

The display postures of the male Musk Duck

PETER J. FULLAGAR and MONTSE CARBONELL

Introduction

Populations of the endemic Musk Duck *Biziura lobata* of Australia occur in two regions. The larger population is distributed over an extensive part of south-eastern Australia ('eastern' birds), and a much smaller population is confined to a small area in south-western Australia ('western' birds) (Frith 1967; Blakers *et al.* 1984).

The bizarre displays of the male Musk Duck have been described previously in detail (Serventy 1946; Stranger 1961; Johnsgard 1966; Lowe 1966; Frith 1967; Ogilvie 1975), but there is still a lingering suggestion that birds from the west may perform displays different from those of birds from the east. This idea gained support from a comparison of the calls of males from different regions. Sound spectrograph analysis of tape recordings confirmed that there are striking regional differences, particularly between birds from opposite sides of the continent (Robinson & Robinson 1970). In the same study it was also concluded that a 'ker-plonk' noise was caused by the feet entering and leaving the water during display by males in south-eastern Australia, but was of vocal origin when made by Musk Duck in Western Australia.

The aim of our study was to re-examine the evidence for these regional peculiarities. In so doing we were not specially concerned with the calls but with the possibility that the postures of males during display might be different. An opportunity to study Musk Duck at close hand was provided by the fact that birds were held in captivity at the Wildfowl Trust, Slimbridge, England, and at the Serendip Wildlife Research Station, near Melbourne, Australia.

The birds at Slimbridge and Serendip

At Slimbridge, where all birds had originated from Western Australia, information was gathered (by M.C.) during 1976, 1980, 1981 and 1982. Two males and one female arrived in the collection in 1974 as adult birds, M1, M2 and F1. One of the males, M1, died before the spring of 1980 and the

female died in 1981. These birds were kept in two separate but adjacent wire-covered pens (Ogilvie 1975) each 6 × 3 m. A male (M3) and female (F2), hatched in October 1979 from new importations of eggs, were placed in the adult male's (M1) aviary after he died, but were soon removed to a larger pen, 10 × 10 m, which had a promontory on one side with a small pool, 1 × 2 m, half way up its slope. The young male, almost three years old in summer 1982, still did not have a fully developed lobe beneath his bill and did not display 'properly', which probably indicates that by his third year he had not reached maturity.

At Serendip, where eastern population birds were held, observations (by P.J.F.) were based on a male that was at least 17 years old in 1984 (D. White, pers. comm.). A second male was 8 years old in that year. These and other Musk Duck at Serendip were kept in an octagonal series of pools, each about 13 × 3 m, that formed a circle surrounding an inner pond and central island. A breeding pair, which included the old male, was held in adjoining pools with a connecting pop-hole. This was too small for the male, but of a size which would allow the more diminutive female to escape to the seclusion of one pool in which she nested and reared her ducklings. The pair at Serendip bred each spring and summer. In November 1982 ducklings had been fledged recently while in July 1984 a newly hatched brood was present with the female.

At Slimbridge, courtship displays were filmed using 30 m of Super-8 mm movie film shot at 24 frames/s. These were analysed frame by frame and drawn using a Eumig 2000 projector. In addition, descriptions of sequences were recorded at the pens on a tape recorder and later transcribed. All sequences were recorded from the beginning, or from the moment when the observer noticed there was display, until the bout finished.

At Serendip, some display of the old male was filmed on Super-8 at 24 frames/s in November 1982, but much more extensive sequences were obtained using a portable video cassette recorder in July 1984. About 1 hour of tape with sound was recorded at

