Survival of Female Black Ducks, *Anas rubripes*, During the Breeding Season

JAMES K. RINGELMAN[1,2] and JERRY R. LONGCORE[3]

[1]School of Forest Resources, University of Maine, Orono, Maine 04469
[2]Present address: Colorado Division of Wildlife, 317 W. Prospect Rd., Fort Collins, Colorado 80526
[3]Maine Field Station, Patuxent Wildlife Research Center, U. S. Fish and Wildlife Service, University of Maine, Orono, Maine 04469

Ringelman, James K., and Jerry R. Longcore. 1983. Survival of female Black Ducks, *Anas rubripes*, during the breeding season. Canadian Field-Naturalist 97(1): 62-65.

The Mayfield method was used to estimate the survival rate of 19 radio-marked, female Black Ducks (*Anas rubripes*) in southcentral Maine during 1977-80. An overall survival rate of 0.74 was estimated for the 121-day monitoring period that included the pre-laying and laying, incubation, brood rearing, and post-rearing stages. No differences in survival rates were detected among these stages. Two instrumented hens were killed by Red-shouldered Hawks (*Buteo lineatus*) and a third was killed by an unknown predator. We found no evidence that the attachment of radio transmitters affected hen survival.

Key Words: Black Duck (*Anas rubripes*), biotelemetry, Maine, mortality, survival rate

To understand changes in waterfowl populations it is important to know how annual mortality is partitioned between hunting and non-hunting causes, as well as among specific periods of the annual cycle (Anderson and Burnham 1976:42). It is particularly important to obtain such information for the Black Duck (*Anas rubripes*), a heavily-hunted species that has declined in numbers and for which seasonal mortality estimates are lacking. Because of low band recovery rates during non-hunting periods and the difficulty in detecting deaths of wild, unmarked waterfowl, recent studies (Gilmer et al. 1974; Kirby and Cowardin in press) have used radio-equipped ducks to estimate survival during the breeding and post-breeding period. In the present study, we use biotelemetry to estimate survival rates of adult female Black Ducks in southcentral Maine breeding habitat.

Study Area and Methods

The 151 km^2 study area was located 30 km southwest of Bangor, Maine. The area supported 28-32 Black Duck pairs/year on 112 wetlands typical of the evergreen and deciduous scrub-shrub, deciduous forested, and emergent wetland types (Cowardin et al. 1979) found in the Northeast. Detailed descriptions of the study area are presented by Ringelman (1980).

Nineteen female Black Ducks were captured during 1977-80 (five in April, 10 in May, two in June, and two in July) with nest traps (Coulter 1958) and rocket nets (Wildlife Materials, Carbondale, Illinois: use of trade names does not imply U.S. Government endorsement of products). Birds were fitted with adjustable (Dwyer 1972) back-mounted radio packages (Cedar Creek Bioelectronics Laboratory) weighing 20-25 g with an effective range of 1.5-3.0 km. Transmitter life ranged from 20 to 120 days ($\bar{x}$ = 63). Hens were located 3-4 times/day from mobile tracking vehicles by conventional telemetry techniques. Locations of marked females were plotted on U.S.G.S. topographic maps (1:64 000) to a resolution of 1.0 ha. If a bird remained in an area for >2 days and its radio signal indicated inactivity, we visited the site and determined whether the duck was dead or alive and healthy. Rustrack (model 288) recorders coupled to receivers (AVM Company model LA12) and 3-element yagi antennas allowed continuous monitoring of 16 females. Recorder stations detected attenuations in radio signals that indicated duck activity.

Visual observations of radio-equipped females were made once every three days, and individuals were occasionally flushed to reaffirm that transmitters were not inhibiting flight. Field necropsies of marked birds were conducted to determine cause of death and general condition.

Survival rates were calculated by a method originally developed for determining nesting success (Mayfield 1961, 1975) and recently applied in survival studies of ducklings (Ringelman and Longcore 1982) and adult ducks (Kirby and Cowardin *in press*). Known days of survival represented days of "exposure", and time of death was estimated as one-half the interval between the last date the bird was known to have been alive and the date that death was confirmed. The breeding season was partitioned into four stages: pre-laying and laying, incubation, brood-rearing, and post-rearing. Unsuccessful nesters were assigned to the post-rearing period following their final nesting attempt. Because hens were captured before or during incubation, birds were assigned to the brood-rearing or post-rearing stages based on behavioral data obtained by telemetry. Estimates of the duration of the prelaying-laying (16 days) and incubation (26 days) stages were used to back-date reproductive phenology and determine exposure for these early intervals. Comparisons of survival rates follow procedures described in Johnson (1979).

