-3.6)	3	7.20	(7.0-7.4)	3
gambelii	9.20		1	3.40		1	7.20		1
douglasii	9.05	(8.9-9.2)	2	3.35	(3.2-3.5)	2	7.00	(7.0-7.0)	2
Odontophorus gujanensis	12.55	(12.2-12.9)	2	5.10	(4.9-5.3)	2	9.50		1
stellatus	11.30		1	4.60		1	9.30		1
guttatus	11.90		1	4.60		1	9.30		1
Dactylortyx thoracicus	10.83	(10.5-11.2)	3	3.97	(3.8-4.2)	3	8.37	(8.2-8.5)	3
Cyrtonyx montezumae	10.27	(10.0-10.5)	3	3.63	(3.6-3.7)	3	7.90	(7.7-8.2)	3
Rhynchortyx cinctus	9.80		1	3.60		1	7.40		1

Continued

TABLE 1 (continued)

Recent species	Length of ulna			Proximal width of ulna			Midshaft of ulna		
Dendrortyx									
leucophrys	36.50		1	7.10		1	3.20		1
Philortyx									
fasciatus	28.00		1	5.70		1	2.60		1
Oreortyx									
picta	35.78	(34.5-36.8)	4	6.75	(6.0-7.0)	4	2.98	(2.9-3.0)	4
Callipepla									
squamata	32.85	(32.2-33.7)	4	6.13	(6.0-6.2)	4	2.53	(2.3-2.8)	4
Colinus									
virginianus	31.15	(28.4-34.0)	57	5.74	(6.0-6.4)	69	2.61	(2.1-3.1)	59
leucopogon	29.50	(28.4-30.2)	3	5.70	(5.4-5.9)	3	2.53	(2.4-2.7)	3
Lophortyx									
californica	28.75	(28.5-29.0)	2	6.00	(5.9-6.1)	2	2.70	(2.6-2.8)	2
gambelii	30.00		1	5.80		1	2.50		1
douglasii	29.10	(29.0-29.2)	2	5.45	(5.4-5.5)	2	2.30	(2.2-2.4)	2
Odontophorus									
gujanensis	42.70		1	8.00		1	3.70		1
stellatus	40.20		1	7.20		1	3.10		1
guttatus	42.20		1	8.00		1	3.50		1
Dactylortyx									
thoracicus	37.90	(36.1-39.7)	3	6.83	(6.5-7.1)	3	2.93	(2.8-3.2)	3
Cyrtonyx									
montezumae	37.93	(37.3-39.1)	3	6.43	(6.2-6.6)	3	2.87	(2.7-3.1)	3
Rhynchortyx									
cinctus	33.60		1	5.90		1	2.50		1

Continued

TABLE 1 (continued)

Recent species	Distal width of ulna			Length of carpometacarpus			Proximal height of carpometacarpus		
Dendrortyx leucophrys	5.60		1	21.50		1	6.50		1
Philortyx fasciatus	4.50		1	18.00		1	5.40		1
Oreortyx picta	5.78	(5.5-6.6)	4	21.75	(20.9-22.5)	4	6.33	(5.9-6.6)	4
Callipepla squamata	5.00	(5.0-5.0)	4	19.55	(19.0-20.0)	4	5.65	(5.5-5.8)	4
Colinus virginianus	4.72	(4.1-5.3)	57	18.65	(17.0-21.2)	66	5.38	(4.7-6.2)	63
leucopogon	4.63	(4.4-4.9)	3	17.50	(16.5-18.0)	3	5.17	(5.0-5.4)	3
Lophortyx californica	4.85	(4.7-5.0)	2	17.85	(17.6-18.1)	2	5.65	(5.5-5.8)	2
gambelii	4.90		1	18.10		1	5.30		1
douglasii	4.65	(4.6-4.7)	2	17.80	(17.7-17.9)	2	5.20	(5.2-5.2)	2
Odontophorus gujanensis	6.30		1	24.25	(23.2-25.3)	2	7.05	(7.0-7.1)	2
stellatus	6.00		1	23.10		1	7.10		1
guttatus	6.00		1	23.10		1	7.10		1
Dactylortyx thoracicus	5.57	(5.5-5.7)	3	20.83	(19.8-22.0)	3	6.63	(6.4-6.8)	3
Cyrtonyx montezumae	5.00	(4.9-5.2)	3	21.20	(20.8-21.9)	3	5.97	(5.8-6.2)	3
Rhynchortyx cinctus	5.00		1	18.70		1	5.90		1

