

## ADDITIONAL RECORDS OF AVIAN EGG TEETH

KENNETH C. PARKES AND GEORGE A. CLARK, JR.

IN an admittedly preliminary survey (Clark, 1961), the junior author listed 146 families of birds for which he had found records of the presence in hatchlings or embryos of an egg tooth on the upper mandible. In five additional families (Haematopodidae, Charadriidae, Recurvirostridae, Burhinidae, Bucerotidae), egg teeth or analogous structures had been reported as having been found on the lower jaw only. The 1961 paper was based primarily on an extensive but by no means exhaustive survey of the literature, supplemented by examination of specimens at the Yale Peabody Museum of Natural History.

In connection with a study of early plumages of birds, we have had occasion to handle several hundred additional specimens, both study skins and alcoholics, and have taken advantage of this opportunity to record additional data on egg teeth. The principal collections utilized were those of the American Museum of Natural History (hereinafter abbreviated as AMNH), Chicago Natural History Museum, Carnegie Museum (CM), and Yale Peabody Museum. Parkes examined certain additional specimens in the collections of the United States National Museum (USNM), University of California (both Berkeley and Los Angeles), the California Academy of Sciences, and Cornell University (CU).

Unless otherwise specified, records of egg teeth in the following list are based on specimens examined by one or both of us. Also included are additional literature records, both prior and subsequent to Clark's 1961 paper. Families not previously reported by Clark as having egg teeth on the upper mandible are starred (\*); there are 51 such additional family records included in the present paper. Confirmatory records or discussions of families previously reported are given in some cases, especially when only one or two species of large families were definitely known to have egg teeth. The family sequence followed is that of Wetmore (1960).

The large number of families and genera from which egg teeth have now been reported makes it increasingly likely that Gadow (1891) was correct in stating that this structure occurs in the embryos of all birds. The presence and the gross similarity of egg teeth on the upper mandible among such a diversity of families strongly suggests that this structure is homologous throughout the class Aves and thus was presumably present in the common ancestors of living birds. One problem which remains to be studied is the mode of *loss* of the egg tooth. In some groups it is obviously quickly deciduous; in others it appears to be shed after a longer period; and in still others (notably passerines) it gradually disappears without, apparently, actually falling off. Pycraft

(1900:154) attempted to confine the definition of the true egg tooth to a "detachable" structure, believing that the egg tooth in all "Neognathae" is "detachable, and falls off after [hatching]." He described for the "Palaeognathae" a "non-detachable egg-tooth becoming absorbed after hatching." The latter mode of loss, however, is also found in many "Neognathae," as mentioned above, and Pycraft's separation cannot be upheld.

Negative evidence such as the absence of egg teeth on the culmens of some of the specimens mentioned later must be interpreted with caution. It is entirely possible that the egg tooth may have been lost in some of these during preservation or later handling. Records of absence of an egg tooth in an avian species can be misleading unless adequate series of freshly collected material are available to cover potential individual variations in time of loss of egg tooth, and possible effects of drying or preservation in fluids on the presence and distinctness of the egg tooth.

#### ANNOTATED LIST

Spheniscidae.—Clark (1961) listed five species of four genera of penguins for which egg teeth had been reported; to these we can now add *Spheniscus demersus*.

\*Rheidae.—*Rhea americana*.

\*Dromiceidae.—Miranda-Ribeiro (1936) described and figured a 23-day embryo of *Dromaeus* (= *Dromiceius*) *novae-hollandiae* with an egg tooth. We have seen an egg tooth on a downy young emu in the AMNH collection.

\*Tinamidae.—Beebe (1925) described the egg tooth and its use during hatching of *Crypturellus variegatus*. A one-day-old chick of *C. soui* (AMNH) shows a pale calcified cap over the whole terminal segment of the bill, of which only a part is raised into a tooth. We have also seen egg teeth in *Rhynchotus rufescens*, *Tinamus major*, and *Nothura maculosa*.

Gaviidae.—The egg tooth has now been recorded in all four species of loons. Clark (1961) had seen only *Gavia immer*; we have now seen egg teeth on study skins of *G. stellata* and *G. arctica* (CM), while Sutton (1963) has described the egg tooth of *G. adamsii*.