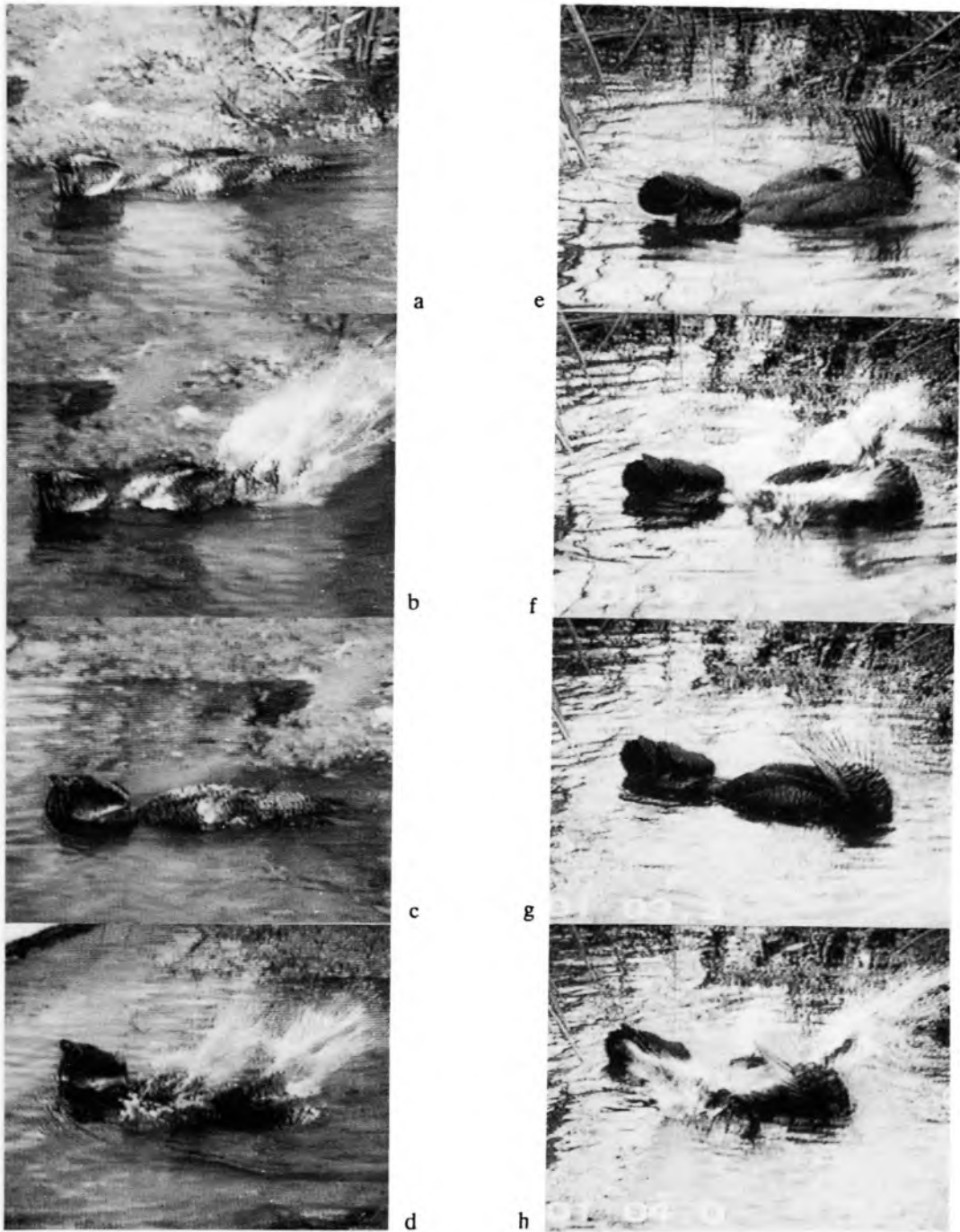


Figure 1. The advertising display of the male Musk Duck.

Sequences selected to show:

a-d Paddle-kick. Note the flaccid bill lobe and the rapid movement forwards.

e-h Plonk-kick. Note rotation right.



i



j



k



l



m



n



o



p

i-l Transition to Whistle-kick. Note rotation left.

m-p Whistle-kick. Note the turgid bill lobe and gradual forward movement.

These are photographic reproductions of 'frames' from the video recordings of July 1984 showing the old male at Serendip, Australia.

between 1 m and 10 m distance. Frame by frame analysis (by M.C.) was performed on the November film. The video tape was not analysed in detail for this study.

