NOTES ON PLUMAGES AND WEIGHTS OF THE BLACK-HEADED DUCK, *HETERONETTA ATRICAPILLA*

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A study of the measurements, plumages, and sequence of molts of *Heteronetta* was initiated (1) to determine whether sexual dimorphism and timing of molts differed from normal in a species adapted to life as a nest parasite, (2) to study the sequence of plumages as an aid in the taxonomic classification of the species, and (3) to learn methods of sex and age determination for field use. A total of 105 museum skins (58 in North America, 47 in South America) and 37 freshly killed birds were examined.

In addition to the usual problems of interpretation of plumages, the study is complicated by the fact that this species, like several South American ducks, has been recorded as breeding in the fall in some places (Olrog, personal communication), although most populations breed in spring. As a result, skins gathered from various areas may show different molt cycles. For this reason, the major descriptions, patterns, and timing are based on birds observed and collected in the marshes of Cape San Antonio, Province of Buenos Aires, Argentina, from September 1964, to July 1965. Even there, however, population movements created some complications.

SEXUAL DIMORPHISM IN BODY SIZE

Because no weights were recorded on any of the specimens found in museums, several measurements were taken to evaluate a general impression that females were larger than males. Females exceeded males slightly in average measurement of chord of the culmen, width of the upper mandible, wing (unflattened), and tail length (table 1). Average tarsal measurement of skins of males is slightly higher than that of females, but this measurement is the least accurate of those taken. Data from fresh specimens show general agreement with data from skins, and males are smaller than females in all measurements (table 2). Data for all specimens measured are pooled in table 3 because there was little difference in measurements of adults and immatures.

Weights taken during this study spanned 10 months, so that few were taken at one time. However, it was rare to find males that exceeded females in weight. Only during molting, when birds were very fat, did some molting males exceed the weights of females no longer in molt. In most cases, females exceeded males by about 10 per cent, even in the nonbreeding period.

According to data presented by Delacour (1954 *et seq.*), it is unique to find female anatids equaling males in size. Bolen (1964) recently has shown that in the Black-bellied Tree Duck (*Dendrocygna autumnalis*), a species in which males and females are the same size, females may outweigh males during the laying period. Although only the weight data show statistically significant difference between the sexes ($P < 0.05$), the uniformity of the observations strongly indicates that *Heteronetta* females are slightly larger in all measurements than are males. Whether this size differential is related to the parasitic behavior of the female, or is associated with the large size of its egg, is uncertain. There seems to be little aggressiveness by the hen in laying for which weight would be an advantage (Weller, unpublished observation). Males do engage in courtship battles.

TABLE 1

LINEAR MEASUREMENTS, IN MILLIMETERS, OF SOME SKINS OF ADULT AND IMMATURE *Heteronetta* IN NORTH AND SOUTH AMERICAN MUSEUMS

Structure	Sex	Sample size	Range	Mean	SD	Difference in means F – M	Per cent difference[a]
Culmen length	Male	51	41.3–47.0	44.2	1.36	+0.67	+1.49
	Female	38	41.0–48.0	44.9	1.48		
Bill width	Male	46	16.0–19.3	18.1	0.56	+0.24	+1.31
	Female	32	15.9–20.0	18.3	1.92		
Tarsus length	Male	54	30.0–34.5	32.1	1.07	– 0.19	– 0.59
	Female	43	28.0–34.0	31.9	1.38		
Wing length	Male	54	157.5–178.0	169.3	4.71	+2.50	+1.45
	Female	42	154.0–182.0	171.8	4.98		
Tail length	Male	53	44.0–57.0	48.3	2.47	+3.40	+6.57
	Female	42	44.0–59.0	51.7	3.11		

[a] Per cent larger of larger sex.

PLUMAGES

Several systems of terminology presently are in use for describing plumages. To provide both a standard and a recent system, the terminology of Dwight (1902) has been utilized with slight modification, and the new system of Humphrey and Parkes (1959) has been inserted for comparison.

