

S. Zack, and an anonymous reader. To these agencies and persons, I express my sincere thanks.

## LITERATURE CITED

- ANKNEY, C. D. 1982. Sex ratio varies with egg sequence in Lesser Snow Geese. *Auk* 99: 662-666.
- COULTER, M. C. 1977. Growth, mortality and the third-chick disadvantage in the Western Gull, *Larus occidentalis*. Unpublished Ph.D. dissertation. Philadelphia, Pennsylvania, Univ. Pennsylvania.
- NISBET, I. C. T., & M. E. COHEN. 1975. Asynchronous hatching in Common and Roseate terns, *Sterna hirundo* and *S. dougallii*. *Ibis* 117: 374-379.
- PARSONS, J. 1970. Relationship between egg size and post-hatching mortality in the Herring Gull (*Larus argentatus*). *Nature* 228: 1221-1222.
- RYDER, J. P. 1976. The occurrence of unused Ring-billed Gull nests. *Condor* 78: 415-418.
- , & P. L. SOMPMI. 1979. Female-female pairing in Ring-billed Gulls. *Auk* 96: 1-5.
- RYDER, P. L., & J. P. RYDER. 1981. Reproductive performance of Ring-billed Gulls in relation to nest location. *Condor* 83: 57-60.
- SOKAL, R. R., & F. J. ROHLF. 1981. *Biometry*, 2nd Ed. San Francisco, W. H. Freeman.
- TRIVERS, R. L., & D. E. WILLARD. 1973. Natural selection of parental ability to vary the sex ratio of offspring. *Science* 179: 90-92.
- VERMEER, K. 1969. Egg measurements of California and Ring-billed Gull eggs at Miquelon Lake, Alberta, in 1965. *Wilson Bull.* 81: 102-103.
- WILSON, E. O. 1975. *Sociobiology*. Cambridge, Massachusetts, Harvard Univ. Press.

Received 18 October 1982, accepted 18 January 1983.

## Mate Changes by Black-bellied Whistling Ducks

DON DELNICKI

U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, % WES, Box 631,  
Env Lab, Vicksburg, Mississippi 39180 USA

Delacour and Mayr (1945) suspected that whistling ducks (*Dendrocygnini*) kept the same mate for life. Bolen (1971) confirmed that Black-bellied Whistling Duck (*Dendrocygna autumnalis*) pairs remain together from year to year and reported one pair that had nested together for at least 4 yr. My recapture records of birds banded at nest boxes indicate that Black-bellied Whistling Ducks will pair again when their mate dies; here, I describe two occurrences in which both members of pairs obtained new mates, although their previous mates were still alive.

I studied the nesting ecology of Black-bellied Whistling Ducks by inspecting nest boxes during all or parts of the 1971-1972, 1974, and 1976-1979 nesting seasons in eight south Texas locations. Study areas are described in Meanley and Meanley (1958), Box and Chamrad (1966), Bolen (1967), and Delnicki (1973).

I banded a male Black-bellied Whistling Duck (897-94372) incubating five eggs in Cameron County on 23 July 1971. On 30 July 1971 a female incubating this nest, then containing nine eggs, also was banded (897-94377). This female was also incubating the nest on 6 August 1971. The male was additionally observed incubating on 13 August and brooding four hatchlings and incubating five eggs on 21 August 1971. Ultimately, six of the nine eggs hatched. Female 897-94377 was recaptured incubating 30 eggs on 29 June 1972. Her new mate had been banded 12 days earlier while incubating 25 eggs. Twenty-five of the 30 eggs in this nest hatched between 12 and 19

July 1972. On 27 July 1972 male 897-94372 was recaptured incubating 22 eggs in a nest box 58 m from his 1971 nest and 46 m from the nest box where his 1971 mate had successfully nested 8-15 days earlier. His new mate was banded 3 August 1972. This male was also observed incubating on 14 August, and 18 of the 22 eggs hatched between that date and 25 August 1972.

On 20-21 July 1978 I banded a pair of Black-bellied Whistling Ducks (male 597-64652 and female 597-64653) at Santa Ana National Wildlife Refuge. At that time their nest contained 11 eggs. The female was recaptured at the nest box on 31 July; on 8 August 1978 the male was incubating 11 pipped eggs, all of which hatched. I recaptured male 597-64652 incubating 42 eggs on 8 June 1979, about 1.7 km from the 1978 nest site. On 11 June 1979 his new mate was caught and banded, and I observed this hen on the nest 4 days later. The male was incubating 40 eggs on 21 June, of which 24 hatched between that date and 3 July 1979. Female 597-64653 was recaptured on 19 June 1979 while incubating 32 eggs about 130 m from where her 1978 mate was simultaneously nesting. The following day I caught her new mate, a bird that I had banded in 1977. This hen was incubating 33 eggs on 11 July, 29 of which hatched between that day and 16 July 1979.