Continued

TABLE 1 (continued)

Recent species	Distal height of carpometacarpus			Length through first four synsacral vertebrae			Length of femur		
Dendrortyx									
leucophrys	5.00		1	17.60		1	58.00		1
Philortyx									
fasciatus	4.50		1	11.80		1	41.00		1
Oreortyx									
picta	5.40	(4.9-6.0)	4	12.88	(11.9-13.5)	4	44.83	(44.0-45.2)	4
Callipepla									
squamata	4.58	(4.4-4.9)	4	11.58	(11.0-12.2)	4	41.03	(39.5-42.0)	4
Colinus									
virginianus	4.45	(3.9-5.4)	57	12.33	(10.6-13.8)	92	41.02	(37.7-45.7)	94
nigrogularis	—		0	10.80	(10.2-11.4)	2	37.65	(37.6-37.7)	2
leucopogon	4.40	(4.1-4.9)	3	12.00	(11.0-12.8)	3	40.95	(40.0-41.9)	2
Lophortyx									
californica	4.80	(4.7-4.9)	2	12.10	(11.7-12.6)	3	41.35	(40.9-41.8)	2
gambelii	4.00		1	12.30		1	40.40		1
douglasii	4.55	(4.5-4.6)	2	11.15	(10.9-11.4)	2	39.70	(39.7-39.7)	2
Odontophorus									
gujanensis	5.40	(5.4-5.4)	2	14.10	(14.0-14.2)	2	50.35	(49.9-50.8)	2
stellatus	5.40		1	16.10		1	48.60		1
guttatus	5.20		1	14.80		1	52.80		1
Dactylortyx									
thoracicus	5.00	(4.6-5.4)	3	11.30	(10.8-12.2)	3	42.43	(40.7-43.8)	3
Cyrtonyx									
montezumae	4.77	(4.5-5.0)	3	12.23	(11.9-12.6)	3	41.37	(40.0-42.1)	3
Rhynchortyx									
cinctus	4.50		1	10.50		1	38.50		1

Continued

TABLE 1 (continued)

Recent species	Proximal width of femur			Midshaft of femur			Distal width of femur		
Dendrortyx leucophrys	10.50		1	4.50		1	9.70		1
Philortyx fasciatus	7.30		1	3.20		1	6.70		1
Oreortyx picta	8.08	(7.6-8.3)	4	3.38	(3.3-3.5)	4	7.70	(7.6-7.8)	4
Callipepla squamata	7.55	(7.3-7.8)	4	3.00	(2.8-3.1)	4	7.25	(6.7-7.5)	4
Colinus virginianus	7.17	(6.4-8.1)	97	2.93	(2.4-3.3)	96	6.70	(6.0-7.6)	97
nigrogularis	6.65	(6.5-6.8)	2	2.65	(2.6-2.7)	2	6.10	(5.9-6.3)	2
leucopogon	7.07	(6.5-7.8)	3	2.93	(2.9-3.0)	3	6.75	(6.7-6.8)	2
Lophortyx californica	7.60	(7.6-7.6)	2	3.25	(3.0-3.5)	2	7.30	(7.2-7.4)	2
gambelii	7.40		1	3.10		1	7.20		1
douglasii	7.15	(7.1-7.2)	2	2.90	(2.9-2.9)	2	6.90	(6.9-6.9)	2
Odontophorus gujanensis	9.55	(9.3-9.8)	2	3.70	(3.6-3.8)	2	8.80		1
stellatus	9.10		1	3.50		1	8.40		1
guttatus	9.00		1	3.60		1	8.70		1
Dactylortyx thoracicus	7.90	(7.7-8.2)	3	3.27	(3.1-3.4)	3	7.93	(7.6-8.2)	3
Cyrtonyx montezumae	7.43	(7.1-7.8)	3	3.03	(3.0-3.1)	3	7.43	(7.1-7.7)	3
Rhynchortyx cinctus	7.00		1	2.90		1	6.70		1

