TIMING OF REMIGIAL MOLT IN FULVOUS WHISTLING DUCKS NESTING IN LOUISIANA

WILLIAM L. HOHMAN AND DAVID M. RICHARD

National Biological Survey, National Wetlands Research Center, 700 Cajundome Blvd., Lafayette, LA 70506
Louisiana Department of Wildlife and Fisheries, Rockefeller Wildlife Refuge, Route 1, Box 20-B, Grand Chenier, LA 70643
Present address of DMR: J. G. Grey Estate, P.O. Box 40, Lake Charles, LA 70602

Only 11 families of birds have members that simultaneously shed flight feathers (King, 1974). In the Anatidae, very few exceptions exist to the pattern of one simultaneous wing molt per plumage cycle (Hohman et al., 1992). Most migratory waterfowl in North America undergo wing molt soon after the nesting season, but before migration to wintering areas. In the Anserinae, breeders (as opposed to subadults and nonbreeders) initiate wing molt shortly after eggs hatch and regain flight about the time young fledge (Hohman et al., 1992). Members of the Anserinae have long-term pair-bonds with both sexes providing parental care; however, in the Anatinae, only females provide parental care (Palmer, 1976). Males typically abandon their mates during incubation and migrate to isolated areas, often outside of their breeding areas, where molt occurs ("molt migration": Sterling and Dzubin, 1967; Salmonsen, 1968). Females that failed to rear young may join them on those areas (Hochbaum, 1944). Successful hens molt on or near the breeding area after young have fledged, although remigial molt occasionally occurs on wintering areas (Chabreck, 1966; Smith, 1977).

Patterns of molt in free-ranging whistling ducks (Anserinae: Dendrocygnini) are poorly known. Here we report on the timing of wing molt in fulvous whistling ducks (*Dendrocygna bicolor*) nesting in Louisiana. The breeding distribution of fulvous whistling ducks, which occur worldwide in tropical and semitropical regions (Johnsgard, 1978), expanded into the southeastern United States after the mid 1800s, following the establishment of rice cultures in Texas, Louisiana, and Florida (Lynch, 1943; Bolen and Rylander, 1983; Turnbull et al., 1989). Fulvous whistling ducks nesting in Louisiana are migratory, arriving in southern Louisiana in March (McCartney, 1963), initiating nesting from April to August (W. L. Hohman and J. L. Moore, unpubl. data), and departing in September or October to wintering areas in southern Mexico (Flickinger et al., 1973). Timing of wing molt relative to development of young is unknown for this migratory population.

We observed adult fulvous whistling ducks through spotting scopes while they attended young in southwestern Louisiana near Rockefeller State Wildlife Refuge (29°35'N, 92°45'W) on 24–25 July 1990. During that time, we captured eight adults with young at night by means of spotlights (Cummings and Hewitt, 1964). Ages of broods attended by captured or observed parents (n = 21 pairs) ranged from downy ducklings to broods that were fully feathered with contour feathers and remigial growth >50% completed (i.e., age-classes Ia–IIc; age classification follows J. B. Gollop and W. H. Marshall (in Schemnitz, 1980). Captured adults (3 males, 5 females) showed light molt (<10% molting feathers) in the head/neck, sides/flanks, upper breast/back, lower breast/belly, mid-rump/lower back, and scapulo-humeral regions (feather regions follow Billard and Humphrey, 1972), but no adults captured or observed in 1990 were molting remiges. Further, remiges of captured birds showed no signs of wear. Absence of remigial wear in waterfowl approaching the prebasic molt (summer) is very unusual (e.g., Hohman and Cypher, 1986). Based on phenology of nesting and migration in Louisiana, the apparent delay in onset of wing molt until after fledging of young, and lack of remigial wear, we speculate that wing molt in fulvous whistling ducks occurs on wintering areas. If so, they would be the only species of North American waterfowl to consistently molt after fall migration.

To substantiate that speculation, we continued observations on brood-rearing adults and captured more adults on 14 and 15 September 1991, and 2, 3 and 25 September 1992. In addition, we attached 25-g radio transmitters by means of a harness (Dwyer, 1972) to 5 adult males and 11 adult females (one parent per nest) that were

captured on nests (Weller, 1957) in Acadia and Evangeline Parishes, Louisiana, from 29 May to 5 August 1992. Transmitters had unique frequencies in the 164–168 Mhz range, a minimum lifespan of 100 days, and reception range of ≥2 km from the ground or ≥12.5 km from the ground to an airplane equipped with 4-element antennas flying at an altitude of 300 m. Birds were located every other day from the ground using vehicle-mounted or hand-held receiver-antenna systems (Cochran, 1980) and flushed weekly to determine their molt status (i.e., flighted or flightless). We systematically searched southern Louisiana in an airplane to find birds that could not be located from the ground (Gilmer et al., 1981).