Podicipedidae.—Additional species records: *Podiceps dominicus*, *P. auritus*, *P. caspicus*, *P. rolland*, *Podilymbus podiceps*. See also Fisher (1961).

\*Diomedidae.—We have seen the egg tooth only in *Diomedea bulleri*. Sorensen (in Bailey and Sorensen, 1962:126) describes the egg tooth of a chick of *D. exulans* approximately 4 days old. The egg tooth is visible in several excellent photographs by Dr. Bailey of *D. epomophora* (op. cit.:157, 161, 162). The egg tooth of this species is said to "drop off" during the fourth week posthatching (op. cit.:159) while that of *Phoebetria palpebrata* is said to "remain briefly" (op. cit.:205).

Procellariidae.—Clark (1961) listed a record of an egg tooth in "*Procellaria grisea*," as originally published by Richdale (1945). This is *Puffinus griseus* of the A.O.U. Check-list. In a later paper Richdale (1963:27) reports that the egg tooth of *Puffinus griseus* "disappears" between the ages of 9 and 11 days (based on nine records). We have subsequently seen egg teeth also in *Puffinus auricularis* and *P. lherminieri*. Tickell (1962) reports the egg tooth gone by the tenth day posthatching in *Pachyptila desolata*.

Hydrobatidae.—Additional species: *Oceanodroma leucorhoa*, *O.* (“*Loomelania*”) *melania*, *Halocyptena microsoma*.

\*Phaethontidae.—*Phaethon aethereus*, *P. lepturus*, *P. rubricauda*.

\*Pelecanidae.—*Pelecanus erythrorhynchos*, *P. occidentalis*.

\*Sulidae.—*Sula dactylatra*, *S. leucogaster*, *Morus serrator*, *M. bassanus*. The egg tooth of the Gannet is clearly shown in a plate by Joseph Wolf accompanying a paper by Cunningham (1866), in which the following description appears: “The bill [of the young bird when just hatched] is horn-coloured at the tip, and the upper mandible is provided with a scale, which soon disappears.”

\*Anhingidae.—*Anhinga rufo*.

Ardeidae.—Clark (1961) listed egg tooth records only for *Ardea cinerea*. To these we can add *Butorides virescens*, *Florida caerulea*, *Dichromanassa rufescens*, *Egretta (Casmerodius) alba*, *Egretta (Leucophoyx) thula*, *Nycticorax nycticorax*, and *Botaurus stellaris* (the latter shown in a photograph in Whitlock, 1953, pl. 35).

\*Cochleariidae.—A study skin of a small downy young *Cochlearius cochlearius* (USNM) shows a typical culmen egg tooth.

\*Ciconiidae.—The egg tooth in *Mycteria americana* is quite persistent. It is apparent in a large downy young with a culmen length of 82.5 mm (as compared with 30 mm in the youngest available specimen—both USNM).

\*Phoenicopteridae.—*Phoeniconaias minor*.

\*Cathartidae.—*Cathartes aura*, *Coragyps atratus*.

\*Falconidae.—*Falco sparverius*.

\*Cracidae.—*Chamaepetes goudotii*, *Ortalis wagleri*, *O. vetula*.

\*Tetraonidae.—We have seen egg teeth in *Bonasa umbellus* and *Canachites canadensis*. Examination of several dozen study skins of very young downy grouse of four or five genera (CM) without finding egg teeth suggests that the structure is lost very shortly after hatching in this family, as reported for the Phasianidae (Clark, 1961). A photograph of “day-old” chicks of *Centrocercus urophasianus* (Patterson, 1952) shows what appear to be egg teeth.

\*Numididae.—*Guttera* sp.

\*Meleagrididae.—Peterson (1963:150, 151) has published photographs of a 23-day embryo and a newly hatched chick of the “turkey,” presumably domestic *Meleagris gallopavo*. The egg tooth is visible in the photographs.

Turnicidae.—A chick of *Turnix suscitator* that could hardly have been more than a day or two out of the egg was purchased from natives by Parkes in Luzon, Philippines, and prepared as a study skin. No egg tooth is visible; under magnification a faint depression can be seen on the culmen at the usual site of the egg tooth, but we have not yet recorded an actual egg tooth in *Turnix*.

\*Aramidae.—*Aramus guarana*.