Continued

TABLE 1 (continued)

Recent species	Length of tibiotarsus			Proximal width of tibiotarsus			Midshaft width of tibiotarsus		
Dendrortyx									
leucophrys	80.90		1	12.80		1	3.90		1
Philortyx									
fasciatus	52.90		1	8.20		1	2.90		1
Oreortyx									
picta	63.30	(62.6-64.0)	3	10.13	(10.0-10.3)	4	3.18	(3.1-3.3)	4
Callipepla									
squamata	56.80	(54.9-58.5)	4	9.45	(9.1-9.6)	4	3.08	(2.9-3.2)	4
Colinus									
virginianus	55.15	(49.7-60.9)	84	8.78	(8.0-9.7)	93	2.79	(2.5-3.1)	91
leucopogon	52.85	(51.8-53.9)	2	8.37	(7.8-8.7)	3	2.60	(2.5-2.7)	3
Lophortyx									
californica	56.85	(56.8-56.9)	2	9.45	(9.4-9.5)	2	2.95	(2.7-3.2)	2
gambelii	56.30		1	9.10		1	2.90		1
douglasii	52.12	(51.7-52.6)	2	8.85	(8.8-8.9)	2	2.75	(2.7-2.8)	2
Odontophorus									
gujanensis	68.55	(68.5-68.6)	2	11.65	(11.4-11.9)	2	3.80	(3.8-3.8)	2
stellatus	64.50		1	11.40		1	3.30		1
guttatus	70.90		1	11.50		1	3.60		1
Dactylortyx									
thoracicus	58.17	(55.9-60.8)	3	10.90	(10.4-11.3)	3	3.20	(3.1-3.3)	3
Cyrtonyx									
montezumae	54.63	(53.4-55.4)	3	9.53	(9.0-10.0)	3	3.17	(3.1-3.2)	3
Rhynchortyx									
cinctus	54.40		1	7.30		1	2.50		1

Continued

TABLE 1 (continued)

Recent species	Distal width of tibiotarsus			Length of tarsometatarsus			Proximal width of tarsometatarsus		
Dendrortyx leucophrys	7.50		1	80.90		1	7.80		1
Philortyx fasciatus	5.30		1	52.90		1	5.80		1
Oreortyx picta	5.67	(5.5-6.0)	3	63.30	(62.6-64.0)	3	6.38	(6.2-6.6)	4
Callipepla squamata	5.30	(5.1-5.5)	4	56.80	(54.9-58.5)	4	5.68	(5.5-5.9)	4
Colinus virginianus	5.16	(4.4-5.8)	93	55.15	(49.7-60.9)	84	5.61	(5.0-6.3)	91
leucopogon	4.93	(4.9-5.0)	3	52.85	(51.8-53.9)	2	5.40	(5.4-5.4)	3
Lophortyx californica	5.35	(5.3-5.4)	2	56.85	(56.8-56.9)	2	5.90	(5.8-6.0)	2
gambelii	5.60		1	56.30		1	5.90		1
douglasii	5.05	(5.0-5.1)	2	52.12	(51.7-52.6)	2	5.55	(5.5-5.6)	2
Odontophorus gujanensis	6.85	(6.7-7.0)	2	68.55	(68.5-68.6)	2	7.40	(7.4-7.4)	2
stellatus	6.50		1	64.50		1	7.30		1
guttatus	6.70		1	70.90		1	7.30		1
Dactylortyx thoracicus	5.93	(5.7-6.1)	3	58.17	(55.9-60.8)	3	6.83	(6.7-7.0)	3
Cyrtonyx montezumae	5.53	(5.3-5.7)	3	54.63	(53.4-55.4)	3	5.80	(5.7-6.0)	3
Rhynchortyx cinctus	5.00		1	54.40		1	5.60		1