TABLE 2

LINEAR MEASUREMENTS IN MILLIMETERS AND WEIGHTS IN GRAMS OF SOME FRESH SPECIMENS OF ADULT AND IMMATURE *Heteronetta*

Structure	Sex	Sample size	Range	Mean	SD	Difference F – M	Per cent difference[a]
Culmen length	Male	16	40.7–46.3	43.8	1.78	+1.41	+3.11
	Female	19	41.8–48.1	45.2	1.60		
Bill width	Male	2	17.0–19.8	18.4	1.98	+1.38	+6.97
	Female	5	18.7–20.8	19.8	0.89		
Tarsus length	Male	17	30–34	32.0	1.10	+1.05	+3.17
	Female	20	31–35	33.1	1.16		
Wing length	Male	17	157.5–174	165.9	4.12	+7.03	+4.06
	Female	20	165–180	172.9	3.67		
Tail length	Male	17	46–54	50.1	2.50	+2.98	+5.61
	Female	20	49–58.5	53.1	2.51		
Weight	Male (Adult)	11	434–580	512.6	43.39	+52.2	+9.2
	Female "	13	470–630	565.2	51.64		
	Male (Imm.)	2	350–370	360.0	14.14		
	Female "	3	400–500	453.3	50.33		

[a] Per cent female larger than male.

TABLE 3

LINEAR MEASUREMENTS, IN MILLIMETERS, OF SOME SKINS AND FRESH SPECIMENS OF ADULT AND IMMATURE *Heteronetta*

Structure	Sex	Sample size	Range	Mean	SD	Difference F – M	Per cent difference[a]
Culmen length	Male	67	40.7–47.0	44.12	1.47	+0.89	+1.97
	Female	57	41.0–48.1	45.01	1.52		
Bill width	Male	48	16.0–19.8	18.07	1.47	+0.43	+2.32
	Female	37	15.9–20.8	18.50	1.88		
Tarsus length	Male	71	30–34.5	32.04	1.07	+0.21	+0.65
	Female	63	28–35	32.25	1.43		
Wing length	Male	71	157.5–178	168.44	4.78	+3.68	+2.13
	Female	62	154–182	172.12	1.46		
Tail length	Male	70	44–57	48.74	2.58	+3.40	+6.52
	Female	62	44–59	52.14	2.97		

[a] Per cent female larger than male.

Natal. The downy young of *Heteronetta* were not described until 1946 and seem to be represented in Northern Hemisphere collections only by the two specimens reported by Delacour and Mayr (1946: U.S. Natl. Mus. no. 337995; Univ. Mich. no. 93120). In addition, three are in the Museo Argentino de Ciencias Naturales in Buenos Aires. Three were collected during this study, and several others were observed in the wild.

Figure 1. Black-headed Duck approximately five hours old. Note vertical line above the eye.

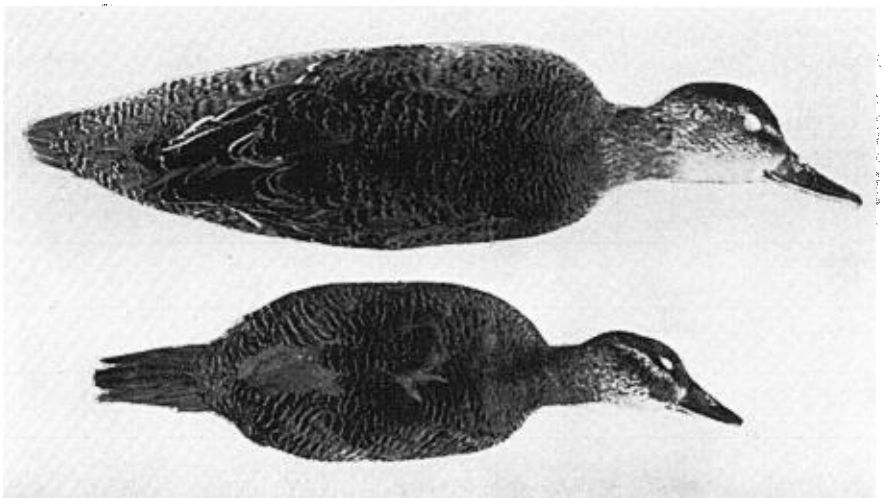

Figure 2. Juvenal Black-headed Duck (top) and Ruddy Duck (bottom), showing similarity of barring of body feathers and differences in the location of the head-stripe.

This duckling is shown in figure 1. It has a generally blackish-brown and yellow pattern like young dabblers, but the yellow is dark, and the facial area has an orange-brown cast. Moreover, as Delacour and Mayr (1946) pointed out, the general aspect is dark with long and woolly-like down. In life, the duckling has the stocky shape, stance, and behavior of a young ruddy (*Oxyura* spp.). It differs from other ducklings in the presence of a distinctive vertical line from the eye to the crown (this is not correctly figured in either Delacour and Mayr, 1946, or Delacour, 1959). Presumably, this marking aids in camouflaging the bird in dense marsh emergents. Although the duckling has a horizontal facial stripe, the mark tends to be below the eye while it runs through the eye in downy dabbling ducks. The upper mandible is nearly black with yellow edges while the lower mandible is a dull yellowish. The feet are deep gray.

