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Handbook of Waterfowl Behavior: Tribe Oxyurini (Stiff-tailed Ducks)

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type, juveniles resemble adults, and the sexes of adults do not differ in plumage. The adult plumage pattern is similar to that of the female red-breasted merganser, and the speculum pattern is of the typical *Mergus* type, but there is little white on the upper-wing coverts. Humphrey (1955) has described the male trachea, which is very similar to those of the goosander and the Chinese merganser. The species, if it survives, is restricted to the Auckland Islands and is not sympatric with any near relatives.

TRIBE OXYURINI (STIFF-TAILED DUCKS)

The stiff-tailed ducks constitute a unique section of the Anatidae that is possibly the most isolated of all the tribes with the exception of the Anseranatini. There are eight species which almost certainly belong in the group, plus one more that is only very tentatively included. The tribe is of worldwide occurrence. Seven of the species have long, narrow, and stiffened tail feathers that function as rudders in underwater swimming, at which all species are very adept. These species also have a dense and shiny body plumage much like that of grebes, but lack metallic coloration altogether. The typical species have short, thick necks with loose-fitting skin that can be expanded through the inflation of the esophagus or special air sacs. All species have large feet and their legs are placed well toward the rear, which results in a poor walking ability. All species but the most aberrant one (the white-backed duck) exhibit sexual dimorphism. Vocalizations are extremely variable, and male calls are often produced by extra-tracheal structures. Sexual maturity is probably reached in the first year in all but one of the species (the musk duck), and pairs are probably renewed yearly in most and quite possibly all species. Male displays are generally elaborate and tend to produce sound. Nests are generally built over the water surface and the eggs are generally chalky white and relatively large, the young being very precocial at hatching.

Affinities with other tribes are uncertain. No definite intertribal hybrids are known, although an alleged hybrid of the greater scaup and the North American ruddy duck has been mentioned (Sibley 1938). One species, the black-headed duck, appears to be the least specialized of the group and in its downy plumage, female plumage, and tail structure resembles the dabbling duck group. It also has an unlobed hallux and a bill which rather resembles that of a typical

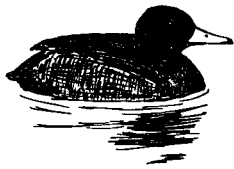
dabbling duck, and it tips-up a good deal. Thus I consider that the Anatini are the Oxyurini's closest relatives, although the two groups are no doubt well isolated.

Black-headed Duck (*Heteronetta atricapilla*)

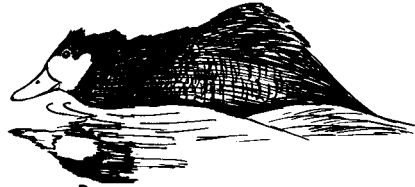
The South American black-headed duck has often been included with the species that now constitute the Anatini, but Wetmore (1926) first pointed out its similarities with the stiff-tails. Unlike the downy young of the stiff-tails, however, downy black-headed ducks have a yellow-and-brown-spotted pattern and a dark eye-stripe much like downy dabbling ducks. Juveniles resemble adult females, which have a general similarity to female cinnamon teal. The male has a uniformly black head. Although the body feathers of the male have the characteristic sheen of those of the stiff-tails, they lack the ruddy coloration typical of the stiff-tailed ducks. There is no eclipse plumage. The tracheal structure indicates probable affinities with the stiff-tails, since there is a large throat sac which in the region of the lower jaw is projected forward into two sacs that connect with the mouth, and it is no doubt inflatable. The trachea is of simple structure, lacking a large bulla, and there is an enlargement near the middle of the tube (Wetmore, 1926). The anterior end of the esophagus is enlarged and is possibly also inflatable. The species is sympatric with two species of *Oxyura*, but no hybrids are known. Woolfenden (1961) has concluded that the black-headed duck is the least specialized of the stiff-tailed ducks and a possible evolutionary link with the dabbling ducks.

General behavior. Black-headed ducks are common birds in their restricted range, and they mingle both with dabbling ducks and with stiff-tails. Although they often feed by up-ending, they can dive very well. Apparently they have the unique characteristic of being obligate nest-parasites, since no nests have ever been found which could be positively identified as belonging to black-headed ducks. Females lay their eggs, which are large, roundish, and rough-textured, in other birds' nests, with little regard for the species they are parasitizing.

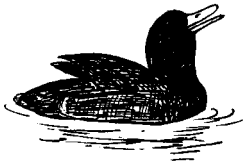
Agonistic and sexual behavior: female. I have not observed females of this species, and the only account of their behavior comes from Wetmore (1926), who states that they behaved "like other ducks" during courtship display, swimming about with the head



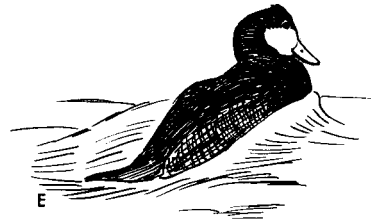
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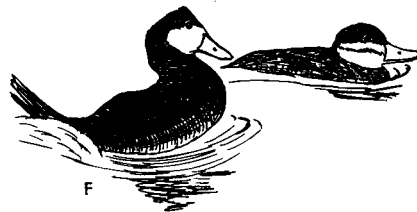
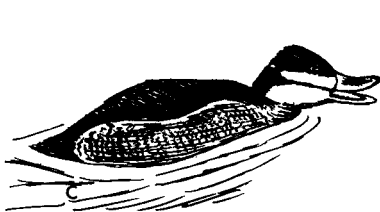
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B



E



F

Figure 94. Black-headed Duck, North American Ruddy Duck

- A. Black-headed duck male, normal swimming posture.
- B. Black-headed duck male, performing Gulping display. Note partly raised wings, expanded throat.
- C. Female ruddy duck performing aggressive gaping.
- D. Aggressive Hunched Rush by male ruddy duck.
- E, F. Stages in the Rush to the female.

erect. It would be of interest to learn if an Inciting display is present, as it is apparently lacking in at least some of the typical stiff-tails.

