

Plumages and wing spurs of Torrent Ducks *Merganetta armata*

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Introduction

The Torrent Duck *Merganetta armata* of the Andean highlands is one of the most colourful and intriguing of all species of waterfowl. It has adapted to the demanding environment of cascading mountain torrents, and only rarely is seen in highland lakes. Taxonomically, the species has been a puzzle, and Johnsgard (1966) has recently reviewed its biology and taxonomy. Both he and Delacour (1956) recognize only one species but differ in the number of races accepted. Sub-specific names here refer to Delacour's terms which were based on Conover's (1943) classification and which are recorded on most museum specimens.

My own experience with the species in life is restricted to observations of several pairs in Chile (Curico Province) and observation of its habitat in northern Patagonia (Provinces of Rio Negro and Neuquen) and sub-tropical Argentina (Province of Jujuy) during 1964 and 1965. Subsequently, this species was chosen as part of a study of the plumages of selected Neotropical anatids because of its dramatic sexual dimorphism despite its isolation from other ducks (see Sibley 1957, for a discussion of factors possibly influencing dimorphism).

Because of the difficulties of studying this species in the wild or in keeping captive birds, an attempt has been made here to utilize the specimens collected by scientists and professional collectors throughout the Andes. Pooling data from these museum specimens permits the biologist to visualize and even quantify many of the major patterns before attempting to solve problems in the field. Such museum study is still impossible with rarer species and at one time would have been difficult for Torrent Ducks. However, there is now an excellent collection in the American Museum of Natural History and an especially fine series of young birds in the Conover Collection at the Field Museum of Natural History in Chicago. The sequence of plumages was studied mostly from the latter collection but nearly 200 skins were examined in museums in the eastern United States.

Another unusual feature of the Torrent Duck is the presence of a metacarpal spur on each wing. True spurs are well-defined pointed projections of a bony core covered with horny material (as opposed to the bony knobs on the wings of geese) and are not common among Anseriformes. They occur in the three species of Screamers

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(Anhimidae), and in the well-named Spur-winged Goose *Plectropterus gambensis* (Rand 1954). It is interesting that Johnsgard (1966) has suggested placing the Torrent Duck in the Tribe Cairinini which also contains the Spur-winged Goose. It is known that Screamers and Spur-winged Geese fight with their wings but no such fighting has been reported among Torrent Ducks.

During examination of specimens, it became obvious that spur length differs with sex and age of the birds, as noted also by Conover (1943), Rand (1954) and Delacour (1956). Spurs were measured as a potential age criterion to aid in understanding the chronology and sequence of plumages.

Description of plumages

The colourful plumages of the various forms of torrent ducks have been described by Phillips (1926), Conover (1943) and Delacour (1956), and a general description of the species will suffice here. Adult males are characterized by a bold black and white head pattern and a brownish grey body, wings and tail. The crown, nape and the area at the base of bill are black, and the face is white with an eyeline extending down the neck to the upper breast and connected to the nape by another black stripe. In the southern *Merganetta a. armata*, the eyeline continues in a circular fashion forward and downward and connects to a black chin, throat and ventral neck. The back and scapular feathers are elongated and pointed, and various races have brown, tan, grey or white edges to these feathers. The chest, belly and side are very dark and rufous in the southern race, but others have pale grey breasts streaked with black.

Adult females also are greyish dorsally and on the head and neck, but they have finely vermiculated feathers in the eyeline area that extend down the side of the neck and along the side. The lower face, chin, throat and entire ventral surface are rich cinnamon.

An iridescent green speculum is present on the secondaries of both sexes at all ages. It is bordered by a narrow white line anteriorly (on the greater secondary coverts) and at the posterior of the secondaries themselves. Both sexes have an extremely large alula, the function of which can only be theorized.

Both sexes have red bills and legs. The iris is said to be brown in both sexes (Delacour 1956) but specimens in the Field Museum have labels indicating a white iris in adult males *Merganetta a.*

garleppi and 'coffee-coloured' eyes in other races. Both sexes have wing spurs but the colours of these in life have not been recorded.

The downy young are generally dark grey above with a narrow white dorsal stripe and two white bars on either side. They are white ventrally and on the face and have a grey eyeline and an indistinct dark patch in the auricular area.