Description of the display

At Slimbridge, display bouts by M1 lasted 12 minutes on average (n = 14), while the longest he displayed without interruption was 20 minutes. On the other hand M3, at the age of three years, displayed on average 24 minutes (n = 6), with a longest bout of 32 minutes. No comparable measurements were made at Serendip.

Figure 1 shows the form of the different display actions illustrated by reproduction of frames from the video tapes of the old male at Serendip. Frame by frame comparison of films and video tapes from the two sites did not reveal any obvious differences in the way the display was per-

formed. Diagrammatic representations of these different actions are given in Figure 2.

1. *Paddle-kick* (Paddling kick, Johnsgard 1966; Position 1, Serventy 1946). At Slimbridge eight analysed. Duration = 0.57 ± 0.06 (0.5 - 1.7) s. Percentage of occurrence = 44.3%.

In this movement, the male kicked his feet sideways and backwards producing a noisy splash of water. Sometimes a kick was followed by a quick series of foot-paddles propelling the male forwards in a rush. At the same time the tail was spread open over the water and the head aimed forwards, the bill pointing slightly upwards. The upper part of the neck and cheeks were inflated, the bill lobe touching the water. Before each kick the folded wings were lifted to the centre of the back by elevating and drawing together the distal portions of the humeri. They were not flapped as Stranger (1961) reported. Johnsgard (1966) mentioned that

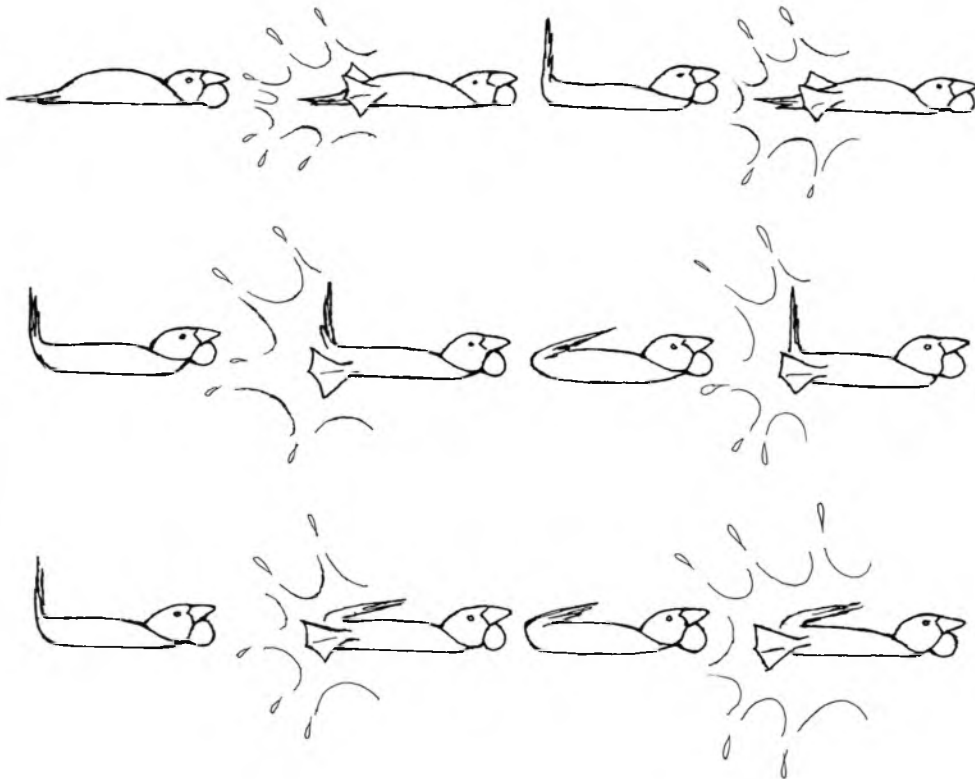


Figure 2. Diagrammatic representations of the display of the male Musk Duck. Upper: paddle-kick. Middle: plonk-kick. Lower: Whistle-kick.

both feet were not kicked in synchrony, but at Slimbridge, M1 always kicked them at the same time, as did the two males at Serendip. Examination of the Serendip video-tapes confirmed that the bill lobe was always flacid at the start of a series of Paddle-kicks (see Fig. 1), but rapidly became turgid. At Serendip the males always moved rapidly forwards during the Paddle-kick, travelling across and along their pools.