Continued

TABLE 1 (continued)

Recent species	Midshaft width of tarsometatarsus			Width through trochlea of tarsometatarsus		
Dendrortyx						
leucophrys	3.60		1	7.20		1
Philortyx						
fasciatus	3.10		1	5.30		1
Oreortyx						
picta	2.80	(2.7-2.9)	4	6.33	(6.2-6.6)	4
Callipepla						
squamata	2.70	(2.5-2.8)	4	5.75	(5.3-6.0)	4
Colinus						
virginianus	2.65	(2.4-3.1)	89	5.52	(5.0-6.3)	89
leucopogon	2.73	(2.6-2.8)	3	5.20	(4.9-5.5)	3
Lophortyx						
californica	2.80	(2.7-2.9)	2	6.05	(6.0-6.1)	2
gambelii	2.50		1	5.80		1
douglasii	2.65	(2.5-2.8)	2	5.70	(5.4-6.0)	2
Odontophorus						
gujanensis	3.60	(3.5-3.7)	2	7.10	(7.1-7.1)	2
stellatus	3.30		1	7.10		1
guttatus	3.50		1	7.10		1
Dactylortyx						
thoracicus	3.13	(3.1-3.2)	3	7.00	(6.8-7.3)	3
Cyrtonyx						
montezumae	2.80	(2.7-3.0)	3	6.27	(6.2-6.4)	3
Rhynchortyx						
cinctus	2.80		1	5.00		1

TABLE 2. SUBSPECIFIC VARIATION IN *Colinus virginianus* (IN MM.), GIVING MEAN, STANDARD ERROR, RANGE, STANDARD DEVIATION, AND SAMPLE SIZE

Subspecies	Length of spina sterni				Length of coracoid			
C. v. virginianus, Michigan	4.56 ± .05	(4.1-5.0)	.23	18	29.59 ± .20	(28.5-30.9)	.86	19
C. v. virginianus, Illinois	4.46 ± .04	(3.9-5.0)	.24	37	29.06 ± .15	(27.2-30.8)	.91	37
C. virginianus subsp., northern Florida	4.33 ± .07	(3.6-4.8)	.29	19	28.31 ± .20	(27.3-30.1)	.87	19
C. v. floridanus, southern Florida	4.04 ± .10	(3.6-4.8)	.30	10	26.65 ± .32	(25.7-28.5)	1.01	10
C. v. coyolcos, Oaxaca, Mexico	4.50			1	——			0
C. v. insignis, Chiapas, Mexico	4.40	(4.1-4.8)		5	27.94	(26.9-28.9)		5
Subspecies	**Distal width of coracoid**				**Proximal width of scapula**			
C. v. virginianus, Michigan	8.97 ± .11	(8.3-9.9)	.44	17	6.98 ± .05	(6.5-7.4)	.24	19
C. v. virginianus, Illinois	8.87 ± .14	(8.0-9.6)	.14	39	6.93 ± .04	(6.4-7.4)	.24	39
C. virginianus subsp., northern Florida	8.26 ± .02	(7.8-8.9)	.11	19	6.45 ± .03	(5.7-7.0)	.11	20
C. v. floridanus, southern Florida	7.82 ± .10	(7.2-8.2)	.31	10	6.13 ± .09	(5.7-6.5)	.28	10
C. v. coyolcos, Oaxaca, Mexico	——			0	——			0
C. v. insignis, Chiapas, Mexico	7.66	(6.9-8.4)		5	6.38	(5.8-6.8)		5
Subspecies	**Length of humerus**				**Proximal width of humerus**			
C. v. virginianus, Michigan	36.29 ± .19	(34.8-37.7)	.86	20	9.62 ± .02	(8.8-10.2)	.10	20
C. v. virginianus, Illinois	35.34 ± .19	(33.7-37.5)	.97	26	9.43 ± .04	(9.0-10.0)	.26	37
C. virginianus subsp., northern Florida	34.43 ± .17	(32.8-35.8)	.72	18	9.12 ± .07	(8.7-9.6)	.32	19
C. v. floridanus, southern Florida	33.29 ± .38	(32.0-35.4)	1.19	10	8.79 ± .12	(8.2-9.5)	.37	10
C. v. coyolcos, Oaxaca, Mexico	33.80			1	8.90			1
C. v. insignis, Chiapas, Mexico	33.78	(33.2-34.0)		5	9.04	(8.7-9.4)		5