Results and Discussion

Three of 19 instrumented Black Ducks died during the monitoring period; one during pre-laying and laying, two during post-rearing and none during incubation and brood-rearing (Table 1). Differences in survival rates could not be detected among stages ($p > 0.10$); thus the overall survival rate for the 121-day season was estimated as 0.74 (the probability of surviving 1 day, 0.99748, times itself 121 times). All dead birds had been killed by predators. Two ducks (one pre-laying, one post-breeding) were killed by Red-shouldered Hawks (*Buteo lineatus*), and a third female just completing the wing-molt was killed by an unknown predator. Another unmarked, incubating hen (not included in our estimate of survival) was killed by a Raccoon (*Procyon lotor*). All predator-killed ducks were in good body condition when recovered, exhibiting no lesions or other debilitating physical effects attributable to the transmitter packages, and two of those birds whose esophagi were examined had been feeding immediately before death.

Although it has been suggested that predation accounts for a small portion of nonhunting mortality in waterfowl (Stout and Cornwell 1976), it may have a disproportionately large effect on population levels by affecting nesting success (Duebbert and Lokemoen 1980) and sex ratios (Johnson and Sargeant 1977). Reduced survival rates of breeding and molting females, when examined in a computer simulation model, showed a potentially significant effect on the Black Duck population (Ringelman and Longcore 1980). Common predators of adult Black Ducks include large raptors (Mendall 1944, Wright 1954; Appendix II), Red Foxes (*Vulpes fulva*; Wright 1954: Appendix II), and Raccoons (Stotts 1959;168, Stotts and Davis 1960). Although Mendall (1944) reported no waterfowl remains in 14 stomachs of Red-shouldered Hawks in Maine, this species obtains most of its prey from wetland habitats (Bednarz and Dinsmore 1981). Thus Red-shouldered Hawk predation on Black Ducks in our study is not implausible.

It is important to assess the effects of instrumentation on survival because the validity of survival rate estimates derived from radio-equipped ducks is contingent upon marked ducks experiencing the same mortality factors as the wild, unmarked population.

We flushed instrumented females on over 30 occasions, and none exhibited reduced flight ability. Some hens preened excessively around the transmitter during the week following instrumentation, but this behavior was not apparent after a one-week acclimation period. However, we could not determine whether the death of the hen during the pre-laying and laying period, which occurred during the first week of instrumentation, was related to behavioral changes associated with instrumentation. Three Black Ducks (1 male, 2 females) with radio packages still attached one year following instrumentation, were observed on the study area and all were paired with new mates and behaving normally. One of these females that we recaptured was of average weight and body condition, and showed no skin abrasion or feather wear beneath the harness or transmitter. Habitat preferences of marked and unmarked Black Ducks on our study area were similar (Ringelman 1980:22).

Caution must be used when interpreting published accounts of the effects of transmitter packages on duck behavior and survival (Schladweiler and Tester 1972; Greenwood and Sargeant 1973; Gilmer et al. 1974; Kirby and Cowardin *in press*), because harness configuration, transmitter size and weight, temperament of individual birds, and especially the care taken in installing the harness may influence behavior and survival. A review of previous studies, along with our data on instrumented Black Ducks, leads us to conclude that the capture, handling, and instrumentation of free-living *Anas* species does not cause biased survival estimates during the breeding and early post-breeding seasons.

TABLE 1. Survival rates of radio-marked, female Black Ducks during four stages of the breeding season.

Period	N	Period length (days)	Exposure (days)	Deaths	Period survival rate	95% Confidence interval
Pre-laying and laying	18	16	278.5	1	0.94	0.84–1.06
Incubation	15	26	299.0	0	1.00	
Brood-rearing	6	45[a]	175.0	0	1.00	
Post-rearing	13	34[b]	438.5	2	0.86	0.69–1.07
Totals		121	1191.0	3		

[a] Length equals the average number of days that two radio-marked hens remained with broods (43–48 days).
[b] Length equals the average number of days birds were monitored during this period.