The Paddle-kick always started a display sequence (Johnsgard 1966). The number of Paddle-kicks that initiated a display sequence varied between 5 and 64 ($n = 18$), $\bar{x} = 35 \pm 17$. Johnsgard (1966) observed a maximum of 30 ($\bar{x} = 13$, $n = 4$) before the male started to perform the Plonk-kick and Lowe (1966) suggested three or four was usual with a maximum of 30 or more. The average interval between kicks was 6.72 ± 1.90 (3–10) s, $n = 18$. Johnsgard (1966) found an interval of 4.1 ± 1.7 (2.4–8.3) s, $n = 19$.

2. *Plonk-kick* (Johnsgard 1966; Position 2, Serenty 1946). At Slimbridge five analysed. Duration = 0.67 ± 0.09 (0.5–0.8) s. Percentage of occurrence = 10.8%.

These kicks were performed with the tail spread open and in a vertical position at the instant of kicking. The head and neck was inflated and stretched forward, as in the Paddle-kick, with the bill lobe turgid. By this stage the top of the head was markedly inflated and broadened by virtue of the considerable inflation of the cheek regions. The same wing-lift movement preceded the kick as seen during the Paddle-kick. During the Plonk-kick the males did not move rapidly forwards, but would remain essentially stationary, rotating slowly or gradually moving backwards or forwards.

Johnsgard (1966) noted that in this movement the feet were kicked in a different way than during the Paddle-kick, but from our film and video analyses no such difference was noted.

Both Johnsgard (1966) and Lowe (1966) reported that this is perhaps the most commonly observed kick, and counted uninterrupted sequences of 51 and 48 Plonk-kicks respectively. From the observations made at Slimbridge the percentage of occurrence of this kick shows that it was the least common of the three. The maximum number of Plonk-kicks given without interruption was 20. In general, this

kick was performed between the last Paddle-kicks and the first Whistle-kicks, rather than as a long uninterrupted sequence. Number of Plonk-kicks per bout (of Plonk-kicks) was $\bar{x} = 3 \pm 3.26$ ($n = 59$ bouts).

The average time interval between kicks was 6 ± 2 (4–10) s, $n = 19$ (for M1 at Slimbridge), while Johnsgard (1966) obtained 3.3 ± 0.4 (2.6–4.2) s for one set of measurements ($n = 14$) and 3.3 s for another set ($n = 120$), for birds from the south-east of Australia. Robinson and Robinson (1970) obtained $\bar{x} = 5.64 \pm 0.35$ (5.04–6.15) s, $n = 12$ and $\bar{x} = 4.72 \pm 0.34$ (4.20–5.29) s, $n = 12$ for birds from Western Australia; and $\bar{x} = 3.25 \pm 0.32$ (2.65–3.93) s, $n = 22$ for birds from the south-east of Australia.

3. *Whistle-kick* (Johnsgard 1966). At Slimbridge eleven analysed. Duration = 0.57 ± 0.07 (0.3–0.6) s. Percentage of occurrence = 44.9%. At Serendip forty analysed. Duration = 0.45 ± 0.06 (0.3–0.6) s.

This was the most extreme posture assumed by the males while displaying. The kick was given while the tail, fully cocked, was pressed against the back leaving the undertail coverts and vent feathers well in view and bristling. The bird is capable of bringing the tail to such an extreme position due to the addition of two post-pelvic caudal vertebrae and to the massive size of the *Musculus levator coccygis* (Raikow 1970). The neck was stretched forward and partially submerged in the water and the upper part of the neck and cheeks fully inflated. There was a wing-lift movement before the kick.