Agonistic and sexual display: male. A single male (Fig. 94A) has been in the Wildfowl Trust collection for some years and has been observed to display on a few occasions. When this bird is preparing to display, he expands his neck considerably and then swims near the courted bird and Turns-the-back-of-the-head toward her, in exactly the manner of a dabbling duck. In the same situation a typical stiff-tail would direct his tail, rather than the back of his head, toward the courted bird. There is no preliminary shake equivalent to the Introductory Shake of dabbling ducks; rather, the major display is preceded immediately by a single lateral head-shake. The bird then cocks his stubby tail vertically, lifts his folded wings a few inches (as a male ruddy duck does during the latter part of his Bubbling display), and suddenly performs about three rapid "Gulping" movements with his bill and head as if he were attempting to catch and then swallow flying insects (Fig. 94B). Finally the tail is lowered and shaken to terminate the display. The associated call is weak and hard to hear, but seems to be a three-note *pic-pic-pic*, with the first note loudest, the last weakest, and each associated with a "Gulping" movement. I have never heard any other calls, although Wetmore (1926) states that males puff out their throats and utter low *quah-quah* notes, and members of the Wildfowl Trust staff have mentioned hearing soft whistles and clucking notes. One of the ground staff informed me that he had observed the male "imitating" the head-pumping movements of a Chiloé wigeon (presumably precopulatory Head-pumping), and it would be of great interest if the precopulatory display of the black-headed duck actually is a mutual Head-pumping. It appears, however, that although the black-headed duck shares behavioral characteristics with both the dabbling ducks and the stiff-tails, it is closer to the latter group.

TYPICAL STIFF-TAILS

The following six species, the "blue-billed" or "ruddy" ducks, may be considered the most typical representatives of the stiff-tail tribe. Males of all these species have brilliant cobalt-blue bills and rich ruddy brown body plumages during the breeding season. The head patterns of males are various combinations of black, white, and brown. The tails are long and stiff, and the wings are short. Females

of all species are rather uniform in appearance, being primarily a barred brownish color, with distinct eye and cheek stripes in most species. The downy young are miniature editions of their mothers, with dark crowns and cheek markings. One species, the masked duck, differs from the rest in its less-specialized bill structure and plumage pattern, and in its well-marked white wing-speculum. The other five species seem to fall into two major species groups, a southern, lowland group (the maccoa duck, the blue-billed duck, and the Argentine ruddy duck) and a northern, or montane, group (the white-headed duck and the North American, Colombian, and Peruvian ruddy ducks). In the former group the downy young tend to be more whitish below and on the cheeks, and the males have all-black heads and relatively narrow bills. In the latter group the males tend to have white on the cheeks and throat and somewhat wider bills. A second possible, but not yet definite, difference may be that in the latter group the males have inflatable tracheal air sacs which are used as "sounding boards" during display, whereas at least the Argentine ruddy duck inflates its esophagus and uses jerky neck and head movements to expel the air and produce sound. The blue-billed duck is similar to the Argentine ruddy duck in this respect, but the maccoa duck is less certainly so.

Masked Duck (*Oxyura dominica*)

The masked duck differs from the other species of *Oxyura* in several respects and is apparently somewhat less specialized than they. Woolfenden (1961) supports this view and advocates the generic separation of this species. The downy young have a spotted back and a head pattern approaching that of *Heteronetta*, although there is also the typical *Oxyura* cheek stripe. Juveniles resemble females, which have strongly contrasting eye and cheek stripes as well as a white speculum. Adult males have an interesting plumage pattern with a distinct back and flank spotting which is not found in the other *Oxyura* species. The ruddy body color extends over the back of the head, producing a restricted black "mask," and white is restricted to the chin. As in the females there is a large white speculum formed by the secondaries and their coverts. It is uncertain whether there is an eclipse plumage, although it is unlikely that there is. The trachea of the male lacks a bulla, but the tracheal tube is enlarged anteriorly. Dr. A. Wetmore informs me (pers. comm.) that the male tracheal

tube has an attached air sac similar to that of the ruddy duck; apparently there is a syrinx-produced call-note. Masked ducks are sympatric with two other species of *Oxyura* in Central and South America, but no hybrids are known.

General and sexual behavior. The masked duck has been little studied, and practically nothing can be said of its behavior. The male is said to have a loud, distinct call, described as a *kuri-kirro*, and the female is said to have a lower, hissing voice. Unlike the other species of *Oxyura*, masked ducks can take flight by "leaping" out of the water in the manner of dabbling ducks. Diving, however, is done with the same consummate skill as characterizes the other stiff-tails.