Nine of 16 radio-marked adults nested successfully (i.e., hatched one or more eggs). Individuals were tracked an average of 52 days (range = 2 to 90 days; median = 46). Monitoring continued until 28 September when the last radio-marked individual apparently migrated.

No radio-marked birds became flightless before their departure from Louisiana and most adults observed with young in 1991 or 1992 (approximately 20 pairs) were capable of flight. However, we did capture two flightless adults on 3 September 1992: a male with eight age-class IIb ducklings and female with two age-class IV ducklings. Those observations suggest that most free-ranging fulvous whistling ducks nesting in Louisiana molt remiges after migration to wintering areas in Mexico. McCartney (1963) likewise found no evidence of wing molt by free-ranging fulvous whistling ducks in Louisiana, although he reported captives (ages and reproductive histories unreported) to undergo wing molt in mid September. Seasonal movements of our radio-marked birds were in a generally southwesterly direction which is consistent with observations that fall-migrating fulvous whistling ducks follow the Texas coast or overfly the Gulf to wintering sites in southern Mexico (McCartney, 1963; Flickinger et al., 1973). However, it is unlikely that Louisiana birds molt in Texas since flightless adults have not been observed there (McCartney, 1963).

Fulvous whistling ducks in the northern Gulf of Mexico region use rice fields extensively during the spring and summer. Rice fields are managed ephemeral wetlands; that is, water levels are relatively stable, but water depth is generally shallow and flooding is of short duration. Whereas fulvous whistling ducks nest successfully in rice fields, this habitat is poorly suited for ducks during wing molt because it does not meet basic requirements of flightless waterfowl; namely, predictable food resources, protection from predators, and seclusion from disturbance (McCartney, 1963; Hohman et al., 1992). Habitats occupied in winter presumably provide these requirements, although habitat use by fulvous whistling ducks during winter is generally not well understood (Bellrose, 1980). Delay of wing molt until after fall migration thus represents a possible adaptation whereby fulvous whistling ducks are able to exploit rice field habitats for nesting and rearing of young while minimizing potential risks to survival during the flightless period.

Patterns of wing molt in fulvous whistling ducks likely vary geographically. The pattern of molt in Texas and Louisiana birds is probably similar, but timing of wing molt may be different in Florida and in other portions of the species' range, where at least some birds are nonmigratory or move only short distances (Turnbull et al., 1989).

We were assisted in the field by B. Cox, J. L. Moore, T. M. Stark, and G. A. Weisbrich. We are grateful to P. Yakupzack for operating the airboat and encouraging this study on Cameron Prairie National Wildlife Refuge. We acknowledge G. S. Farris, T. C. Michot, J. L. Moore, and M. W. Weller for their helpful comments on the manuscript.

Literature Cited

Bellrose, F. 1980. Ducks, geese, and swans of North America. Stackpole Books, Harrisburg, Pennsylvania.

Billard, R. S., and P. S. Humphrey. 1972. Molts and plumages in greater scaup. J. Wildl. Mgmt., 36:671–684.

Bolen, E. G., and M. K. Rylander. 1983. Whistling ducks: zoogeography, ecology, anatomy. Mus. Spec. Publ. 20, Texas Tech. Univ., Lubbock.

Chabreck, R. H. 1966. Molting gadwall (*Anas strepera*) in Louisiana. Auk, 83:664.

Cochran, W. W. 1980. Wildlife telemetry. Pp. 507–520, *in* Wildlife management techniques (S. P. Schemnitz, ed.). Wildlife Society Inc., Washington, D.C.

Cummings, G. E., and O. H. Hewitt. 1964. Capturing waterfowl and marsh birds at night with light and sound. J. Wildl. Mgmt., 28:120–126.

Dwyer, T. J. 1972. An adjustable radio-package for ducks. J. Field. Ornithol., 43:282–284.

Flickinger, E. L., K. A. King, and O. Heyland.