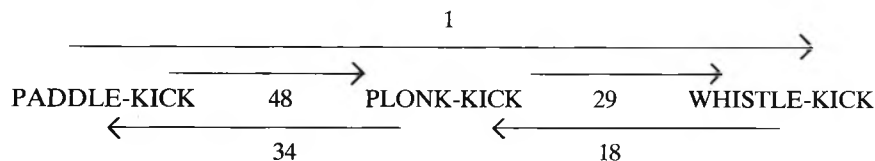
The maximum number of Whistle-kicks performed (by M1 at Slimbridge) without interruption was 116, $\bar{x} = 28.4 \pm 33.6$, $n = 30$. The longest unbroken sequence observed by Johnsgard (1966) had 64 of these kicks, while Lowe (1966) observed 58.

The average interval of time between Whistle-kicks (performed by M1 at Slimbridge) was 3.91 ± 1.68 (2–10) s, $n = 204$, and the bird at Serendip 2.10 ± 0.94 (1.1–4.0), $n = 36$. Johnsgard (1966) obtained 3.7 ± 0.3 (2.7–4.3) s, $n = 44$, for birds from the south-east of Australia, while Robinson and Robinson (1970) found $\bar{x} = 4.81 \pm 0.28$ (4.22–5.58) s, $n = 37$, for the birds from Western Australia, and $\bar{x} = 3.37 \pm 0.32$

(3.24–3.59) s, n = 31, for the birds from the south-east. At Serendip the old male would give Whistle-kicks with a ‘kick’ immediately followed by the sharp whistle call, but alternatively by a ‘kick’ and then ‘kick-whistle’. The two versions were discernible on inspection of the video-tape.

The three forms of the display were similar with the essential difference between them being the position of the tail during the kicking of the feet. It started in a horizontal position in the Paddle-kick, was raised to a vertical position in the Plonk-kick and was drawn down over the back with the feathers pointing horizontally forward in the Whistle-kick. Sometimes, the tail was lowered or lifted between kicks. The male would perform a Paddle-kick after which he would lift his tail, sometimes to the vertical position, and lower it again to its position over the surface of the water and then perform another Paddle-kick. Similarly he would perform a Plonk-kick, then lower his tail over the surface of the water, lift it again to the vertical position and perform another Plonk-kick. As the display became more intense the tail was drawn over the back between kicks until the Whistle-kick level was reached and eventually the tail was left pressed against the back between kicks.

The display did not always progress in a regular way, with Paddle-kick followed by Plonk-kick, followed by Whistle-kick, but this was the trend. There were Paddle-kicks performed between Plonk-kicks and between Whistle-kicks, and Plonk-kicks mixed with Whistle-kicks. The percentage of shifts between kicks recorded in a total of 1859 displays (20 sequences) involving 130 transitions (from M1 at Slimbridge) was:



In his third year (1982) the young male, M3, at Slimbridge did not show a properly developed display. It consisted of positions identical to the Paddle, Plonk and Whistle-kicks but lacked the kicking of the feet. All the other elements of the display were present: head stretched forward, with bill pointing slightly upwards; cheeks and upper

part of the neck fully inflated, neck almost submerged during the Whistle-kick, the appropriate position of the tail and the wing-lift movement. The pouch was at this time only half grown, did not touch the water, but it became turgid in display. The associated whistle was sometimes ‘out of key’ and often given as a sequence of ‘attempts’, as if the bird was trying to get it right. This gradual development of the full display has been noted in males at Serendip (D. White, pers. comm.).

Contrary to Serventy (1946) and Johnsgard (1966) all three kicks were recorded with an associated whistle, but 28.5% of the Paddle-kicks, 9.0% of the Plonk-kicks and 2.2% of the Whistle-kicks were performed (by M1 at Slimbridge) without the whistle, which might have led Johnsgard (1966) to believe that only the Whistle-kick was associated with this piercing call. On the other hand Stranger (1961) reported that a sound is produced by the shot of water as the wings are lifted. Neither Johnsgard (1966) nor the observations made by us at Slimbridge and Serendip support this idea.