The juvenile plumage is female-like dorsally but is pure white below in both sexes. Some individuals, especially of *Merganetta a. armata*, have an orange-cinnamon tinge to feathers in the neck or upper chest region. Apparently this occurs in both sexes although a conspicuous shortage of immature females in collections makes me question the data on some labels. The feathers of the side, flank and rump are broadly barred.

Sequence of plumages

Because the sequence and number of plumages do not seem to differ in the various races, comments here are for the species as a whole. The natal plumage is replaced in a pattern similar to that of other ducks. The tail is renewed very early and some natal down clings to the tail-feathers until the tail is fully juvenile and much of the body is feathered. Natal down also clings to back feathers. The advent of juvenile feathers on the ventral surface and side precedes those on the head and back. The entire body is essentially fully feathered before the primaries develop noticeably. Although body plumage precedes wing development in most species, flight usually is possible before or just as the back is fully feathered (Weller 1957). Presumably their diving ability and the habitat provides adequate safety and complete protective body feathering is more valuable than are flight feathers.

Replacement of juvenile by adult plumage begins as soon as the primaries are fully grown, as evidenced by five flightless juveniles with no tail moult (Field Museum 10400, 14295, 16068, 13762, 14491) and seven flying immatures which have some notched juvenile and some new adult tail-feathers (F. M. 13761, 14962, 88246, 16097, 12263, 17432, 14298). Concurrently, there is moult of the scapulars and upper back. These new feathers are adult-like, being darker, broader, more firm, and comparable in colour to those adults or to immatures in advanced stages of plumage development. Specimens with 1 to 7 adult tail-feathers uniformly show moult of the scapulars and often have new feathers on the side

of the neck and on the head. Specimens with 4 to 10 adult tail-feathers also show moult of the back, side, undertail-coverts, rump, head and occasionally the chest. Belly moult is rare until the tail is fully adult, but even then the belly feathers are the last to be replaced, being preceded by those on the chest, chest-side, and flank, in that sequence.

As Conover (1943) noted, the new feathers which appear on juveniles are fully adult in colour and pattern. There is no positive evidence of a dull first non-nuptial plumage (the first basic plumage of Humphrey and Parkes 1959). There are possible exceptions with regards to the head and chest. The white facial area becomes mottled white and black when the distinct black pattern forms on males. Specimens of what are assumed to be yearlings (see below) lack this mottling so that it is lost either by moult or by wear. The distinct pattern formed during this moult suggests that the latter may be the case. Another area of uncertainty is on the chests of both sexes when some rufous feathers appear during the loss of the juvenile plumage. Possibly these are first non-nuptial feathers but, if so, they are neither widespread nor regular in all individuals.

Some specimens of the northern *Merganetta a. columbiana* show little or no head moult even when the tail is nearly fully adult. However, several specimens of immature male *Merganetta a. armata* show the acquisition of its unique black throat when there is no moult or little moult of the juvenile tail (Phil. 5442 and F. M. 88246, respectively). New black feathers develop as a 'V' of two lines within the two halves of the lower mandible. Eventually a black throat and a ventral mid-line on the neck are formed.

Either this head moult precedes that of northern races or too few specimens of other sub-species have been collected at an appropriate time.

Almost no data are available for females and I suspect that many of the immature specimens are mislabelled. Many immature females have reddish on the chest but so also do males of *Merganetta a. armata*. The best specimens showing the transition from juvenile to nuptial plumage of females are F. M. 17432 (April—mostly juvenile) and intermediate specimens which still have the white belly but show a red throat (A. M. N. H. 424855) or a red throat and chest (F. M. 17433—taken in May). Several near-adult specimens retain only a few white belly feathers (F. M. 17430—June; F. M. No. 19202—August).

Most nesting of the southern form probably occurs in October to January with a peak in November. Johnson (1963) reported two nests in October and November, and a female was captured on a nest in November at Cautin, Chile (F. M. 14296). Flightless juveniles have been taken in January and early March (Tables I and II). Birds dominantly in juvenile plumage were taken in January to April, and birds dominantly in first nuptial plumage were taken from May to September (Tables I and II).

Thus it appears that both sexes are essentially in full first nuptial plumage by the time of the normal breeding season. Whether yearlings actually breed is not known. There is no evidence of an intermediate body moult in the spring in yearlings, although tail replacement is not unlikely.