Rallidae.—Clark (1961) mentioned records of egg teeth on the upper mandible of *Rallus elegans*, *R. limicola*, *Notornis mantelli*, and *Fulica atra*. To these we can now add *Ortygonax rytirhynchos*, *Limnecorax flavirostra*, *Laterallus jamaicensis*, *Porphyriops melanops*, *Gallinula chloropus*, *Porphyryla martinica*, *Porphyrio porphyrio*, *Fulica americana*, *F. ardesiaca*, *F. armillata*, and *F. rufifrons*.

\*Heliornithidae.—*Podica senegalensis*; specimen at AMNH seen by Clark through the courtesy of Dr. James P. Chapin.

Otididae.—Clark (1961) listed specific records only for *Afrotis afra*. We can now add *Choriotis kori*, *C. australis*, *Chlamydotis undulata*, and *Houbaropsis bengalensis*.

\*Haematopodidae.—Clark (1961) listed for this family only an old record of a “tooth-

like callosity on the lower jaw" of *Haematopus ostralegus*. We have now examined typical egg teeth on the upper mandible of both *H. ostralegus* and *H. palliatus*. Webster (1941) published a photograph of a week-old chick of *H. bachmani* and called attention to the fact that the egg tooth was still visible.

\*Charadriidae.—Clark (1961) mentioned only a secondhand report of "a small egg tooth on the anterior end of the lower mandible of *Vanellus vanellus*." Gerber (1939) has published excellent photographs of 12- and 14-day embryos of the latter species which clearly show typical culmen egg teeth on the upper mandible. A study skin of a small downy *Eupoda montana* (CM) shows a very small bump which may be the remains of an egg tooth, as it is not present in a somewhat older chick. One of two very young sibling *Sarciophorus tectus* (CM) shows what appears to be the scar of a recently dehisced egg tooth. These specimens, plus study skins of several species of *Charadrius* preserved within a day or two of hatching and lacking egg teeth, strongly suggests that, as in many Galliformes, the egg tooth is quickly lost in plovers.

Scolopacidae.—As in the Charadriidae, the egg tooth of the upper mandible appears to be lost shortly after hatching in the Scolopacidae. Clark (1961) quoted Romanoff (1960) to the effect that this was true of *Gallinago gallinago* and *Scolopax rusticola*. Clark also cited Wetherbee (1959), who did not find an egg tooth in a newly hatched *Philohela minor*; Wetherbee and Bartlett have since (1962) published a detailed account of the egg teeth and hatching technique of this species. The four woodcock chicks they observed "had egg teeth on both upper and lower jaws. The one on the upper jaw was typical, but the egg tooth of the lower jaw appeared as a rounded, smooth, calcareous deposit only barely raised from the surface of the bill, and was located at the extreme tip of the bill. The teeth were shed between the second and third day after hatching." The latter seems rather late for loss of egg tooth in a scolopacid (see below).

The reported variations in occurrence of egg teeth in the Scolopacidae need further study. Although, as mentioned above, Romanoff (1960) implied that *Gallinago gallinago* possesses a typical egg tooth on the upper mandible (i.e., on the culmen near the tip), an alcoholic specimen of *G. g. delicata* taken from an egg just pipped (CM) shows hardened areas at the tips of both mandibles, but no typical tooth on the culmen. In a reverse discrepancy, Clark (1961) quoted Willink (1899) as having found an egg tooth on the anterior end of the lower jaw of *Numenius* sp. However, Parkes has examined an embryo of *N. tahitiensis* (CU) taken from the egg 3 days before the remainder of the clutch hatched (see Allen and Kyllingstad, 1949). This clearly shows a well-developed egg tooth near the tip of the culmen, but nothing resembling an egg tooth on the lower mandible. That the egg tooth at the upper mandible is ephemeral is suggested by the color photographs published by Allen (1948). In his plate II, the bill tip is visible in three of four newly hatched Bristle-thighed Curlews; in two of these the egg tooth is visible, while in the third only a slight scar appears to be present. In plate III, a single chick of another brood shows no sign of an egg tooth.

Carnegie Museum contains long series of study skins of various sandpipers, many certainly younger than the 2 to 3 days at which the egg tooth is lost in *Philohela* according to Wetherbee and Bartlett (1962). None of these chicks appears to have an egg tooth. A series of eight *Erolia minutilla* in the USNM alcoholic collection, apparently removed from the eggs just prior to hatching, shows typical culmen egg teeth, as well as apparent calcification of the very tip of both mandibles. An alcoholic specimen of *Catoptrophorus semipalmatus* (USNM), stated on the label to be 26 hours old, shows no trace of an egg tooth.