(Continued)

TABLE 2 (continued)

Subspecies	Width of humerus below epicondyles				Length of ulna			
C. v. virginianus, Michigan	6.53 ± .04	(6.3-6.9)	.18	20	32.45 ± .13	(31.5-34.0)	.56	20
C. v. virginianus, Illinois	6.36 ± .04	(6.0-6.8)	.20	30	31.53 ± .38	(29.3-32.7)	1.02	7
C. virginianus subsp., northern Florida	6.17 ± .05	(5.8-6.5)	.20	18	30.64 ± .17	(29.5-31.9)	.68	17
C. v. floridanus, southern Florida	5.86 ± .07	(5.5-6.2)	.21	10	29.54 ± .25	(28.4-31.5)	.78	10
C. v. coyolcos, Oaxaca, Mexico	6.00			1	——			0
C. v. insignis, Chiapas, Mexico	6.02	(5.9-6.1)		5	29.20	(28.6-29.8)		2

Subspecies	Proximal width of ulna				Length of carpometacarpus			
C. v. virginianus, Michigan	6.10 ± .04	(5.8-6.4)	.16	20	19.36 ± .17	(18.5-21.2)	.74	20
C. v. virginianus, Illinois	5.84 ± .06	(5.4-6.0)	.18	9	19.09 ± .17	(18.5-19.8)	.46	7
C. virginianus subsp., northern Florida	5.50 ± .05	(5.0-5.8)	.20	17	18.23 ± .12	(17.2-19.3)	.49	18
C. v. floridanus, southern Florida	5.31 ± .08	(5.0-5.8)	.25	10	17.60 ± .19	(17.0-19.1)	.60	10
C. v. coyolcos, Oaxaca, Mexico	——			0	——			0
C. v. insignis, Chiapas, Mexico	5.35	(5.3-5.4)		2	17.50	(17.5-17.5)		2

Subspecies	Proximal height of carpometacarpus				Length from synsacral vertebra 1 to 4			
C. v. virginianus, Michigan	5.63 ± .05	(5.3-6.2)	.20	18	12.89 ± .12	(11.7-13.8)	.47	16
C. v. virginianus, Illinois	5.51 ± .07	(5.3-5.9)	.17	7	12.29 ± .07	(11.1-13.2)	.47	40
C. virginianus subsp., northern Florida	5.25 .05	(5.0-5.5)	.19	18	12.15 ± .19	(10.6-13.4)	.76	17
C. v. floridanus, southern Florida	5.09 .05	(4.7-5.4)	.15	10	11.84 ± .18	(11.0-12.8)	.55	9
C. v. coyolcos, Oaxaca, Mexico	——			0	12.20			1
C. v. insignis, Chiapas, Mexico	5.00	(4.9-5.1)		2	12.02	(11.0-12.6)		5

(Continued)

TABLE 2 (continued)

Subspecies	Length of femur				Distal width of femur			
C. v. virginianus, Michigan	42.56 ± .27	(40.5-45.8)	1.19	19	6.94 ± .06	(6.6-7.6)	.24	19
C. v. virginianus, Illinois	41.29 ± .18	(38.8-44.8)	1.07	37	6.77 ± .03	(6.4-7.2)	.16	39
C. virginianus subsp., northern Florida	40.12 ± .14	(38.6-42.0)	.62	19	6.52 ± .05	(6.2-6.9)	.21	19
C. v. floridanus, southern Florida	38.66 ± .40	(37.7-41.2)	1.21	9	6.27 ± .10	(5.9-6.9)	.30	10
C. v. coyolcos, Oaxaca, Mexico	40.70			1	6.80			1
C. v. insignis, Chiapas, Mexico	40.38	(39.3-41.5)		5	6.64	(6.6-6.7)		5