Once the first nuptial plumage has been acquired, the plumages of yearlings and adults are not readily distinguishable by

Table I. Series of specimens of male *Merganetta a. armata* showing the chronology of acquisition of the first nuptial plumage. For each column heading: + = some present; - = none present.

Museum No.	Date	Flightless	Male			
			Juv. tail	Nupt. tail	Juv. Body	Nupt. Body
A. M. N. H. 734385	January	+	+	-	+	-
A. M. H. H. 734384	January	+	+	-	+	-
F. M. 10400	March	+	+	-	+	-
F. M. 88246	March	-	+	+	+	-
R. O. M. 93534	May	-	-	+	+	+
F. M. 14298	June	-	+	+	+	+
F. M. 12263	June	-	+	+	+	+
R. O. M. 93536	July	-	+	+	+	+
F. M. 16097	July	-	+	+	+	+
R. O. M. 93535	July	-	-	+	+	+
F. M. 16096	September	-	-	+	+	+

Table II. Series of specimens of female *Merganetta a. armata* showing the chronology of acquisition of the first nuptial plumage. For each column heading: + = some present; - = none present.

Female						
Museum No.	Date	Flightless	Juv. tail	Nupt. tail	Juv. Body	Nupt. Body
A. M. N. H. 734383	January	+	+	-	+	-
A. M. N. H. 424855	March	-	+	+	+	+
F. M. 17432	April	-	+	+	+	+
M. C. Z. 96607	April	-	-	+	+	+
F. M. 17433	May	-	-	+	+	+
F. M. 17430	June	-	-	+	+	+
F. M. 19202	August	-	-	+	+	+

body plumage. However, in examining wing spurs and other characters as possible age criteria (see below), some characters of the male wing were observed which show reasonably good agreement with known juveniles and with those individuals assumed by their spur length to be either yearlings or adults. As is usual in waterfowl, the juvenile wing is retained for nearly a year until the simultaneous wing moult following the first breeding season. The greater secondary-coverts of the juvenile wing are white-tipped like those of adults but adult males have a slight black edge proximal to the white band which is reduced or lacking in immatures. Females show a less clear-cut pattern because both juvenile and adult females have the black band on the wing coverts but usually it is larger than in adult males.

Annual moult

Following the acquisition of the first nuptial plumage, there is permanent sexual dimorphism in colour with no evidence of any intermediate non-nuptial ('winter' or 'eclipse') plumage. Subsequent plumages are merely replacements of feathers of the same colour. Only three flightless adults were observed in collections: a male from Junin, Peru (F. M. 12797—no date), a male taken in Ecuador in April (F. M. 14268) and a female taken in December in Ecuador (F. M. 11769). All three were in body moult but the new feathers were of the same colour as were the worn ones, confirming the general observation that there is no 'eclipse' plumage.

Because of the extensive nesting period of Torrent Ducks in northern breeding areas (Johnsgard 1966), the chronology of the plumage cycle is difficult to appraise. Assuming that the breeding season is more restricted in the southern *Merganetta a. armata*, six adult females and nine adult males of this race were ex-

amined. Ten of the 15 had tail moult while only seven had body moult. Five of the seven in body moult were taken in autumn (Feb.-April), one was taken in spring (Nov.), and one in winter (June). It seems probable that a late summer or autumn moult is regular, concurrent with and following the wing moult. More data are needed to determine whether a late winter or spring moult is regular in adults but it seems common in other Neotropical anatis (Weller, in press).

Tail moult seems to be a more regular and a less seasonally restricted event in this species than in typical northern species. Some tail moult was found in 79% of 49 adult birds, representing all seasons, examined for this feature. This suggests a constant replacement or a double moult each year. There was no apparent serial pattern to the moult although central tail-feathers seemed to be replaced first.

One female taken on a nest of 5 eggs (F. M. 14296) near Cautin, Chile, in November, had tail moult but no body moult. It did have long, plumose, grey nest-down, characteristic of many nesting ducks (Weller 1957).

Wing spurs

While examining the plumage of specimens of various ages and both sexes, it was noted that considerable variation occurs in the size, shape and colour of wing spurs. To clarify and quantify this, spur length, shape and colour were recorded for 191 specimens.