Ruddy Duck (*Oxyura jamaicensis*)

It is reasonably certain that the South American forms *andina* and *ferruginea* should be considered as southern montane populations of the North American ruddy duck which have progressively lost their white cheek markings and have become larger. The downy young are all blackish, with a dusky cheek and an indistinct cheek stripe. Juveniles resemble females, which in the northern race have strong cheek stripes but in the South American and West Indian populations have duskiere cheeks. Adult males of the North American population have clear white cheeks and exhibit distinct nuptial and eclipse plumages, whereas the southern populations have cheeks with a varying amount of black (the further south the population, the more black on the cheeks) and lack an eclipse plumage. In at least the North American race the males possess a large tracheal air sac which is inflatable during display. The South American populations very probably also possess such structures. There is no tracheal bulla, and the syrinx is extremely simple in both sexes. The southern populations of this species are sympatric with the masked duck and Argentine ruddy duck, but no definite hybrids are known.

General behavior. Miss Helen Hays has completed a detailed study, as yet unpublished, on the ecology and behavior of the North American ruddy duck, and when published it will no doubt be the standard reference on the species. So far as possible I have followed the terminology of Miss Hays. Ruddy ducks apparently lack preflight movements and, except during migration, rarely take flight at all. Miss Hays (pers. comm.) has observed head-rolling ("cheeking") movements which she believes to be preflight signals. Ruddy ducks do

not walk well on land, and they usually sleep in the water with the bill tucked into the scapulars. North American ruddy ducks make large nests over the water, which are usually ramped. Females often drop their eggs in other birds' nests, and the young are extremely precocial at hatching. I have not studied the South American races, and the following comments refer to the North American ruddy duck.

Agonistic and sexual behavior: female. Female ruddy ducks are highly aggressive toward males and often gape at them with outstretched neck and ruffled scapulars (Fig. 94C). The only vocalization I have heard is a high-pitched, almost rodentlike squeak, which is uttered infrequently when the female is threatening or fleeing from other birds. Females seem entirely to lack any behavior which is functionally related to Inciting; for the most part they apparently ignore the frantically displaying males as they rush about trying to attract attention. Rarely, females (and also the downy young) will perform the same "Bubbling" display as the males, but this is of uncertain significance.

Agonistic and sexual behavior: male. The male displays of ruddy ducks are several and varied. Throughout most of the courtship situation the male keeps his long tail cocked vertically, although usually not spread. This Tail-cocking (Fig. 95A) brings into full view the white under-tail coverts, which the male tries to exhibit to the female by swimming directly in front of her in what Miss Hays calls the Tail-flash display. Unlike male dabbling ducks, the male of this species does not try to keep the back of his head toward the female; rather, he keeps his head stationary and maneuvers his whole body as he jockeys for position. The Tail-flash is a purely sexual display and is never directed toward other males. The major sexual display, however, is also used as a threat toward other males. This display, called the Bubbling display, is an elaborate and complex one. The male begins by erecting his "horns," inflating his neck, and cocking his tail (Fig. 95A, D). He then suddenly begins to beat his bill against his inflated neck, forcing air out from under the feathers and causing bubbles to appear at the surface of the water, and at the same time producing a hollow tapping sound (Fig. 95B, E). The tapping speeds up toward the end of the display, and at the same time the tail is cocked even farther toward the head and the folded wings are slightly lifted for a moment just before the display terminates with a partial

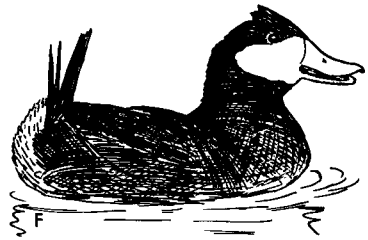
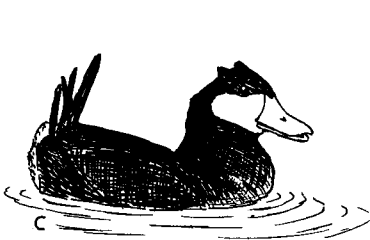
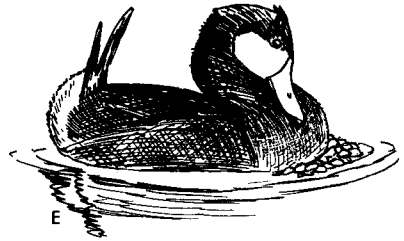
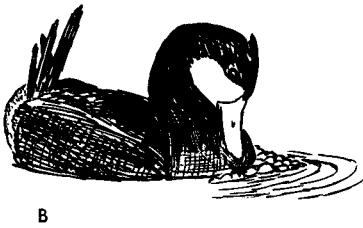
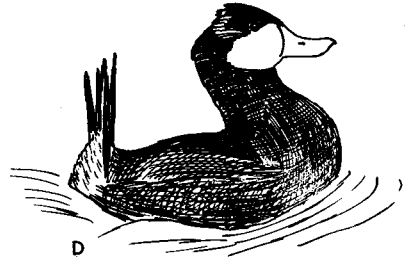
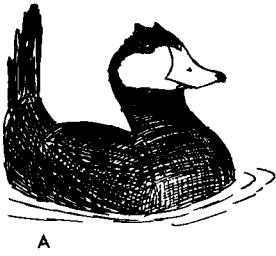


Figure 95. North American Ruddy Duck

A-C. Stages in the Bubbling display.