Subspecies	Length of tibiotarsus				Proximal width of tibiotarsus			
C. v. virginianus, Michigan	57.17 ± .40	(54.8-60.9)	1.73	19	9.06 ± .08	(8.4-9.7)	.34	19
C. v. virginianus, Illinois	55.75 ± .26	(53.2-58.0)	1.44	31	8.89 ± .03	(8.4-9.2)	.20	40
C. virginianus subsp., northern Florida	53.86 ± .40	(51.3-57.0)	1.70	18	8.52 ± .07	(8.0-9.1)	.28	18
C. v. floridanus, southern Florida	52.09 ± .48	(49.7-55.1)	.52	10	8.33 ± .10	(8.0-8.8)	.32	10
C. v. coyolcos, Oaxaca, Mexico	——			0	——			0
C. v. insignis, Chiapas, Mexico	51.95	(51.0-52.9)		2	8.30	(8.0-8.6)		2

Subspecies	Distal width of tibiotarsus				Length of tarsometatarsus			
C. v. virginianus, Michigan	5.41 ± .05	(5.1-5.9)	.23	19	33.28 ± .26	(31.4-35.5)	1.14	20
C. v. virginianus, Illinois	5.22 ± .03	(4.9-5.5)	.16	40	32.46 ± .18	(30.0-34.5)	.99	32
C. virginianus subsp., northern Florida	4.99 ± .04	(4.6-5.4)	.18	18	31.03 ± .26	(29.4-34.0)	1.17	18
C. v. floridanus, southern Florida	4.86 ± .08	(4.4-5.2)	.25	10	30.65 ± .29	(28.9-31.8)	.91	10
C. v. insignis, Chiapas, Mexico	4.95	(4.8-5.1)		2	29.15	(28.4-29.9)		2

(Continued)

TABLE 2 (continued)

Subspecies	Proximal width of tarsometatarsus				Distal width of tarsometatarsus			
C. v. virginianus, Michigan	5.86 ± .05	(5.4-6.3)	.22	20	5.71 ± .06	(5.3-6.3)	.25	19
C. v. virginianus, Illinois	5.67 ± .04	(5.0-6.0)	.21	37	5.60 ± .04	(5.2-6.0)	.21	36
C. virginianus subsp., northern Florida	5.42 ± .05	(5.0-5.7)	.20	18	5.31 ± .06	(5.0-5.8)	.24	18
C. v. floridanus, southern Florida	5.31 ± .06	(5.0-5.6)	.18	10	5.31 ± .04	(5.1-5.6)	.14	10
C. v. insignis, Chiapas, Mexico	5.35	(5.2-5.5)		2	5.45	(5.4-5.5)		2

TABLE 3. SIZE VARIATION (IN MM.) IN FOSSIL *Colinus*, GIVING MEAN, STANDARD ERROR, RANGE, STANDARD DEVIATION, AND SAMPLE SIZE

Species	Distal width of coracoid				Length of coracoid			
C. hibbardi								
Meade County	11.30			1	——			0
C. suilium								
Arredondo I	9.00			1	30.80	(30.3-31.3)		2
Arredondo II	8.70			1	29.80			1
Orange Lake	9.00	(9.0-9.0)		2	29.53	(29.2-29.9)		3
Reddick A	9.05	(8.8-9.3)		2	28.83	(28.5-29.0)		3
Reddick B	9.35	(9.3-9.4)		2	29.80			1
Reddick C	——			0	29.65	(28.8-30.5)		2
Reddick, unspecified	8.79 ± .14	(8.3-9.4)	.39	7	28.99 ± .18	(27.8-30.1)	.72	16
C. virginianus								
Warren's Cave	8.20			1	27.70			1