Discussion

It is now generally agreed that Paddle, Plonk and Whistle-kicks represent three levels of intensity of the same display (see, e.g., Ogilvie 1975). All three involved a position with the head stretched forward and bill slightly pointing upwards; a lobe turgid and just touching the surface of the water; a wing-lift and a synchronised foot-kick (sideways and backwards). In all three the feet came out of the water (*contra* Johnsgard 1966) although they were in a

higher position during the Whistle-kicks, due to the extreme raising of the tail over the back which forced the legs to come upwards. This also made the animal keep his neck almost entirely under the water, and hence the bill was tilted at a smaller angle than in the Paddle and Plonk-kicks (see Fig. 1).

Another posture which has been reported as having a possible sexual context is the "U-shape" (Johnsgard 1966) assumed by the male Musk Duck when other males approached. Under the circumstances in which the males lived at Slimbridge and Serendip this could not be studied. It is possible that Johnsgard refers to the position maintained between Whistle-kicks (see illustration in Ogilvie 1975), in which the male kept his tail pressed over the back with the feathers pointing forward, neck submerged in the water and head stretched forward with turgid lobe, inflated cheeks and upper neck, and at the same time would swim swiftly to and fro.

Lowe (1966) observed two birds, within a few feet of each other, "Spinning", that is nibbling at the base of the tail while spinning on the spot. This made him "wonder if it was merely extraordinary preening or if it had special significance". This "spinning" was observed many times in preening birds at Slimbridge and at Serendip, not just in the Musk Duck, but also in other Oxyurini, and was simply a consequence of paddling with one foot while rolling almost onto the back when preening the tail area (see Fig. 3).

A posture with head lowered to the water and neck extended ("Sinister Chasing" of Lowe 1966) may be similar in purpose to the "Hunch-rush" posture of other Oxyurini and is certainly used in Musk Duck as a threatening approach. Aggression between individuals takes the form of a straight forward chase and attack across the water, but often the chasing bird will dive to surface near or under the attacked bird. Sometimes both birds will dive and then surface fighting vigorously with bills and feet. An exaggerated Splash-dive ("Splash-Diving-Display" of Lowe 1966) was observed both at Slimbridge and at Serendip in response to people near the pens. The male dipped his head in the water, as he would normally have done at the beginning of a dive, kicked his feet sideways and backwards, producing a loud splash and widely scattered spray of water, before submerging. It was reported by Serventy (1946) and Johnsgard (1966). Specially during Paddle-kicks, males at Slimbridge and Serendip have been seen giving exaggerated kicks, which splash water over a wide arc. At the same time the bird swims quickly forwards ("Travel-Splash-Kick" of Lowe 1966).

Few observations on copulation in Musk Duck have been reported. C. Davey (pers. comm.) observed from a distance of less than 20 m a male Whistle-kicking to a female on Lake Burley Griffin, A.C.T., in November 1984. His field notes record that no other Musk Duck were in the vicinity and the two birds were within 0.5 m of each other; the female circling the displaying male who rotated to face her. The female then lowered herself into the water. The male approached the female and on mounting he grabbed the nape feathers in the usual manner of ducks. The female did not completely submerge. After copulation the male sank back into the water and immediately rushed around the female half submerged, neck stretched out and tail flat against the water. The female sank from view reappearing at the same spot, at the same time the male finished describing a circle around her. Both birds then swam away in different directions. There was no post-copulation bathing or wing flap by either bird. These observations only differ in detail with those of V. Lowe and A. Robinson reported by Johnsgard (1966).

The vocalisations of the Serendip birds have been studied in some detail using the video recordings obtained in 1984. Briefly, it was found that other soft calls were associated with the shrill whistle given when performing the Whistle-kick display. Before each 'whistle' there were two sharp 'cuc' calls, a soft one just following the 'kerplonk' cavitation sound made by the kicking feet, and another louder version immediately before the high intensity and rapidly modulated whistle. A soft and difficult to detect 'whirr' sound was given with each kick and with each of the 'cuc' calls. Descriptions of vocalisations by the Slimbridge birds are essentially the same, but no sound recordings were available for comparison.