Juvenal. Only two birds in juvenal plumage were found in Northern Hemisphere collections. These were called to my attention by J. D. MacDonald of the British Museum who noted their peculiar plumage as differing from previous descriptions. These two were collected on 28 February 1899 by Ernest Gibson at Estancia "Los Yngleses" near General Lavalle, Buenos Aires Province, Argentina.

This plumage is especially important because of the unique barring not evident in other plumages. The plumage is a rufous-brown coloration with dark-brown cross-barring on the feathers of the back, rump, and flank (fig. 2). The barring strongly resembles that found in adult female and young ruddys (fig. 2) and is unlike the barring of the feathers of dabblers.

The coloration of the juvenal resembles the adult female in its generally brown dorsal surface, but it is more rufous on both dorsal and ventral aspects. The abdomen is unmarked but is tannish-white rather than white. Both sexes in the juvenal plumage have the eye-stripe, but males differ from juvenal females in having, in most cases, plain rufous rather than brown-barred, white undertail coverts.

The juvenal wing differs slightly from that of the adult in having tan or dull white edges on the coverts whereas those of adults are flecked with white or are pure gray-brown (fig. 3).

Figure 3. Adult (left) and juvenal (right) wings of Black-headed Ducks.

Unfortunately, Gibson's specimens lacked all the tail feathers. Five additional specimens with tail feathers were seen in Argentine museums (Buenos Aires and Tucumán), and six in this plumage were collected during the present study. The juvenal rectrices are conspicuous by their broad untapered rachis (fig. 4), whereas adults have a fine and well-tapered rachis. This rachis is, like those of ruddys, over one-half millimeter wide while those of dabblers generally are much more narrow.

First non-nuptial (basic). Before the last natal down under the wing has been shed, molt of the juvenal plumage begins by means of the postjuvenal or first prebasic molt. In the Argentine summer (January and February), specimens showed new feathers of an adult type on the back and tail (fig. 5). New feathers gradually appear on the back and sides and give the bird a darker-brown and more shiny appearance with a contrasting white abdomen. A bird in this plumage was taken in Bolivia in May of 1916 (Carnegie Mus. no. 81286; see fig. 2). The tail feathers are fully adult, and only a few juvenal body feathers remain. Worn scapulars on this individual suggest that these are the last of the juvenal feathers to be replaced and possibly that they are held until the prenuptial (pre-alternate) molt.

Because of its color and feather pattern, it is difficult to separate this plumage from the first nuptial (alternate) plumage in females. However, its recognition as a

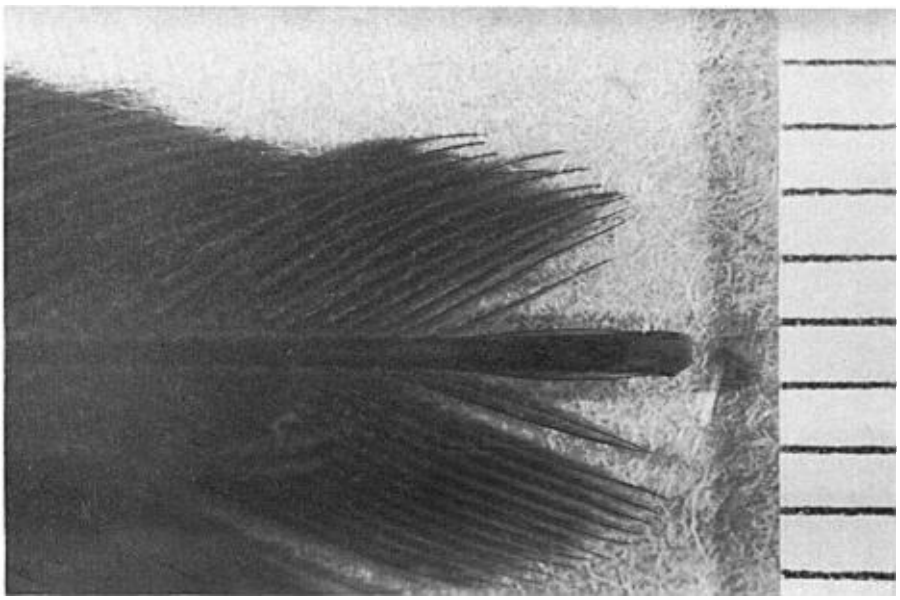

Figure 4. Juvenal rectrix of *Heteronetta*; millimeter scale at right.