Species	Length of tibiotarsus			Length from 1st to 4th synsacral vertebra			
C. suilium							
Arredondo I	60.00		1	13.00			1
Williston	56.00		1	——			0
Orange Lake	58.50	(58.2-58.9)	3	12.85	(12.3-13.4)		2
Reddick A	57.20		1	——			0
Reddick, unspecified	——		0	13.18	(12.9-13.5)		4

(Continued)

TABLE 3 (continued)

Species	Width below epicondyles				Proximal width of humerus			
C. suilium								
Arredondo I	7.10	(7.1-7.1)		2	10.02	(9.8-10.4)		6
Arredondo II	6.75	(6.7-6.8)		3	10.00			1
Williston	6.95	(6.5-7.3)		4	9.83	(9.2-10.2)		4
Orange Lake	7.23	(7.2-7.3)		3	9.85	(9.5-10.1)		4
Reddick A	6.67 ± .06	(6.4-7.0)	.16	7	9.66	(9.4-10.2)		5
Reddick B	6.60	(6.3-7.0)		3	9.40	(9.2-9.6)		3
Reddick C	6.54 ± .07	(6.3-7.0)	.23	11	9.50	(9.2-9.8)		6
Reddick, unspecified	6.63 ± .02	(6.3-7.0)	.16	84	9.75 ± .03	(9.0-10.2)	.28	66
cf. *C. suilium*								
Oakhurst Quarry	7.00			1	10.20			1
Eichelberger Cave	6.60			1	9.40			1
Lake Monroe	6.70			1	—			0
C. virginianus								
Kanapaha	6.35	(6.3-6.4)		2	9.20	(9.2-9.2)		2
Saber-tooth Cave	6.30	(6.2-6.4)		2	—			0
Vero, stratum 2	6.10	(5.9-6.3)		2	—			0
Vero, stratum 3	6.10			1	—			0
Vero, unspecified	6.00			1	9.10			1
Friesenhahn Cave	6.20			1	9.50	(9.4-9.6)		2

Species	Length of humerus			Length of tarsometatarsus			
C. suilium							
Arredondo I	37.75	(37.6-37.9)	2	34.60			1
Williston	35.83	(34.3-36.9)	4	—			0
Orange Lake	36.40		1	—			0
Reddick A	36.40	(35.6-37.6)	3	—			0

(Continued)

TABLE 3 (continued)

Species	Length of humerus				Length of tarsometatarsus			
Reddick C	35.13	(34.7-35.9)		3	32.80			1
Reddick, unspecified	35.91 ± .11	(34.5-36.8)	.60	31	32.86	(32.4-34.6)		7
cf. *C. suilium*								
Haile II	——			0	33.70			1
Oakhurst Quarry	34.90			1	——			0
Eichelberger Cave	35.30			1	33.90			1
C. virginianus								
Kanapaha	35.45	(35.1-35.8)		2	——			0
Vero, unspecified	34.80			1	——			0
Friesenhahn Cave	35.60			1	——			0

Species	Length of ulna				Proximal width of ulna			
C. hibbardi								
Meade County	38.02	(37.4-38.7)		2	——			0
C. suilium								
Arredondo I	33.05	(32.8-33.3)		2	6.30	(6.2-6.4)		2
Arredondo II	33.00			1	5.90			1
Williston	34.00			1	6.60			1
Orange Lake	——			0	6.00			1
Reddick A	32.00			1	——			0
Reddick C	31.30	(30.9-31.7)		2	5.90	(5.8-6.0)		2
Reddick, unspecified	32.33 ± .24	(30.7-33.6)	.78	11	6.11 ± .04	(5.7-6.5)	.21	23
cf. *C. suilium*								
Haile II	——			0	6.40			1
C. virginianus								
Vero, stratum 3	29.80			1	——			0
Friesenhahn Cave	31.00			1	——			0

(Continued)

TABLE 3 (continued)