Spur lengths were plotted according to season for males and females of all ages and from all areas. Data on unsexed downy young were used as a base. A summary of means and ranges of specimens from all regions is presented in Table III which shows clearly the pattern of size in relation to age. In addition 9 unsexed downy juveniles had the smallest spurs (up to 1 mm.). Because the great variation in the breeding season

tends to obscure patterns, data for Argentine and Chilean males only are plotted in Figure 1.

Growth of the spur starts as a rounded burr which is broader than long. Presumably, growth of horny material initiates at the base (Rand 1954) so that growth must be a continuous process that moves tissue upward to form a point when the spur length equals its width. Spur size increases to 2.8 mm. (both sexes combined) when the juvenile is full-winged. Thereafter rate of growth differs by sex and when they are in nearly full first nuptial plumage males average 5.8 mm., females only 3.7 mm. From the chronology of nesting in the southern

race, many birds still recognizable as sub-adults are present during June and a few are recognizable in October and November (Figure 1). Thus, it appears that the age of acquisition of the complete first nuptial plumage is approximately nine months to one year and that spur length of males at that time is less than 6.5 mm. in the southern race (Figure 1). Spurs of all such immatures are rounded or have a blunt tip. (Plate III a and b, facing page 44.)

Spurs of adults develop an enlargement at the base so that a constriction is apparent near the point of attachment to the wing (compare Plate III b with c). Males in full nuptial plumage have spurs

Table III. Spur length (mm.) of Torrent Ducks of various ages and all sub-species.

	Male			Female		
	No.	Av.	Range	No.	Av.	Range
Partial Juvenile	5	1.8	1.0-2.4	—	—	—
Flightless Juveniles	7	1.9	1.0-2.8	1	1.7	—
Juvenile	5	2.8	2.1-3.4	—	—	—
Immatures	6	3.8	3.2-3.8	2	3.2	3.0-3.4
Sub-Adult	10	5.8	4.5-7.0	7	3.7	3.1-4.1
Adults	84	10.5	4.1-16.5	55	6.1	2.7-12.8

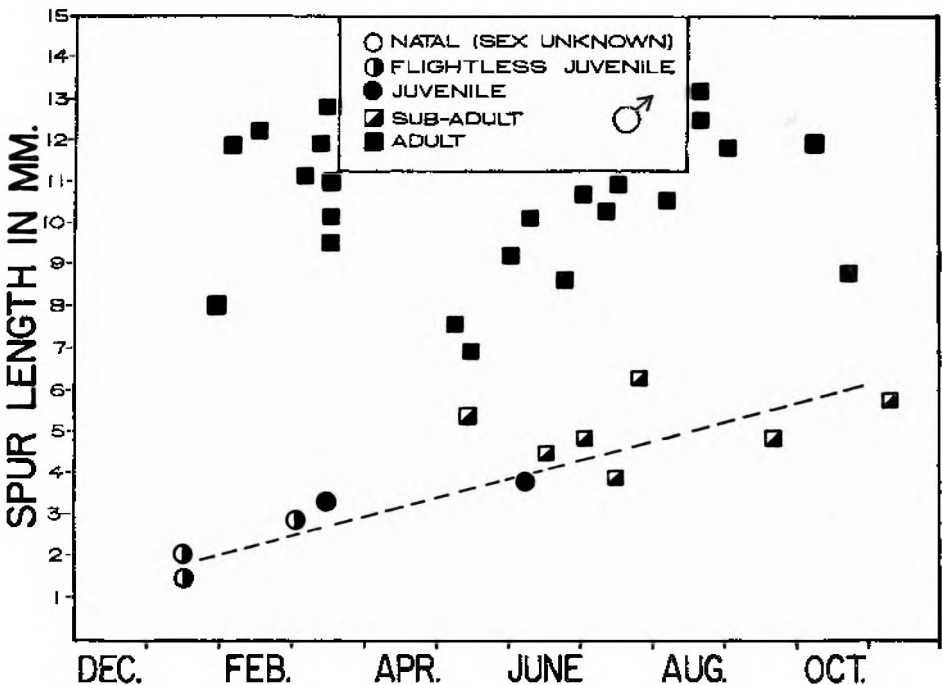


Figure 1. Spur lengths of males of Argentine and Chilean specimens plotted by age and time.

which tend to fall into one of the following classes: short and blunt, intermediate and pointed, or long and sharp (Plate III *a*, *b* and *c*). Long spurs often are extremely sharp, occasionally are curved and may bear a translucent tip (*c* and *d*). Although the colour of horny material varies with the conditions at the time of preservation, blunt spurs are dominantly yellow, the longer spurs horn-brown or nearly black with a yellowish tip.