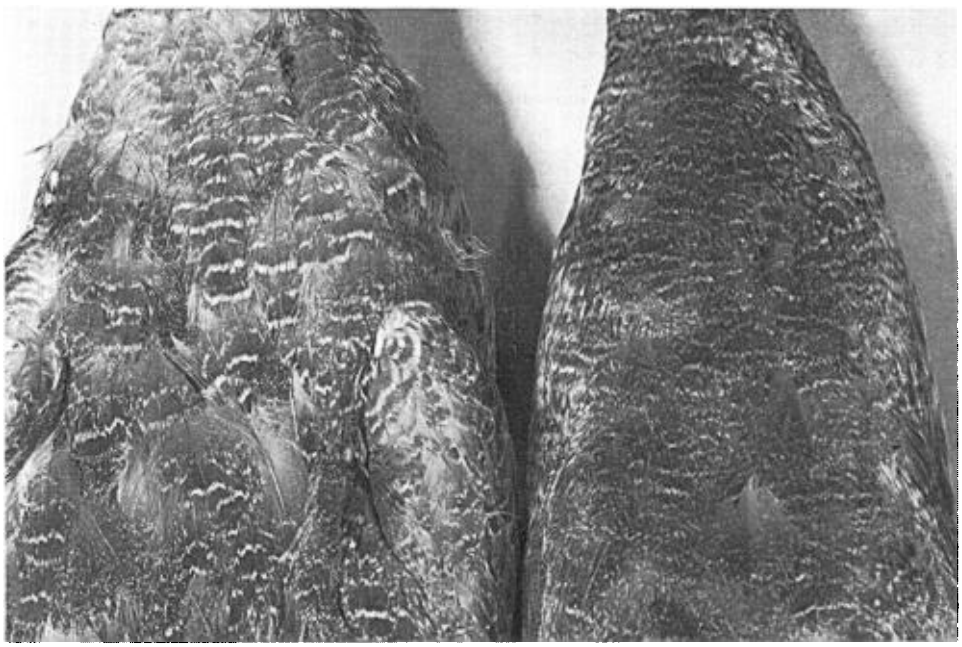

Figure 5. Juvenile *Heteronetta* at left showing dominately barred juvenal back feathers and a few incoming postjuvenal (first basic) feathers. Bird at right is in full postjuvenal (first basic) plumage.

complete non-nuptial plumage is due to the presence of this nonsexually dimorphic plumage in males. A male collected in northwestern Argentina in July (AMNH 140474) shows this brown hen-like plumage but has brownish-red undertail coverts. Moreover, yearlings taken in the spring appear to be in still another molt, the prenuptial.

Nuptial (alternate). The adult plumage has been described by numerous authors, including Salvadori (1895), Phillips (1925), and Delacour (1959). These descriptions are generally correct with two exceptions as regards males. Most authors indicate that the undertail coverts, flanks, and sides are rufous while the dorsal surfaces of the body are deep brown flecked with tan. In reality, the distal undertail coverts are unmarked and are more brownish-red while the sides tend to be rufous or tawny. There is usually considerable contrast between the light-colored sides and the darker-brown back. The head and neck are black, but often have brown-tipped feathers which produce a brownish-black cast. Neither Brooks (in Phillips, 1925) nor Scott (in Delacour, 1959) illustrates the correct color of the bill of the male in breeding condition; the lateral bases of the upper mandible are pink to ruby.

The coloration of the female in the adult plumage is generally brown with fine tan flecking on most of the dorsal surface, giving way to fine barring in the tail region. Two points are of special interest in comparison with the ruddys. Although the general plumage color and barring is ruddy-like, the facial pattern is more nearly like *Anas* than *Oxyura*. Unlike ruddys, which have a white line below the eye, *Heteronetta* females have a whitish line which passes through the upper half of the eye but tends to be broken by a dark vertical bar extending from the crown to the posterior portion of the eye (as in the natal plumage).

The first adult plumage is acquired by a gradual prenuptial or pre-alternate molt, probably during June to August or even September. This change is conspicuous, especially on the heads of males, as shown in figure 6, but molt occurs on all parts of the body. I have no clear-cut records of tail molt of yearlings. A male collected at General Lavalle in mid-July appeared to be a yearling. The head was generally dull black, and much of the neck and body plumage was worn and dull-colored. The belly was less white than that of adults collected simultaneously, and the undertail coverts were less reddish. The bursa was 16 mm deep while the adults collected with it had no patent bursa remaining. Several birds in this age category had worn tertials. These may be juvenal feathers which were not molted. A few of the proximal secondary coverts (adjacent to the tertials) also appeared old, and new coverts were observed in juveniles in the fall (March) and yearlings in the late winter (July).