A. Starting posture.

B. Bill-drumming on breast. Note bubbles produced.

C. Termination of display by calling.

D-F. Same as A-C.

deflation of the air sac, accompanied by a forward movement of the head as the bill is opened and a low belching sound is uttered (Fig. 95C, F). When the courted female is approached too closely by a second drake, the possessive drake rushes after him with bill gaping, head near the water, and back feathers ruffled, in a threat posture that has been called the Hunched Rush (Fig. 94D). The attacking bird then rapidly turns about and Rushes back to the female in a totally different posture. In this the hind parts of the body are submerged, the partially cocked but submerged tail is almost level with the water surface, and the breast is raised out of the water and the bill is held against the breast (Fig. 94E, F). In this posture the male "surfboards" back to the female, sending up a wake of water behind him. As soon as he reaches her, he does an "about face" and once again turns the cocked tail toward her. Males also perform short display flights, or "Ringing Rushes," toward females (Fig. 96A, B). From an alert and stretched-neck posture, the head stationary and the tail cocked, the partially spread tail is suddenly lowered to the water and the bird "skitters," with a ringing sound produced by the wings, over the surface to within a few feet of the female, whereupon he stops and usually immediately turns around to perform the Bubbling display. The only vocalization I have heard is a soft noise produced at the end of the Bubbling display. Miss Hays has observed a high-intensity threat posture which I have never seen, in which two males face each other motionless, nearly bill-to-bill, for ten seconds or more before they begin actually to fight.

Copulatory behavior. Precopulatory behavior is entirely different from that of any previously discussed species. The male cautiously approaches the female while slightly nodding his head in the manner of ducks that are swimming while very alert, and he frequently dips his bill in the water (Bill-dipping) and immediately withdraws it and shakes it sideways, flicking water to both sides. Although this display (Fig. 96C, D) is similar to the Water-twitching display of sea ducks, the bill is not left in the water, and Bill-flicking is perhaps the best name for the movement. The female does not return this display; rather, she usually dives, and she may even threaten the male. Sometimes, however, the male is able to approach close enough so that he can suddenly and without warning mount her. Sometimes the female will assume a partially submerged receptive posture. Treading lasts only a few seconds, during which the female is almost entirely sub-

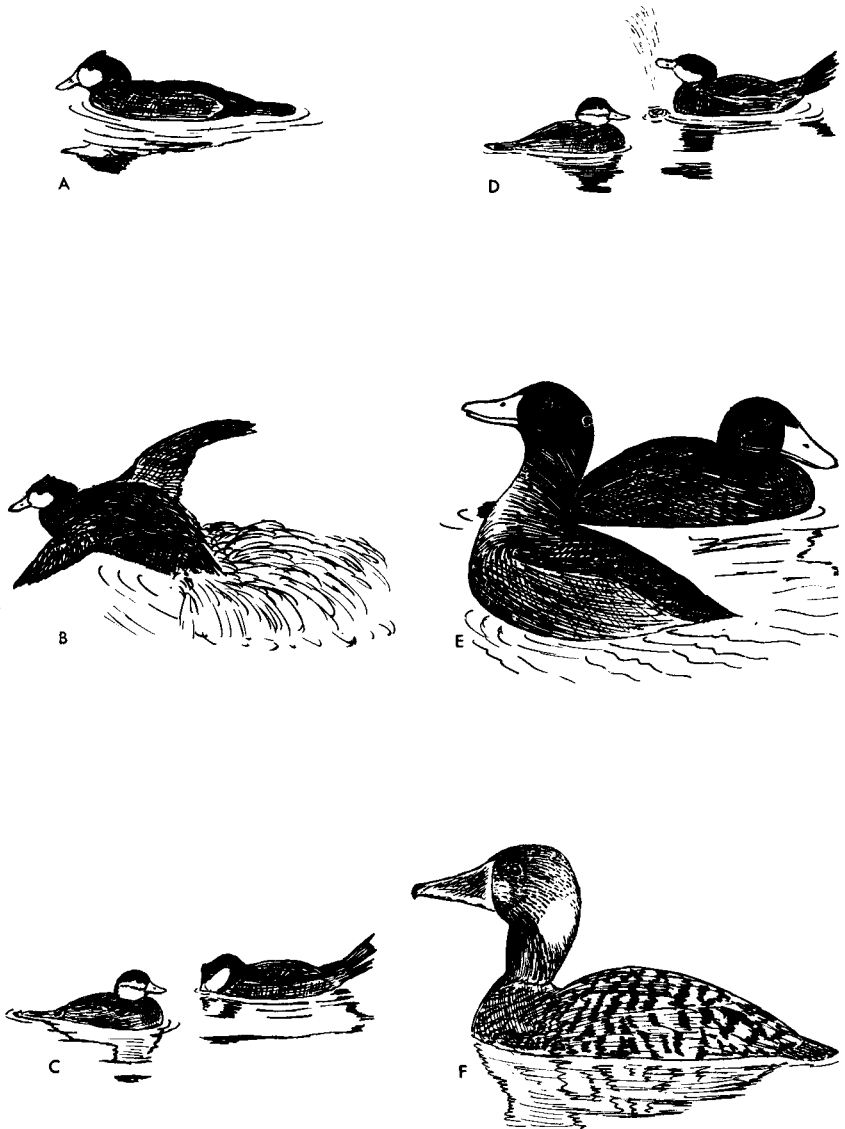


Figure 96. North American Ruddy Duck, Argentine Ruddy Duck, White-backed Duck

- A, B. Ringing Rush by male ruddy duck.
- C. Precopulatory Bill-dipping, which alternates with D.
- D. Precopulatory Bill-flicking.
- E. Male Argentine ruddy duck performing Head-jerking (*male behind in normal swimming posture*).
- F. White-backed duck, swimming posture.

merged. Immediately after treading, the male dismounts rapidly, faces the female, and performs the Bubbling display several times in rapid succession. Both birds then preen and carefully rearrange their plumage.