\*Recurvirostridae.—Clark (1961) listed only an old record for an egg tooth on the

lower mandible of *Recurvirostra avosetta*. A study skin of a very young *R. americana* (CM) shows a strong culmen egg tooth, absent in another specimen about a day older.

\*Burhinidae.—*Burhinus oedicnemus*, *B. senegalensis*, *Esacus recurvirostris*.

\*Glareolidae.—*Pluvianus aegypticus*.

\*Chionididae.—*Chionis minor*.

\*Stercorariidae.—*Stercorarius pomarinus*, *S. parasiticus*, *S. longicaudus*.

\*Rynchopidae.—*Rynchops nigra*, *R. flavirostris*.

Cuculidae.—Clark (1961) listed *Centropus* and *Crotophaga*; we have found egg teeth also in *Clamator glandarius*, *Coccyzus erythrophthalmus*, *Saurothera vetula*, *Tapera naevia*, and *Geococcyx californianus*.

Strigidae.—Clark (1961) mentioned only *Nyctea*. We have now seen egg teeth in *Otus asio*, *Micrathene whitneyi*, *Speotyto cunicularia*, and *Asio otus*, as well as additional specimens of *Nyctea scandiaca*. Among the excellent photographs of owls assembled by Bösigger and Faucher (1958), egg teeth can be seen on nestling *Strix aluco*, *Nyctea scandiaca*, *Bubo bubo*, and *Asio flammeus*.

Steatornithidae.—The presence of an egg tooth in *Steatornis caripensis* is suggested by Snow's description (1961) of the young bird emerging from the shell "by cutting a circular cap from the broad end of the egg." This should be confirmed by examination of specimens.

\*Aegothelidae.—*Aegotheles cristatus*.

\*Caprimulgidae.—*Caprimulgus vociferus*, *Nyctidromus albicollis*.

\*Apodidae.—Burckhardt (1954) published line drawings of embryonic *Apus melba* showing protuberances suggestive of egg teeth. Fischer (1958:113) published a photograph of a *Chaetura pelagica* "less than 24 hours old" in which the egg tooth is visible. Occurrence in the Apodidae is confirmed by alcoholic specimens of newly hatched *Collocalia troglodytes* (CM).

\*Alcedinidae.—Drawings published by Burckhardt (op. cit.) also suggest presence of an egg tooth in *Alcedo atthis*. We have recorded it on numerous alcoholic specimens of *Megasceryle alcyon*, and a study skin of a fully feathered, stub-tailed young *Halcyon senegalensis*.

\*Coraciidae.—*Coracias garrulus*.

\*Leptosomatidae.—*Leptosomus discolor*.

\*Upupidae.—Skead (1950) reported egg teeth on the upper mandible of newly hatched *Upupa africana*.

\*Bucerotidae.—Clark (1961) had no definite records of an upper mandible egg tooth in any hornbill, but has subsequently examined one on an alcoholic specimen of *Tockus alboterminatus* (AMNH).

\*Formicariidae.—A stub-tailed young *Rhegmatorhina gymnops* (CM) has a small but clearly developed egg tooth. A young *Thamnophilus doliatus* of about the same stage of plumage development has a small pimple, barely visible, remaining, as does a somewhat older *Taraba major* (CM). In a juvenile *Grallaria squamigera* with remiges half grown and rectrices not yet appearing, the egg tooth is small but clear, while in a juvenile *G. erythrotis* only slightly older, there is no trace of an egg tooth. We have as yet seen egg teeth in no other member of the superfamily Furnarioidea of Wetmore.

\*Cotingidae.—*Attila spadiceus*, *Tityra semifasciata*, *Rupicola peruviana*. In two study skins of stub-tailed young *Pachyrhamphus polychopterus* (CM), the culmen egg tooth is present, and there is at least a suggestion that the tip of the lower mandible may also have been hardened. It would be of great interest to examine younger specimens in this connection.