It is presently impossible to distinguish the postjuvenal plumages of females with certainty. An individual taken in mid-March in Tucumán, Argentina, proved especially difficult to evaluate. This female had a new and adult-like plumage but had a bursa of 17.5 mm with an open oviduct. Either this female was a fall-breeding yearling in her first nuptial (alternate) plumage or she was in full first non-nuptial (basic) plumage which included new wing coverts. It is possible that all the wing coverts are replaced during the postjuvenal molt, as several birds, taken in the spring, appear to be yearlings and lack the conspicuous white-edged tan coverts. Moreover, some have old, worn secondary coverts near the tertials. The relative roles of wear and molt cannot be clarified with the small number of specimens available. It is clear, however, that spring yearling females have generally adult-type coverts rather than juvenal-type, have white flecking rather than tan edging, and lack the trapezoidal shape common to juvenals of many ducks (Carney and Geis, 1960). In view of the

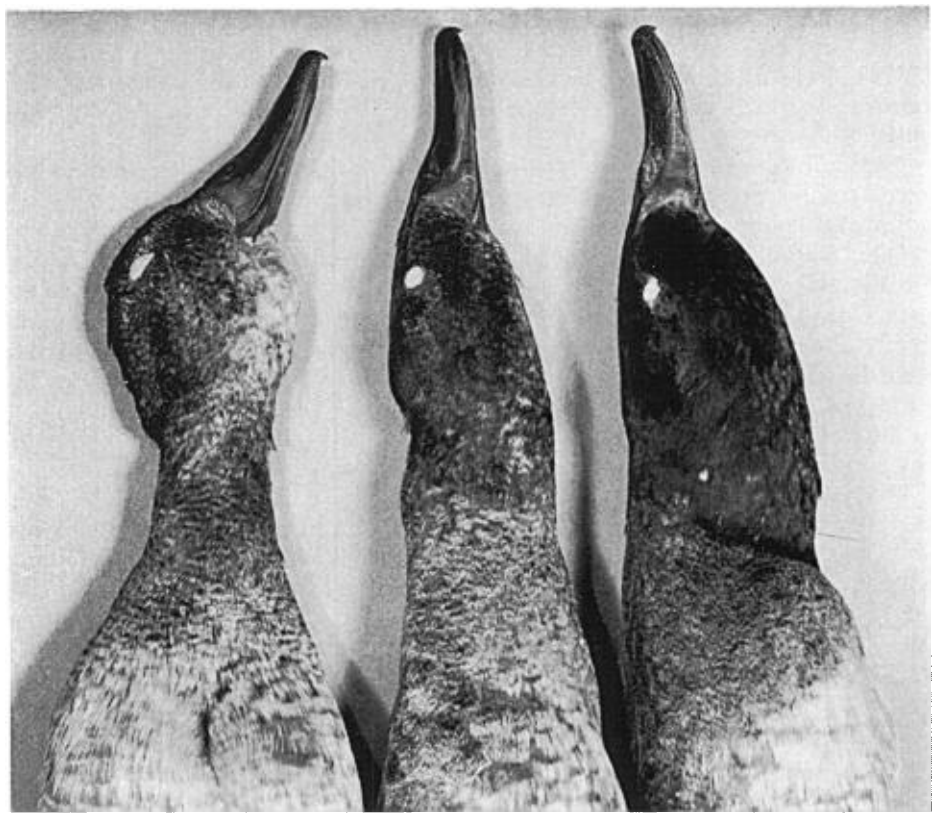

Figure 6. Heads of three male Black-headed Ducks. Left to right: immature male in postjuvenal (first basic) plumage (July); yearling in prenuptial (pre-alternate) molt (September); and adult male (September).

irregularities noted in the wing molt of ruddys (Humphrey, *in* Delacour, 1964:180), this molt pattern is in need of further study.

Adults entering their second or later summers seem to have a partial molt involving most if not all the body and tail. Several adults collected by the author in mid-July (late winter) and several skins collected in July–September show considerable molt on all parts of the body, exclusive of the wings. Thus, the non-nuptial (basic) plumage is acquired in December to January and seems to be worn seven months while the nuptial (alternate) plumage is present about five months.

One plumage characteristic in adult males—the extent of white on the chin—seems to be highly variable. As shown in figure 7, a few males have little or none (8 of 55 skins or 15 per cent) while others (5 of 55 or 9 per cent) have all of the chin and part of the throat white. There appears to be no seasonal variation in the extent of this white area. Presumably, this is a matter of individual variation, although maturity also may be important. Yearlings tend to have many white or tan-tipped chin and throat feathers but few clear-cut white areas.