White-headed Duck (*Oxyura leucocephala*)

It appears probable that the white-headed duck is more closely related to the ruddy duck than to any other species of *Oxyura*. The downy young, juveniles, and females of the two species are very similar. The males differ in that those of the white-headed duck are larger and have a greater amount of white on the head and a markedly higher bill. This higher bill is probably the result of the presumably larger nasal glands associated with the salty or brackish habitat of this species. The body plumage is also less ruddy in color than in the other species of *Oxyura*. There is a definite eclipse plumage in males. The tracheal and esophageal structure is undescribed to my knowledge. No hybrids are known, and there is no sympatry with other stiff-tails.

General behavior. Relatively little is known about the white-headed duck, but except for a tendency to inhabit salt water it appears to be very similar to the ruddy duck. As in that species the nests are large, built over water, and have little down; in addition, the clutch is large and usually consists of six or more eggs.

Agonistic and sexual behavior: female. Females evidently gape aggressively at males, and also occasionally extend their necks (Dementiev, in Delacour, 1959).

Agonistic and sexual behavior: male. Dementiev (in Delacour, 1959) states that males vertically cock as well as spread their tails. They expand their chests and move forward and backward, hitting their chests with their bills in the same manner as North American ruddy ducks. Mountfort (1958) states: "The display consists of the drake swimming in front of its mate while jabbing its short, blue bill rapidly at the water half a dozen times and then jerking its head forward." The behavior described obviously corresponds to the Bubbling display. Dementiev has also described what is clearly the Rush display, saying that males "press the bill against the expanded chest, and press it down into the water; then with a powerful stroke of both feet, they propel their body forward, raising fountains of water."

Copulatory behavior. This is undescribed to my knowledge.

Maccoa Duck (*Oxyura maccoa*)

The African maccoa duck is of uncertain relationships, but possibly it is most closely related to the Argentine ruddy duck. The downy young of the two species are very similar except that the maccoa duck has a striped back and a narrower cheek stripe. Maccoa males are considerably larger than those of the Argentine species, but they have a similar plumage pattern. In both species the bill is relatively narrow and uniform in width. It is uncertain, but doubtful, whether there is an eclipse plumage in males. The tracheal and esophageal anatomy has not been described. The maccoa duck is restricted to Africa and is not sympatric with any other *Oxyura* species.

General behavior. Like the Argentine ruddy duck, this species apparently builds small and frail nests, and lays a small clutch of from three to seven eggs. The male evidently helps care for the young.

Agonistic and sexual behavior: female. Nothing on this has been noted in the literature.

Agonistic and sexual behavior: male. Various authors have described the behavior of this species, the most recent and complete summary being that of Macnae (1959). The male is said to have a relatively loud voice, which is used during various displays. The call has been described as a low, grating *churr*, *crroooo . . .*, uttered with the head and neck stretched out over the water. It has also been characterized as a loud, snoring *purr*, *rr-rr*, uttered with the neck arched, the bill pointed toward the water, and the neck swollen. Macnae states that during calling the bill is opened, the head pushed slightly forward and up, the body lifted slightly out of the water, and the tail erected and fanned out. He also mentions the alternate calling position "with head and neck outstretched over the water" as the drake swims forward and backward. No displays corresponding to the Bubble display have been described. A few other male behavior patterns have been described which might also constitute displays. These include "rubbing the bill on its chest" and "rolling its head on the back," which could be either normal or ritualized preening and head-rolling movements respectively. While in front of the female "the drake swam forward with head and neck outstretched, bill pointing downwards, tail stretched back and separated; before doing

this the drake swam with a slight palpitation of the wings. These were not spread but the movement seems to be against the body. The beak is quickly flicked and water splashed up with the tip." This last sentence could refer to precopulatory Bill-flicking. The spreading of the tail feathers mentioned above does not occur in the American ruddy duck, but it has been described for both the white-headed duck and the Argentine ruddy duck.

Copulatory behavior. This has not been described, but Macnae (1959) has described what might be precopulatory behavior occurring between paired birds. He states: "There is some preliminary bill flicking and head rubbing by the drake while the duck preens. The drake swims rapidly up to the duck and stops, almost touching, across her path. Then he lifts and fans his tail, showing the light under tail coverts, pushes his head forward and calls. Then he rapidly back paddles in a small arc to end on the opposite side of his mate. Sometimes he is so close that he forces her around slightly as he revolves."