During 1971-1979, I banded both members of 106 nesting pairs, 17 pairs of which were recaptured while nesting together one or more years after being banded. One member from each of 26 of these 106 pairs

was subsequently found nesting with a new mate in later years, but none of their original mates was observed again. The percentage of intact pairs I recovered is conservative, because I did relatively little fieldwork during 1974 and 1976, none during 1973, 1975, or after 1979, and because some pairs may have nested in subsequent years in places other than nest boxes or away from the study areas. I have one record of a Black-bellied Whistling Duck nesting about 9.2 km from its nest of the previous year. Therefore, it is possible that other pairs nested within, or perhaps beyond, this distance from the nest box where they were banded.

The reasons for mate changes by waterfowl that form long-term pair bonds are unknown. Cooke et al. (1981) reported that at least five nesting Snow Geese (*Chen caerulescens*) had changed mates although their mates from the previous year were still alive. These authors cited several studies suggesting that "divorce" among birds with long-term pair bonds is most common following a season of reduced reproductive success. Both pairs of whistling ducks, however, had successfully nested before obtaining new mates.

These observations are the only mate changes reported for whistling ducks of which I am aware. I am indebted to the Welder Wildlife Foundation for financial support, to the late Clarence Cottam for assistance with fieldwork during 1971-1972, and to Eric

Bolen, Michael Conroy, Thomas Dwyer, Kenneth Reinecke, and Jim Saunders for reviewing this manuscript.

#### LITERATURE CITED

- BOLEN, E. G. 1967. The ecology of the Black-bellied Tree Duck in southern Texas. Unpublished Ph.D. dissertation. Logan, Utah, Utah State Univ.
- . 1971. Pair bond tenure in the Black-bellied Tree Duck. *J. Wildl. Mgmt.* 35: 385-389.
- BOX, T. W., & A. D. CHAMRAD. 1966. Plant communities of the Welder Wildlife Refuge. Sinton, Texas. Welder Wildlife Foundation, Contrib. 5, Ser. B.
- COOKE, F., M. A. BOUSFIELD, & A. SADURA. 1981. Mate change and reproductive success in the Lesser Snow Goose. *Condor* 83: 322-327.
- DELACOUR, J., & E. MAYR. 1945. The family Anatidae. *Wilson Bull.* 57: 3-55.
- DELNICKI, D. 1973. Renesting, incubation behavior, and compound clutches of the Black-bellied Tree Duck in southern Texas. Unpublished M.S. thesis. Lubbock, Texas, Texas Tech Univ.
- MEANLEY, B., & A. G. MEANLEY. 1958. Nesting habitat of the Black-bellied Tree Duck in Texas. *Wilson Bull.* 70: 94-95.

Received 18 October 1982, accepted 21 March 1983.

### Dump Nesting in the Wood Duck Traced by Tetracycline

G. MICHAEL HARAMIS,<sup>1</sup> W. GEORGE ALLISTON,<sup>2</sup> AND MILO E. RICHMOND  
New York Cooperative Wildlife Research Unit, Cornell University,  
Ithaca, New York 14853 USA

Tetracyclines have been used to mark the bones and teeth of coyotes (*Canis latrans*, Linhart and Kennelly 1967), rodents (Crier 1970), and even the scales of salmonids (Weber and Ridgway 1962). Such marking is based on the property of this group of antibiotics to chelate with calcium ions. Calcium deposits containing chelated tetracycline produce a golden-yellow fluorescence when exposed to wave ultraviolet light.

Alliston and Richmond (unpubl. research) investigated the use of tetracyclines as a possible egg-marking technique for the study of the parasitic egg-laying behavior of the Redhead (*Aythya americana*). Experiments performed with White Leghorn Chickens (*Gallus gallus*) and Mallards (domestic Mallards and Pekin Ducks, *Anas platyrhynchos*) indicated that

an intraperitoneal injection of the tetracycline declomycin (demethylchlortetracycline hydrochloride) at a rate of 100 mg per kilogram of body weight would consistently mark all eggs laid by these females for up to one month and longer in many instances. Unfortunately, further tests indicated that the ability of the labeled eggs to fluoresce decreased rapidly with exposure to sunlight, thus precluding the use of this technique with ground-nesting waterfowl. The technique seemed ideal, however, for investigating the dump-nesting habit of the cavity-nesting Wood Duck (*Aix sponsa*). This paper reports the experimental use of this marking technique during a study of nesting Wood Ducks within a 250-ha green-tree impoundment at the Montezuma National Wildlife Refuge in central New York (Haramis 1975).

We induced two female Wood Ducks to desert their nests by trapping them in nest boxes during their laying period. The nests of these females were separated by 1.2 km, and each was adjacent to active as well as unused nest boxes. The two females were

<sup>1</sup> Present address: U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708 USA.

<sup>2</sup> Present address: LGL Ltd., Environmental Research Associates, Toronto, Ontario M4R 1A1, Canada.