There is no conspicuous seasonal difference in the color of the definitive adult plumages. It is possible that the non-nuptial (basic or "eclipse") plumage is slightly

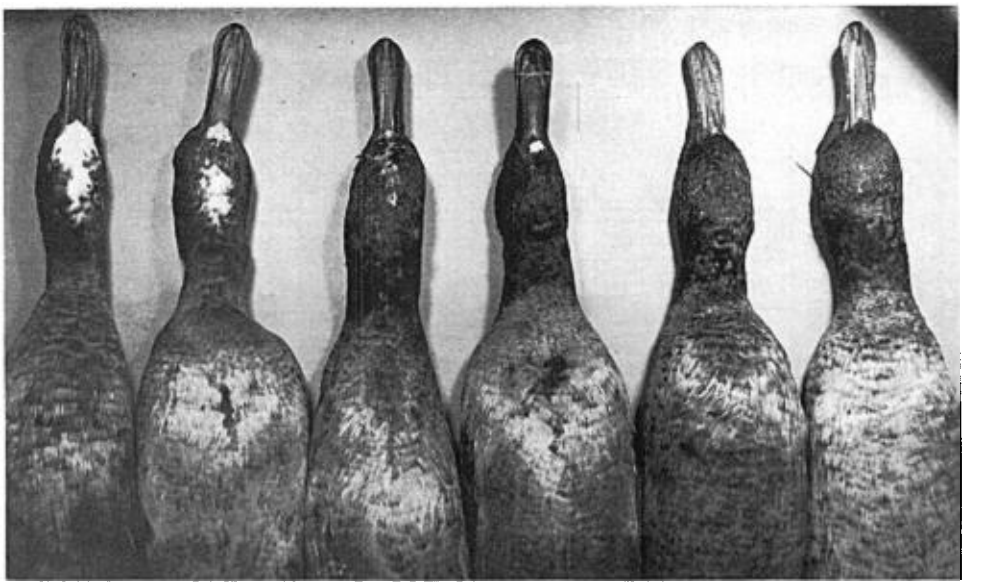

Figure 7. Head of adult male Black-headed Ducks to show variation in the amount of white on the chin and throat.

duller in males, particularly on the head, as the feathers tend to have browner tips than the feathers of the nuptial (alternate) plumage. However, there are no known-age specimens available, and there are several factors which could influence these observations. Moreover, the general aspect is the same. Certainly, the dull color of the bill in winter gives an impression of general drabness.

GENERAL PATTERN AND TIMING OF MOLT

Sequence of plumages. The sequence of plumages is tentatively outlined in figure 8. Molt of the tail (first non-nuptial or basic) of yearlings is still uncertain, but present data suggest that no molt occurs. As a result, their homology is not indicated on this figure. Presumably, the wing plumage is associated with the non-nuptial or basic plumage.

During the first winter of life, components of two plumages are present: juvenal wings and non-nuptial body. Assuming for the present that the non-nuptial (basic) tail is not molted in the yearling spring, components of three plumages may be present in yearlings: nuptial (alternate) body feathers, juvenal wing, and non-nuptial (basic) tail.

The normal adult cycle involves two molts, one complete and one partial, with sexual but no seasonal dimorphism in color. After the juvenal body plumage has been molted, these plumages are the basic (non-nuptial) of late summer, fall, and winter, and the alternate (nuptial) of late winter, spring, and early summer.

Sequence of molt. In juveniles molting into non-nuptial plumage or in adults renewing their plumages, the molt begins with the center or outer tail feathers. A few body feathers—usually on the back—are renewed, and the wing (in adults) and body molt spreads rapidly. The wing molt apparently is completed rapidly in a simultaneous molt, and the body is in full molt (and individuals are very fat) after the wing molt