Argentine Ruddy Duck (*Oxyura vittata*)

The Argentine ruddy duck has at times been considered conspecific with the North American ruddy duck, but this does not appear to be justified. The downy young of this species differ from *jamaicensis* downies in that they have clear white cheeks except for a broad dark stripe. Females have a broad cheek stripe as well, and also have very dark upper-parts. Males have black heads and are otherwise rather uniformly ruddy on the upper parts. The bill increases only slightly in width (about 3 mm. as opposed to 5–7 mm.) beyond the base in the three races of *O. jamaicensis*, and has a relatively straight culmen profile. There appears to be a true eclipse plumage in this species, although such a plumage appears to be lacking in the South American races of *jamaicensis*. The male tracheal structure is simple, with only a weakly developed tracheal air sac, but the esophagus is enlarged and inflatable (Wetmore, 1926). The Argentine ruddy duck is sympatric with the Peruvian ruddy duck in Chile, but no hybrids are definitely known to exist. Hellmayr (1932) mentioned one possible hybrid based on maximum bill width, but the two forms approach each other so closely in this respect (19.4 mm. to 22.2 mm. in 12 male *vittata* vs. 23.0 to 26.1 mm. in 27 male *ferru-*

ginea measured by me) that positive identification of hybrids on this basis is impossible.

General behavior. The Argentine ruddy duck appears to be most readily distinguishable from the Peruvian ruddy duck in that it builds a small, flat, grebelike nest and lays a relatively small clutch of three to five eggs (Goodall *et al.*, 1951). The eggs are also somewhat smaller in size than are those of the Peruvian species.

Agonistic and sexual behavior: female. In limited observations at the Philadelphia Zoo, I noted that the female of this species is much like the North American ruddy duck female in her behavior. Her most common display is a silent gaping, which is performed toward any male that approaches too closely. She also occasionally performs a silent vertical bill-jerking movement similar to the major male display, but done in a much less conspicuous fashion. The only female vocalization I have heard is a high-pitched squeal, very similar to that of the North American ruddy duck female and uttered under similar circumstances.

Agonistic and sexual behavior: male. Little has been published to date regarding male displays in this species; the observations of Kerr (1890) are the only ones known to me. Dr. Martin Moynihan has made extensive observations on the behavior of the Argentine ruddy duck, but these have not yet been published. My own observations are quite limited, but suggest a remarkable difference in male behavior patterns from those of the North American ruddy duck. In fact, in many respects the two species respond in almost opposite ways, which is not surprising considering their sympatric distributions and similar plumages. For example, the Argentine ruddy duck male cocks his tail only rarely, and apparently never during sexual display. He never drums his bill downward on his breast; his commonest display (directed both to females and other males) is instead a very rapid upward jerk of the head with the bill held relatively level (Fig. 96E). This display, frequently repeated several times, appears to be silently performed. Although the esophagus is inflatable I did not notice any marked neck enlargement; Kerr (1890), however, did observe this. I once observed a male stretch his head and neck out on the water toward a female, in a posture similar to the Sneak of the pochards, a posture Kerr (1890) also describes. Kerr states that while in this posture the male spreads and cocks his tail, then advances toward the female, but I did not see this.

Other displays or probable displays that I observed include the Hunched Rush, performed in the same manner as by the North American ruddy duck and a silent gaping which also was apparently a threat toward other males. On several occasions I observed a jerking or quivering of the folded wings which strongly reminded me of the black-headed duck's wing movements during display, but which I have never noted in the North American ruddy ducks. Furthermore, the males gave no indication of trying to swim in front of the females in the manner so typical of North American ruddy ducks, in which this tendency forms an important part of the total display activity.

Copulatory behavior. This has not yet been described, and I observed no copulations. I did, however, see one male approach a female and, while facing her, alternately dip his bill and roll his head on the back. This immediately reminded me of the alternate Bill-dipping and lateral Bill-flicking found in North American ruddy ducks as a precopulatory display, and I believe that this was perhaps also a precopulatory display in the Argentine species. The female, however, made no overt response to the male.

Australian Blue-billed Duck (*Oxyura australis*)

The Australian blue-billed duck is of uncertain relationships, but probably belongs near the Argentine ruddy duck and the maccoa duck. Juveniles and females have dusky, unstreaked head patterns unlike those of the other *Oxyura* species. Males have black heads and necks, and otherwise are a uniformly dark ruddy color on the upper parts. A female-like eclipse plumage is evidently present, to judge from personal observations. The bill is relatively narrow throughout, and the culmen profile is concave as in the maccoa duck. A tracheal air sac is lacking, but the esophagus can be inflated. The species is widespread in southern Australia and is not sympatric with any other species of *Oxyura*. No hybrids are known.

General behavior. Descriptions of nests are few, but apparently the nests tend to be larger and more substantial than those of the Argentine or African species. The average clutch apparently consists of five or six eggs. The male evidently never assists the female with rearing the young, but deserts her when incubation begins.

Agonistic and sexual behavior: female. Judging from my observations on this species, females are quite similar to those of other

Oxyura species. Gaping is commonly performed as a hostile display toward males, and is accompanied by a repeated "tet-tet-tet-tet . . ." series of notes. In addition, females perform a vertical head-pumping as a dive-intention movement. No Inciting displays have been observed.