A frequency distribution (Figure 2) of spur length of males in full nuptial plumage shows a small peak at six to seven millimetres which may represent

paring the age assessed from wing coverts with that derived from the spurs. Of 35 adult males checked, there was 89% agreement between age classification by spurs and by wings, and agreement for 15 young males was 93%. However, there was only a 62% agreement for 21 adult females. Only four young females were available and only one showed agreement. Problems of agreement in the adult males were about equally divided between interpretation of the spur length and of the wing characters. In females, wing characters were the most variable.

No specimens were found without spurs, indicating that they are not shed.

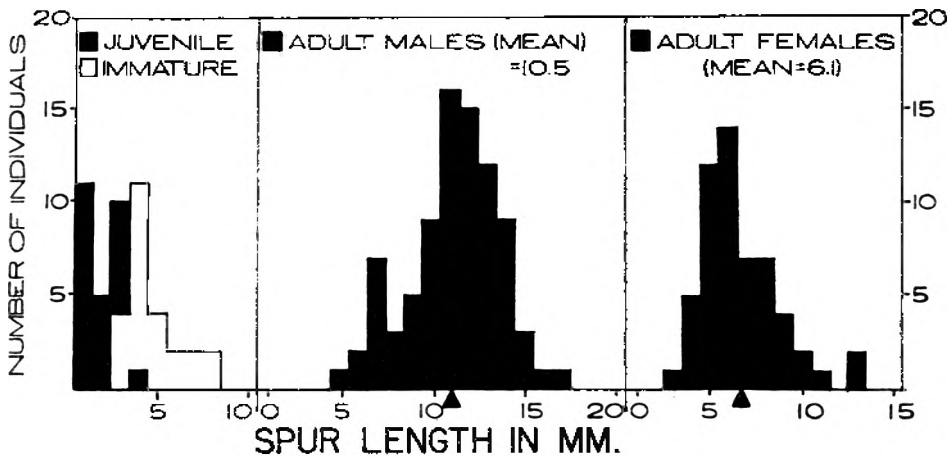


Figure 2. Frequency distribution of spur lengths of juveniles, immatures and birds of both sizes in adult plumage.

yearling males. The fact that some males in adult plumage have spurs no larger than birds still recognizable by their plumage as sub-adults, further suggests that males with spurs of less than 8 mm. may be considered yearlings. The relative bluntness of the spur seems to be an even more reliable character. Blunt spurs, or spurs that are pointed but are as short as they are wide, are probably those of yearlings. Spurs which are longer than they are wide, with a well-developed point, presumably represent older males. Spur length probably increases with age but individual variation cannot be ignored.

Adult females have shorter spurs with less variation in shape. These also can be grouped into categories, but there are many that are intermediate in length and which cannot be aged with certainty. A frequency distribution of their lengths shows no obvious breaks (Figure 2).

A further check on the use of the spurs as an age criterion was made by com-

paring the age assessed from wing coverts with that derived from the spurs. Only one had been damaged in some way and this may have been by a shotgun pellet. The function of these spurs is still unknown, but they show no wear. Occasionally, there are irregular rings near the base or in the middle (Plate III *d*) but they show no pattern suggesting annular growth rings.

To determine whether some internal characteristic of the spur might aid in determination of age (as do annuli of fish scales or bones), spurs of three sizes were sectioned by grinding. I am indebted to Drs. Rand and Blake of the Field Museum for permitting the sectioning of spurs from three specimens in their charge. Three males were examined: a clear-cut sub-adult (identifiable by some white juvenile feathers on the abdomen) which possessed a short, blunt spur (F. M. 208109), an adult with a sharply pointed, black spur (F. M. 208112); and a male with the longest spur recorded (F. M. 15682).