\*Tyrannidae.—King (1955) states of the egg tooth of *Empidonax traillii*: "This structure is visible throughout nestling life. Its white tip is apparent to the unaided eye until about day 4.5 or 5.5. Because of the heterogonic growth of the bill, it shifts from its initial position on the culmen until, at about twelve days, it appears as a minute tubercle on the hook of the bill. It has thus rotated through 90 degrees." Specimens we have examined suggest that a similar change in position takes place in other tyrant flycatchers and cotingas. Study skins of known or estimated age in AMNH include a 16-day specimen of *Arundinicola leucocephala* and a 19-day (estimated) specimen of the much larger *Pitangus sulphuratus*. In both of these the egg tooth is clearly visible but small. We have also recorded egg teeth in *Tyrannus melancholicus*, *Muscivora tyrannus*, *Sayornis phoebe*, and *Todirostrum cinereum*.

\*Alaudidae.—*Lullula arborea*, *Eremophila alpestris*.

\*Hirundinidae.—*Hirundo rustica*.

\*Dicruridae.—*Dicrurus adsimilis*.

\*Cracticidae.—*Gymnorhina leuconota*.

\*Ptilonorhynchidae.—*Prionodura newtoniana*.

\*Paridae.—*Parus atricapillus*, *P. atricristatus*.

\*Timaliidae.—*Turdoides bicolor*, *Garrulax pectoralis*.

\*Pycnonotidae.—*Pycnonotus cafer*, *P. barbatus*.

\*Mimidae.—*Dumetella carolinensis*, *Toxostoma rufum*.

Turdidae.—Clark (1961) listed only a report of "anlagen of egg teeth in both upper and lower jaws in embryos of *Turdus merula*." We have seen egg teeth in preserved specimens of *Turdus libonyanus*, *T. albiventris*, *Hylocichla mustelina*, *Catharus guttatus*, and *Pogonocichla stellaris*, and study skins of *Saxicola dacotiae* and *Turdus migratorius*.

\*Sylviidae.—*Cisticola lais*.

\*Prunellidae.—It is always difficult to determine whether preparators have correctly aligned the upper and lower mandibles in study skins. A specimen of *Prunella modularis* (CM), with feathers in the major tracts barely beginning to emerge from their sheaths, has the lower mandible extended beyond the upper, and with a hardened tip. There is also a small egg tooth almost at the tip of the culmen.

\*Motacillidae.—*Anthus spinoletta*, *Motacilla grandis*.

Laniidae.—Clark (1961) quoted a record of egg teeth in *Lanius ludovicianus*. We have also seen egg teeth in *L. collaris* and *Tchagra* sp.

\*Parulidae.—*Seiurus aurocapillus*.

Ploceidae.—Records of species supplementing the account in Clark (1961) include: *Amblyospiza albifrons*, *Ploceus xanthops*, *P. nigerrimus*, *Lonchura (Spermestes) cucullatus*, and *Estrilda* sp.

Icteridae.—As quoted by Clark (1961), Friedmann (1929) stated that the egg tooth of *Molothrus bonariensis* is no longer very distinct after the fifth day posthatching. A study skin of a nestling of this species (AMNH), the age of which was estimated by the collector to be 12 days, clearly shows a small egg tooth. Two study skins of *Icterus nigrogularis* (AMNH), estimated by the collector to have been 12 and 13 days old, respectively, show not only a well-developed culmen egg tooth, but what appear to be calcified caps to the tips of both mandibles.

\*Thraupidae.—A nestling of *Thraupis virens* (AMNH), said by the collector to have been 9 days old, shows a small but distinct egg tooth. In another skin of this species, stated by the same collector to have been 14 days old, the egg tooth has almost disappeared. An 8-day-old nestling of *Ramphocelus carbo* from the same collection shows no

sign of an egg tooth, while it is present on a stub-tailed young *Piranga olivacea* of unknown age (CM).

Fringillidae.—Clark (1961) listed records for *Geospiza* and *Ammospiza*. We have made no particular search for additional records from this very large and probably composite family, but we have examined specimens with egg teeth from the three major subgroups, as follows: *Spizella passerina* and *Melospiza georgiana* (Emberizinae); *Richmondia cardinalis* and *Pheucticus ludovicianus* (Richmondeninae); *Loxia curvirostra* (Carduelinae). Clark (1961) listed a record of another cardueline, the canary (*Serinus canarius*), under Ploceidae, a family with which some authorities place the Carduelinae.

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