Agonistic and sexual behavior: male. Male display patterns in this species have been reported in detail elsewhere (Johnsgard, 1965b), and will only be summarized here. Earlier notes by Brown (1949), Wheeler (1953), and Scott (1958) mention only a few of these displays. Among the most frequent male displays is Dab-preening, a ritualized preening of the breast feathers done in a rapid and repeated fashion, usually while facing the female. Prior to the most elaborate display, the male performs a series of fairly rapid Head-pumping movements that are seemingly identical to the dive-intention movements made by frightened birds. As this Head-pumping progresses, the tail is gradually cocked and the neck expands greatly. Suddenly the bird throws his head forward and downward into the water, and with a series of neck-jerking movements splashes the surface with his bill and throat in a display I have called Sousing. After from five to seven such jerking movements the tail is quickly lowered and simultaneously the head and bill are submerged, so that only the back of the displaying bird is visible. In this posture the male remains motionless or swims backward a varying distance, then retracts his head and completes the display with a series of bill-dipping and head-shaking movements. Like the Bubbling display of the North American ruddy duck, this display produces considerable noise through splashing, but in all probability these two somewhat similar displays were independently evolved. Two displays clearly derived from comfort movements have been frequently observed; these are Head-rolling and Wing-flapping. A sudden Lurching forward in the water often follows Wing-flapping or Head-rolling, producing a conspicuous splashing sound. Similarly a noisy Display Flight is performed in exactly the same manner as the Ringing Rush of the North American ruddy duck, and an aggressive chase, or Hunched Rush, is frequently seen as males threaten one another. In addition, a rapid "surfboarding" type of swimming has been observed, which is similar to that performed by males of the North American species as they return to courted females. In contrast with that species however, this Motor-boating display also occurs in other situations in the blue-

billed duck. Finally, dorsal preening and diving have been observed occasionally during display and may be ritualized.

Copulatory behavior. An adequate description of copulation is still not available. Wheeler (1953) once observed a male chase a female, finally catch her, and copulate with her while she was completely submerged. After copulation there was a lengthy preening which was completely different from the display preening he observed earlier. It seems unlikely that this represents normal copulatory behavior.

Musk Duck (*Biziura lobata*)

The Australian musk duck is certainly a stiff-tail, differing from the other stiff-tails mainly in being larger and in having different body plumage and different feeding habits. The downy young are only slightly patterned, being dark gray above and lighter below. Juveniles and adults of both sexes are essentially alike in plumage, differing only in size and the degree of development of the sub-mandibular lobe, or wattle. Adult males are two to three times as heavy as females, and have an extremely large wattle which is formed by a folding of the integuments. It is not hollow and therefore cannot be inflated, although it can be thickened considerably at the base and made turgid. There is an inflatable subgular pouch immediately behind the lobe, apparently somewhat similar to the throat pouch of the black-headed duck. The trachea is simple and apparently lacks any air sacs, and the syrinx is a simple ossified area at the junction of the bronchi (illustrated in Johnsgard, 1961c). Doubtlessly the syrinx produces the whistling call of the male, but the so-called "plonk call" is mechanically produced by the slapping of the feet on the water. Musk ducks occur over southern Australia and are sympatric with the Australian blue-billed duck. No hybrids are known.

General behavior. Musk ducks build typical stiff-tail nests, and normally lay only two or three large, rough-surfaced eggs. Young birds often ride on the female's back, a behavioral adaptation not known to occur in other stiff-tails. The diet of musk ducks consists of a wide variety of animal material such as amphibians, fish, crustaceans and other invertebrates. Additional notes on the general behavior of this species can be found elsewhere (Johnsgard, 1965a, 1965b).

Agonistic and sexual behavior: female. Females appear to lack any well-defined courtship displays; instead they are simply attracted to displaying males and watch such birds intently, without however actively initiating or regulating display activity. Thus there appear to be no Inciting or other sexual displays present in females, and I heard no calls uttered by them. To my knowledge, the only vocalization recorded for female musk ducks consists of an apparent warning note uttered to ducklings at the approach of possible danger (Johnsgard, 1965a).

Agonistic and sexual behavior: male. Surprisingly little concerning the behavior of this bizarre species has been published. Aside from some short notes, the paper by Serventy (1946) is the only reasonably detailed description of male displays. I have described these in detail elsewhere (Johnsgard, 1965b), so that an abbreviated summary may suffice here. Unlike the sexual displays of nearly all other species of waterfowl, those of male musk ducks do not appear to accomplish the establishment of pair bonds between individuals. Rather, it would seem that males conduct promiscuous relationships with any females that they manage to attract by their conspicuous display activity, and thus their elaborate displays and considerable sexual dimorphism can probably be explained through sexual selection. The female's role is therefore reduced to one of simply observing and presumably visually stimulating the male by her presence alone. The male displays appear to represent a hierarchy of forms, of which three distinct levels can be recognized. These are the Paddling Kick, the Plonk Kick and the Whistle Kick. The Paddling Kick is apparently always used to begin a display sequence. As the bird moves forward through the water he lowers his head and neck toward the surface, holds his body and tail in a straight axis, and with a strong kick sends a sheet of water upward and backward a distance of up to six or eight feet. Often the feet are not kicked in exact synchrony, so that a double or even triple splash may be produced. The only sounds produced are those of splashing water. The tail is often partly cocked between displays, and the submandibular lobe may be somewhat enlarged. The number of Paddling Kicks performed in a sequence and the duration between them is quite variable, but usually less than 20 occur before the male begins to perform Plonk Kicks. The bird remains fairly stationary in the water, tilts the head upward, and sometimes cocks the tail. The lobe is much thickened at the base,