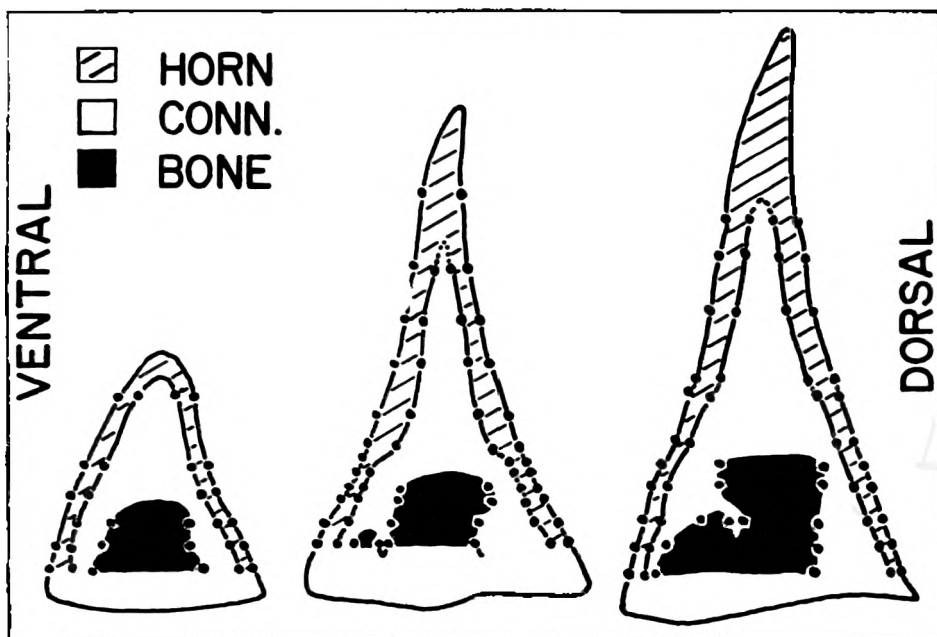


Figure 3. Spur size, shape and internal structure of a sub-adult male (Field Mus. 208109) and two adult males (Field Mus. 208112 in centre; Field Mus. 15682 at right). Dots indicate points at which sections and measurements were made.

Cross-sections demonstrate that spurs have an outer horny layer, grey in adults, grey or yellow in sub-adults. The major portion of the spur consists of a clear yellow material (presumably connective tissue) which surrounds and grows above a small whitish central bony core (Plate III e). A narrow dark brown or black line separates the outer grey horn and the central yellow connective tissue.

Diagrams of these three spurs are shown in Figure 3. They show the small size of the true bony core which apparently increases very little in length with age. They also demonstrate that much of the growth of the spur is in the solid horny tip. Although several irregularities of the horn layer in older birds suggests new overlapping external layers, their pattern was not sufficiently distinctive to be used as an age criterion. Both adults examined did have a more complex bony

core at the base of the spur, being bilobed in vertical cross-section (Figure 3) rather than a single spike and by being mushroom-shaped at the base rather than round. However, the significance of these differences cannot be appraised on the basis of this sample.

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Summary

A study of nearly 200 museum skins of Torrent Ducks has made possible some generalizations on plumages and biology of this species which will facilitate future field work. Torrent ducks are distinctly and permanently sexually dimorphic, lacking any seasonal change in colouration. Juveniles lack sexual dimorphism and are characterized by a white belly and heavily barred sides. There is no evidence of a well-defined first non-nuptial plumage and the first nuptial plumage seemingly is acquired by the time the bird is 9-12 months old. Adults apparently have one complete annual moult in late summer but a partial spring moult is probable.