Species	Length of carpometacarpus				Proximal height of carpometacarpus			
C. hibbardi								
Meade County	22.20	(22.0-22.4)		2	5.90	(5.7-6.2)		3
C. suilium								
Arredondo I	19.30			1	5.50			1
Williston	20.00			1	5.90			1
Orange Lake	19.60			1	5.90			1
Reddick C	19.05 ± .19	(18.1-19.9)	.61	10	5.63 ± .09	(5.3-6.1)	.27	10
Reddick, unspecified	18.93 ± .12	(18.0-19.8)	.47	16	5.75 ± .04	(5.4-6.1)	.18	26
C. virginianus								
Kanapaha	18.50			1	5.80			1
Saber-tooth Cave	18.30	(18.0-18.9)		4	5.50	(5.4-5.6)		4

Species	Proximal width of scapula				Length of spina sterni			
C. suilium								
Arredondo I	——			0	4.90			1
Arredondo II	7.10			1	——			0
Orange Lake	7.13	(6.6-7.6)		3	——			0
Reddick A	——			0	5.30			1
Reddick C	7.00			1	——			0
Reddick, unspecified	6.94	(6.7-7.3)		7	4.85	(4.8-4.9)		2
C. virginianus								
Warren's Cave	6.50			1	——			0

(Continued)

TABLE 3 (continued)

Species	Distal width of femur				Length of femur		
C. suilium							
Arredondo II	6.90			1	42.50		1
Williston	7.05	(6.9-7.2)		2	43.60		1
Orange Lake, Arredondo clay	7.07	(6.6-7.2)		7	42.40	(40.6-43.0)	4
Orange Lake, Arredondo-Wicomico contact	6.60			1	——		0
Reddick A	7.10			1	——		0
Reddick B	7.10	(7.0-7.2)		2	——		0
Reddick, unspecified	7.00 ± .04	(6.6-7.6)	.20	30	42.41	(39.8-44.5)	6
cf. *C. suilium*							
Zuber	6.60			1	42.10		1
C. virginianus							
Kanapaha	6.50			1	——		0
Saber-tooth Cave	6.70	(6.5-6.9)		2	41.90		1

Species	Proximal width of tibiotarsus			Distal width of tibiotarsus		
C. suilium						
Arredondo I	9.65	(9.5-9.8)	2	5.45	(5.2-5.7)	2
Arredondo II	——		0	5.57	(5.5-5.7)	3
Williston	8.90		1	5.50	(5.2-5.7)	3
Orange Lake	9.93	(9.8-10.0)	3	5.65	(5.3-5.8)	4
Reddick A	9.03	(8.6-9.5)	3	5.50	(5.2-5.9)	3
Reddick B	——		0	5.60	(5.5-5.7)	2

(Continued)

TABLE 3 (continued)

Species	Proximal width of tibiotarsus				Distal width of tibiotarsus			
Reddick C	—			0	5.23	(5.0-5.5)		3
Reddick, unspecified	9.23 ± .08	(8.8-9.7)	.26	12	5.58 ± .03	(5.2-5.9)	.18	36
cf. *C. suilium*								
Eichelberger Cave	9.50			1	—			0
C. virginianus								
Saber-tooth Cave	8.50	(8.4-8.6)		2	—			0
Vero, stratum 2	8.20			1	—			0
Vero, stratum 3	8.30			1	—			0
Friesenhahn Cave	9.40			1	5.80			1
Species	**Proximal width of tarsometatarsus**				**Distal width of tarsometatarsus**			
C. hibbardi								
Meade County	—			0	6.80	(6.6-7.0)		3
C. suilium								
Arredondo I	6.20	(6.0-6.4)		2	6.50	(6.5-6.5)		2
Arredondo II	6.00			1	—			0
Orange Lake	6.15	(6.1-6.2)		2	6.00	(5.7-6.4)		3
Reddick A	5.80			1	—			0
Reddick B	6.00	(5.7-6.3)		2	6.00	(5.7-6.3)		2
Reddick C	—			0	5.93	(5.8-6.1)		3
Reddick, unspecified	5.88 ± .05	(5.4-6.4)	.23	24	6.03 ± .04	(5.3-6.5)	.23	27
cf. *C. suilium*								
Haile II	5.90			1	—			0
Eichelberger Cave	5.90			1	5.90			1
C. virginianus								
Warren's Cave	5.40			1	5.40			1

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