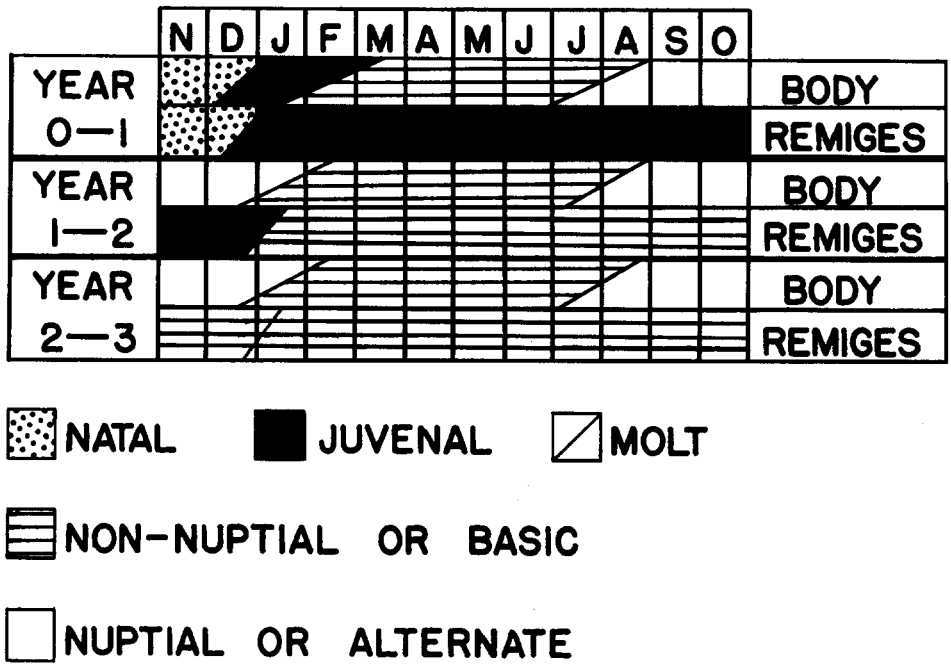

Figure 8. A tentative diagram of the sequence of plumages in the Black-headed Duck. The timing is based on specimens taken on Cape San Antonio Area, eastern Buenos Aires, Argentina.

has been completed. The tail molt often is slow and is finished concurrently with the renewal of the last few body feathers. Either this delay causes different coloration in the rectrices or they are not all molted at one time, because new-looking and faded feathers occur together when no short feathers are apparent.

The tail molt usually starts with the center or outer and then proceeds somewhat irregularly with every second or third feather being replaced rather than two adjacent feathers being lost simultaneously. Presumably, this sequence provides the best flight surface.

The number of tail feathers usually was 14, but two exceptions, one of 12 and one of 16, were noted in 37 fresh specimens examined for this character.

Chronology of molt. In museum specimens, some individuals were found at all times of the year with incoming head feathers. Specimens in full body molt were found in March to April and, to a lesser extent, in July to September. Tail molt was observed in three of five birds observed in March. Museum specimens taken in April (AMNH 424438) and June (Chicago Mus. Nat. Hist. 17416) in Santiago had outer primaries soft. Possibly these were from populations which bred in the fall (March–April), although fall breeding has not been reported in Chile.

Using specimens and observations only from study areas near General Lavalle, the time schedule was dramatically different (fig. 8), and it was apparent that many of the museum specimens examined were from areas of Argentina where birds were on different breeding and molt cycles.

In the General Lavalle area, 25 adults and 7 immatures were examined. These were collected periodically from 29 October 1964 to 22 July 1965. The breeding

period was late September through early December with the peak of laying being in mid-October to mid-November. However, this seems to vary annually with water conditions. Flying adults were observed regularly throughout October and early November but became less numerous in December. One bird collected in late October and one in mid-December had old primaries, but six specimens collected from 31 December to 5 February all had new primaries. One collected 28 February possibly had old feathers, and five of six birds examined in early March all had new primaries; one was questionable.

However, specimens from early March showed much body and tail molt, whereas specimens from late January and February had completed their tail and most of their body molt. Two possible explanations can be made. First, flocks of Black-headed Ducks were observed at this time, and it is possible that birds from other areas were concentrating in the deeper San Antonio marshes. Secondly, it is possible that birds go through two body molts in summer as do males of Northern Hemisphere anatids. However, this would involve a double tail molt which is not characteristic of other known anatids and would not seem to serve any known function. This matter cannot be clearly established at present.

Adults seem to go through a prenuptial (pre-alternate) body and tail molt in July to September. Three specimens from the La Plata and Buenos Aires museums show molt all over the head, body, and tail, and 14 specimens in North American museums show some molt in July to September. Of eight fresh specimens collected at General Lavalle in mid-July, two appeared to be yearlings and showed little molt. However, out of the six adults, three had considerable molt and three had almost none.

Immature birds were seen regularly from 2 January, when the first flying young were seen, until fall (April). They began their postjuvenal molt in mid-January, renewing back and tail feathers. No specimens taken in the Lavalle area had completed this molt. Some early-hatched birds were one-third through this molt in late January, but another bird only halfway through this molt was taken in mid-April 1965.

Museum specimens taken in July to mid-September show the development of the first breeding plumage in yearlings. This molt seems to be concurrent with the spring molt of adults.