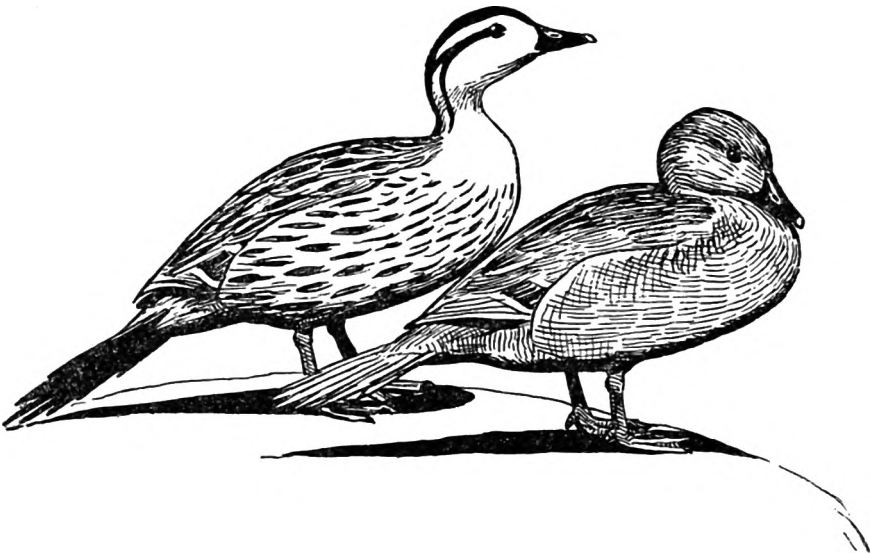
Both sexes have prominent metacarpal spurs on their wings. These spurs increase in length, dark colouration and sharpness with age. However, most yearling males and some females can be distinguished from adults by their short, blunt, yellowish spurs.

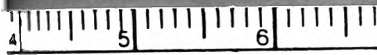
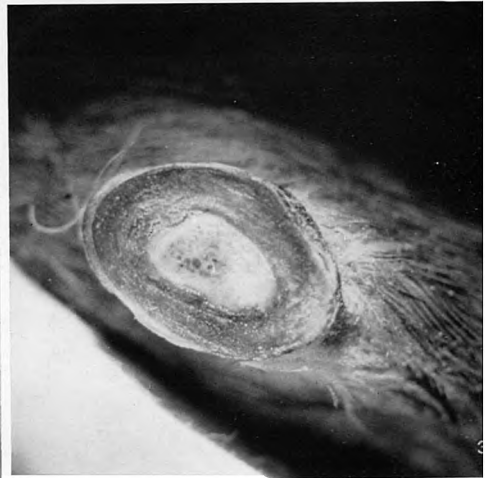
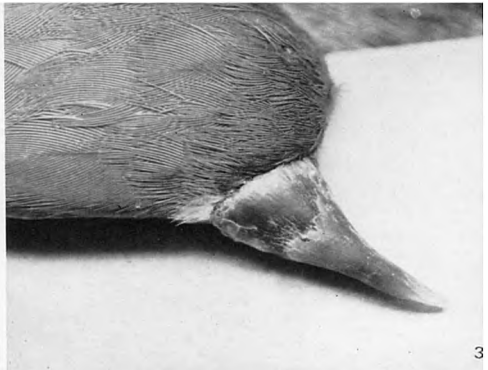
Spurs are made up of a small and short bony core, a more extensive layer of yellow connective tissue, and a relatively thin outer layer of horn. No clear-cut growth rings are observable but the bony core, and probably the horn, increases in complexity with size.

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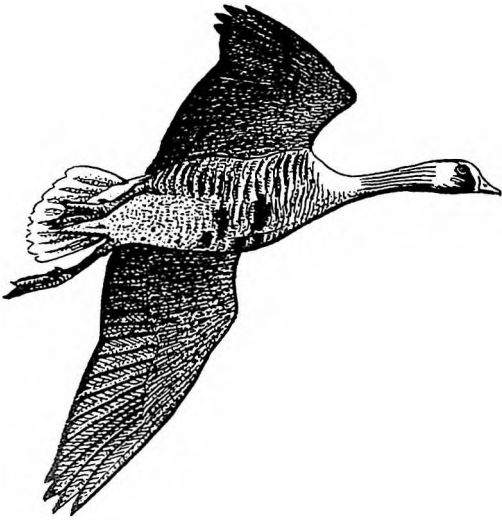
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Plate III. Wing spurs of Torrent Ducks *Merganetta armata* from Argentina and Chile. (a) Juvenile male showing blunt point and wrinkled surface. (b) Yearling male taken in September in nearly full first nuptial plumage; spur point becoming evident. (c) Bird presumed from its wing to be an adult at least two years old. Note the elongated shape, acute and translucent tip (Scale in cm.). (d) Adult male showing overlapping layers of horn and translucent tip. This was the longest spur recorded (16.5 mm.). (e) Cross-section of a spur near the base showing the central bone, the yellow connective tissue, and the outer layer of horn. (See p. 33)



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