1973. Pen-reared fulvous tree ducks in movement studies of wild populations. J. Wildl. Mgmt., 37: 171–175.

GILMER, D. S., L. M. COWARDIN, R. L. DUVAL, L. M. MECHLIN, C. W. SHAIFFER, AND V. B. KUEHLE. 1981. Procedures for the use of aircraft in wildlife bio-telemetry studies. Resource Publ. 40, United States Fish and Wildlife Service, Washington, D.C.

HOCHBAUM, H. A. 1944. The Canvasback on the prairie marsh. Am. Wildl. Inst., Washington, D.C.

HOHMAN, W. L., AND B. L. CYPHER. 1986. Age-class determination of ring-necked ducks. J. Wildl. Mgmt., 50:442–445.

HOHMAN, W. L., C. D. ANKNEY, AND D. H. GORDON. 1992. Ecology and management of postbreeding waterfowl. Pp. 128–189, *in* Ecology and Management of Breeding Waterfowl (B. D. J. Batt, A. D. Afton, M. G. Anderson, C. D. Ankney, D. H. Johnson, J. A. Kadlec, and G. L. Krapu, eds.). Univ. Minnesota Press, Minneapolis.

JOHNSGARD, P. A. 1978. Waterfowl of the world. Univ. Nebraska Press, Lincoln.

KING, J. R. 1974. Seasonal allocation of time and energy resources in birds. Pp. 4–85, *in* Avian energetics (R. A. Paynter, Jr., ed.). Nuttall Ornithol. Club, Cambridge, Massachusetts.

LYNCH, J. J. 1943. Fulvous tree-duck in Louisiana. Auk, 60:100–102.

MCCARTNEY, R. B. 1963. The fulvous tree duck in Louisiana. Unpubl. M.S. thesis, Louisiana State Univ., Baton Rouge.

PALMER, R. S. 1976. Handbook of North American birds, Vol. 2. Yale Univ. Press, New Haven.

SALMONSEN, F. 1968. The moult migration. Wildfowl, 19:5–24.

SCHEMNITZ, S. D. 1980. Wildlife management techniques manual. Fourth ed. The Wildlife Society Inc., Washington, D.C.

SMITH, F. W. 1977. Records of molting in the pintail (*Anas acuta*) and the northern shoveler (*Anas clypeata*) on the Texas gulf coast. Southwestern Nat., 21:558.

STERLING, R. T., AND A. DZUBIN. 1967. Canada goose molt migration to the Northwest Territories. Trans. N. Amer. Wildl. Nat. Resour. Conf., 32: 355–373.

TURNBULL, R. E., F. A. JOHNSON, AND D. H. BRAKHAGE. 1989. Status, distribution, and foods of fulvous whistling ducks in south Florida. J. Wildl. Mgmt., 53:1052–1057.

WELLER, M. W. 1957. An automatic nest-trap for waterfowl. J. Wildl. Mgmt., 21:456–458.

GROWTH AND SURVIVORSHIP OF MOAPA DACE (OSTEICHTHYES: CYPRINIDAE: *MOAPA CORIACEA*) IN AN ISOLATED STREAM REACH ON MOAPA NATIONAL WILDLIFE REFUGE

G. GARY SCOPPETTONE AND HOWARD L. BURGE

National Fisheries Research Center-Reno Substation, 4600 Kietzke Lane, Building C., Room 120, Reno, NV 89502
United States Fish and Wildlife Service, Dworshak Fisheries Assistance Office, Ahsahka, ID 83520

The Moapa dace, *Moapa coriacea,* is a federally listed, endangered, cyprinid fish endemic to the Muddy River (tributary to the Colorado River system), Clark County, Nevada. It is monotypic and the federal government has given it a high priority for recovery. Its decline has been attributed, in part, to the nonnative shortfin molly (*Poecilia mexicana*; Cross, 1976) which was introduced to the Muddy River System in the early 1960s (Hubbs and Deacon, 1964). To increase its chance of survival, Moapa National Wildlife Refuge (Moapa NWR) was established in 1979 within the species' historic range. The intent was to isolate the Moapa dace from nonnative fishes and to secure and protect a segment of its historic habitat.

The Moapa dace has a very restricted distribution. It is only found in the upper 4 km of the 40 km long Muddy River (Hubbs and Miller, 1948; Deacon and Bradley, 1974), commonly referred to as the Warm Springs area. Here the Muddy River flow originates from about 20 warm water springs occurring within a 2-km radius and having a cumulative discharge of 1.1 m^3/s (Eakin, 1964).

Moapa NWR is situated at the south side of the Warm Springs area, which was a former swimming resort. The spring discharge was