and the cheeks and throat are greatly enlarged through inflation of the subgular pouch. In this posture the bird kicks simultaneously with both feet, sending splashes upward and laterally. Although the amount of water and the distance it is kicked seems less than in the Paddling Kick, the noise produced is greater, for as the feet strike the water they produce a loud, hollow "plonk" or "ker-plonk," a noise that persons have often concluded to be of vocal origin. These Plonk Kicks are repeated with considerably more regularity than the Paddling Kicks, and are continued for an indefinite period. Often as many as 30 or 40 Plonk Kicks occur in unbroken sequence, spaced with surprising regularity between three and four seconds apart (Johnsgard, 1965b). After an extended series of Plonk Kicks, and especially after one or more females have been attracted to the male, he usually abruptly shifts from Plonk Kicks to Whistle Kicks. Whistle Kicks involve a more extreme extension of the posturing assumed during the Plonk Kick. The tail is spread and usually kept fully cocked and closely pressed against the back. The head is held low in the water with the bill tilted upward, so that the fully turgid lobe is just over the surface. In this posture the bird suddenly flicks his feet simultaneously outward and backward, throwing jets of water out on both sides of the body for a foot or two. Contrary to previous reports, the wings do not produce this splashing, but rather it is caused by the feet alone. With each splash a sharp, clear whistled note is uttered, somewhat similar to the call of the white-backed duck, and at close range a much softer preliminary breathing noise can be heard. In extreme posturing, as when other birds are nearby, the male raises his head and fully cocked tail between splashes, so that the body appears almost U-shaped. This posture is especially frequent when other males approach. Surprisingly, such males will often swim up to within a foot or so of displaying birds, watching them intently. Fights do not usually result until one of these males approaches too closely to one of the females, which are also strongly attracted to displaying males. The timing of the Whistle Kicks is even more regular than that of the Plonk Kicks, and the average time between kicks is again from three to four seconds. It is not uncommon for a series of 50 or 60 Whistle Kicks to occur in unbroken sequence, and such sequences are generally terminated by the females losing interest and swimming away or by the displaying male attacking one of the other males.

Copulatory behavior. I have not observed copulation, but accounts of it made available to me by Angus Robinson and Vic Lowe are fairly similar and the behavior described is probably representative. There is apparently no special precopulatory behavior in musk ducks distinct from the general display activity described above, but instead the male simply displays with particular intensity when a female approaches closely, almost constantly jockeying for position close to her. Finally the male quickly throws a wing over the female, pulls her beneath him, and she is totally submerged during copulation. Both Robinson and Lowe observed an unusual male postcopulatory display, in which the male, with head submerged, rapidly swam away from the female (Lowe's account) or around her (Robinson's account). The female simply surfaced and flapped her wings.

White-backed Duck (*Thalassornis leuconotus*)

Of all the Anatidae, the white-backed duck is one of the most aberrant, and its position in the family is still somewhat tentative. Although it is generally believed to belong to the stiff-tail tribe, there is relatively little evidence to support this view. The tail feathers are very short and only slightly if at all stiffened, there is no inflatable air sac or specialized esophagus in the male, and the feathers lack the grebelike appearance of the typical stiff-tails. The downy young are altogether unique. Juveniles, females, and adult males are essentially identical in plumage, differing only in the brightness and length of the head feathers. The trachea of the male is simple, but the syrinx is an osseous chamber, slightly enlarged and keeled, much like that of female whistling ducks (illustrated in Johnsgard, 1961c). A fact not previously noticed by taxonomists is that the tarsus has a reticulated pattern; the only other ducks which have this feature are whistling ducks and the freckled duck.

General behavior. White-backed ducks dive frequently, but do so in a "leaping" manner much like that of whistling ducks. Their nests are like those of stiff-tails, and are built over water. The eggs, although relatively large, are smooth and glossy, unlike those of the Oxyurini. No down is placed in the nest, suggesting that, as in the whistling ducks, both sexes incubate. It is at least certain that both sexes rear the young; thus pair bonds may be relatively permanent. In two other aspects of its general behavior the white-backed duck is peculiar. First, I have never seen the birds swimming or resting

on the water with the bill tucked in the scapulars in the manner of typical stiff-tails (at least *Oxyura*). Instead the birds go to shore to sleep or rest. Second, the general shake of the white-backed duck is very much like that of a whistling duck in that it is preceded by wing-shaking for several seconds before the bird rises in the water and shakes its head. In addition, white-backed ducks frequently shuffle their wings for extended periods of a minute or more; this is also characteristic of whistling ducks.

Agonistic and sexual behavior. Unlike the typical stiff-tails, white-backed ducks are exceedingly undemonstrative. Both sexes have a clear whistling voice like that of a whistling duck or guinea pig, and when disturbed they utter their plaintive notes with neck outstretched (Fig. 96F). So far as I can tell, there is no difference in the voices of the two sexes. The birds do not usually threaten or attack one another, although on a few occasions I saw them rushing over the water like ruddy ducks, as one bird chased another. Although I have watched nine of these birds for extended periods, the only possible instance of display I have observed consisted of one bird (apparently a male, judging from head size and color) swimming toward another while calling repeatedly. The second bird then also began to call, and the two swam along together, calling, for several feet. They then separated and nothing more developed. I have also observed a rapid chin-lifting toward other birds during apparently aggressive calling.

Copulatory behavior. Unfortunately, no information on this is available, and a knowledge of it would no doubt be of assistance in judging the real affinities of the species.