As far as we can determine all Musk Duck perform the same displays incorporating an identical water-splash component, which is created by a rapid sideways kicking of the feet. We can find no important detail of posture that might be markedly different on comparison between the displays by mature individuals. Most variation in the visual components of the display can be explained by changes in the level of display intensity. To some extent the confusion caused by the terms used to describe the events during



Figure 3. Musk Duck at Serendip 'spinning' whilst preening, July 1984.

display have added to misunderstanding. There is little doubt that in Musk Duck an increasing competence in display comes with maturity of the performer.

In conclusion, we found no reason to believe that display postures of Musk Duck differ between birds from different regions of Australia, but there are convincing reasons to accept that the associated vocalisations differ regionally and most especially so between birds from Western Australia and the east. This problem would repay further study.

Turning finally to the question of the geographical distribution of the Musk Duck. The assumption that two populations are totally isolated (Frith 1967) should be treated with caution. Musk Duck have been seen along the coast of the Australian Bight; for example they were recently reported in small numbers at sea off Eyre (Blakers *et al.* 1984; Congreve & Congreve 1985). Also they were found in 1978 on the western Nullarbor plain following major floods (Brooker *et al.* 1979). Therefore, there is the possibility of interchange occurring between populations from the west and east, across the otherwise inhospitable intervening arid region.

References

- Blakers, M., Davies, S. J. J. F. & Reilly, P. N. 1984. *The Atlas of Australian birds*. Melbourne Univ. Press.
- Brooker, M. G., M. G. Ridpath, A. J. Estbergs, J. Bywater, D. S. Hart & M. S. Jones. 1979. Bird observations on the North-western Nullarbor Plain and neighbouring regions, 1967–1978. *Emu* 79: 177–90.
- Congreve, D. P., & Congreve, P. 1985. Birds. *Eyre Bird Observatory Report 1981–83. RAOU Rept No. 9*: 20–42.
- Frith, H. J. 1967. *Waterfowl in Australia*. Angus & Robertson Ltd., Sydney.
- Johnsgard, P. A. 1966. Behavior of the Australian Musk Duck and Blue-billed Duck. *Auk* 83: 98–110.
- Lowe, V. T. 1966. Notes on the Musk-duck, *Biziura lobata*. *Emu* 65: 279–90.
- Ogilvie, M. A. 1975. The Musk Duck. *Wildfowl* 26: 113.
- Raikow, R. J. 1970. Evolution of diving adaptations in the Stiff-tailed Ducks. *Univ. Calif. Public. Zool.* 94: 1–52.
- Robinson, F. N. & Robinson, A. H. 1970. Regional variation in the visual and acoustic signals of the male Musk Duck, *Biziura lobata*. *CSIRO Wildl. Res.* 15: 73–78.
- Serventy, V. N. 1946. Display in the Musk Duck. *Emu* 5: 318–21.
- Stranger, R. H. 1961. Display in the Musk Duck. *W. Aust. Nat.* 7: 210–1.

Acknowledgements

We wish to thank Don White, Serendip Wildlife Research Station, for allowing us to observe, film and video-record his Musk Duck; for many years the only breeding group of these birds maintained in captivity in Australia. We also thank the Wildfowl Trust, Slimbridge, for permission to study the Musk Duck held there. David Rushton shot the film at Serendip and Ed Slater gave generously of his many skills in making the video recordings and preparing the photographic illustration from them. We thank Chris Davey for permission to include some of his unpublished observations.

Summary

Detailed study of display postures by male Musk Duck *Biziura lobata* in captivity has shown that there are no differences in the actions of birds when comparing those from western and eastern populations in Australia. Variation in the Paddle-kick, Plonk-kick and Whistle-kick are most likely due to different levels of display intensity by the individual, but an increasing competence at display is associated with increasing maturity of the performer. Several other supposed display postures are discussed. It was accepted that significant regional variation occurs in the call associated with these display postures, but this matter needs further investigation.

P. J. Fullagar, CSIRO Division of Wildlife & Rangelands Research, P.O. Box 84, Lyneham, A.C.T. 2602.

M. Carbonell, The Wildfowl Trust, Slimbridge, England.