COLORS OF SOFT PARTS

The bill coloration of the Black-headed Duck in the breeding season has been erroneously described and figured in most works, apparently because descriptions have been based on museum skins or on specimens not in breeding condition. The color of the bill during most if not all of the year in all age and sex groups is black centrally, including the nail, lightening into gray-blue from the level of the nostrils down to near the edge of the mandible. The flexible edges of the mandible may be flesh-colored or yellowish-pink, as is the lower mandible. The lower mandible may be spotted with pale-purple patches. The depth of color of the bill and the resultant contrast differs by age and sex, being brightest in breeding males and less bright in breeding females. Juveniles and nonbreeding females have similar colors.

The area of the greatest color variation, however, is the lateral basal portion of the bill. In adult males in breeding condition, these areas extend from the base to the nostril area. These have been variously described as flesh-colored to pink but are, in fact, a bright rose (almost ruby) color which rivals in color the bill of the Rosybill (*Metopiana peposaca*). Other males, presumably younger birds, have less-brilliant patches of pale rose-pink. The rose color fades in the postbreeding molting period to

a basal yellowish-pink grading to a pale rose, and most adult males retain this rosy wash throughout the year. Others have a more flesh-colored spot as did one yearling male taken after the breeding season in January.

In the adult breeding female, the basal spots are smaller and have more of a yellowish-orange or yellowish-pink color. This also dulls in the postbreeding condition, and is barely visible in the field. Juveniles resemble nonbreeding females. Bills of females have generally less blue coloration and, hence, less color contrast.

The legs and toes are light green in color with a blending of gray, light brown, or flesh color. The webs are grayish-brown.

Iris color is dark brown in all cases which I have observed.

AGE AND SEX CRITERIA

Juveniles are readily identified by the distinctive rectrices (fig. 4), but these are shed very rapidly so that by late summer most have replaced their juvenal with adult rectrices. The presence of the bursa and closed oviduct in females serves to separate the young from adults. In males, the color of the head as well as the gross size of the penis and bursa are used to determine age.

Adults have either no bursa or a bursa of 2 to 11 mm in depth (average for 14 was 3.5 mm) and less than two mm in diameter. Five juveniles examined in summer had bursas of 19 to 30 mm (average 21) and of larger diameter. Three birds thought to be yearlings had bursas of 15, 16, and 17 mm in depth. Additional work is necessary before the bursa can be used in age determination with certainty.

Adult males are readily identified by their black heads, but males in juvenal and first basic plumage have a brown head and eyestripe like females. However, most young males have brownish-red undertail coverts while those of females are white, barred with brown.

DISCUSSION

Morphologically, the Black-headed Duck differs from most holarctic forms in the following ways: (1) females are larger than males, (2) the brief duration of the juvenal plumage, (3) the presence of an extensive (except remiges) and long-lived first non-nuptial (basic) plumage, and (4) presence of a long-lived, adult non-nuptial plumage which does not differ in color from the nuptial (alternate) plumage.

Taxonomically, there are several plumage characters that strengthen the suggestions for placing this species with the stifftails (tribe Oxyurini) despite its somewhat teal-like appearance and behavior. The juvenal tail feather of this species resembles that of the Ruddy Duck much more than that of dabblers. The barred pattern of the juvenal feathers also is similar to that of ruddys (fig. 2). Moreover, the general color patterns suggest an original relationship of the Black-headed Duck to the ruddy group.

A full first non-nuptial (basic) plumage is regular in *Heteronetta* but is not characteristic of most northern anatids (although they have a partial molt of varying extent). According to Humphrey (*in* Delacour, 1964:180), the North American Ruddy has a first non-nuptial (basic) plumage that is complete for the body and possibly for the wings. On the basis of plumages, feather patterns, and feather structure, it appears that *Heteronetta* is closer to *Oxyura* than to *Anas*.

SUMMARY

A study of the plumages of the parasitic Black-headed Duck (*Heteronetta atricapilla*) was based on 105 museum skins and 37 freshly killed specimens. Weights

and measurements indicate that this species is unique among known anatids in that females are larger than males.

The sequence of plumages is: natal, juvenal, non-nuptial (first basic), nuptial (alternate), non-nuptial (second basic). In adult life, there is sexual dimorphism in color but no seasonal dimorphism. The postjuvenal (first basic) and non-nuptial (later basics) plumages are long-lived, functioning as a winter plumage. The complete molt occurs in midsummer; the partial molt into nuptial (alternate) occurs in the spring.

On the basis of the shape of the juvenal tail feathers, plumage color, and sequence of molt, a strong relationship to the Oxyurini exists.

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