The breeding season survival rate (0.74) for Black Ducks does not differ ($P > 0.50$) from survival estimates obtained from radio-marked female Mallards (0.73) breeding in northcentral Minnesota (Kirby and Cowardin *in press*). These most recent biotelemetry data suggest that breeding and post-breeding season survival rates are lower than had been previously assumed (e.g. Cowardin and Johnson 1979, Ringelman and Longcore 1980).

Population management of waterfowl is accomplished primarily through regulatory manipulation of the harvest. Yet, to recognize *when* and *how much* the harvest should be restricted or liberalized, managers should know the magnitude and timing of seasonal non-hunting mortality. For adult female Black Ducks in Maine the average annual survival rate is 0.51, slightly lower than the continental mean, 0.56 (W. Blandin, Office of Migratory Bird Management, personal communication). Except for our estimate of Black Duck survival for the breeding season, other seasonal survival rates (post-breeding and molt, wintering, and hunting periods) are unknown. If we assume, for purposes of illustration, that these rates approximate those of the closely related Mallard (*A. platyrhynchos*), then the product of the four seasonal survival rates would be breeding — Black Duck, 0.74 × post-breeding - Mallard, 0.947 (Kirby and Cowardin *in press*) × hunting — Mallards, 0.811 (Anderson 1975; Johnson and Sargeant 1977) × wintering — Mallard, 0.919 (Cowardin and Johnson 1979) = 0.520, a value close to the average annual survival rate for female Black Ducks in Maine. In actuality, Black Duck survival rates probably differ greatly from those of the Mallard at many times of the year. Only after additional research is conducted on season-specific survival can we hope to comprehend the dynamics of the Black Duck population.

Acknowledgments

This study was supported in part by contract #14-16-0008-2125 from the Migratory Bird and Habitat Research Laboratory, U.S. Fish and Wildlife Service, and the University of Maine at Orono, School of Forest Resources. J. Boring, J. Connolly, J. Schoultz, M. Scott, J. Sease, and S. Staples helped with field work. We thank D. Gilmer, R. Kirby, J. Nichols and W. Blandin for providing helpful comments on early drafts of the manuscript. Two anonymous referees provided helpful revisions and one referee detected a critical arithmetic mistake, for which we are appreciative.

Literature Cited

Anderson, D. R. 1975. Population ecology of the mallard. Temporal and geographic estimates of survival, recovery, and harvest rates. U.S. Fish and Wildlife Service Resource Publication 125. 110 pp.

Anderson, D. R., and **K. P. Burnham.** 1976. Population ecology of the Mallard. VI. The effect of exploitation on survival. U.S. Fish and Wildlife Service Resource Publication 128. 66 pp.

Bednarz, J. C., and **J. J. Dinsmore.** 1981. Status, habitat use, and management of Red-shouldered Hawks in Iowa. Journal of Wildlife Management 45: 236–241.

Coulter, M. W. 1958. A new waterfowl nest trap. Bird-banding 29: 236–241.

Cowardin, L. M., V. Carter, F. C. Golet, and **E. T. LaRoe.** 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior FWS/OBS-79/31. 103 pp.

Cowardin, L. M., and **D. H. Johnson.** 1979. Mathematics and Mallard management. Journal of Wildlife Management 43: 18–35.

Duebbert, H. F., and **J. T. Lokemoen.** 1980. High duck nesting success in a predator-reduced environment. Journal of Wildlife Management 44: 428–437.

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

Gilmer, D. S., I. J. Ball, L. M. Cowardin, and **J. H. Riechmann.** 1974. Effects of radio packages on wild ducks. Journal of Wildlife Management 38: 243–252.

Greenwood, R. J., and **A. B. Sargeant.** 1973. Influence of radio packs on captive Mallards and Blue-winged Teal. Journal of Wildlife Management 37: 3–9.

Johnson, D. H. 1979. Estimating nest success: the Mayfield method and an alternative. Auk 96: 651–661.

Johnson, D. H., and **A. B. Sargeant.** 1977. Impact of Red Fox predation on the sex ratio of prairie Mallards. U.S. Fish and Wildlife Service Wildlife Research Report 6. 56 pp.

Kirby, R. E., and **L. M. Cowardin.** *In press.* Seasonal survival of female Mallards from north-central Minnesota. U.S. Fish and Wildlife Service, Resource Publication.

Mayfield, H. 1961. Nesting success calculated from exposure. Wilson Bulletin 73: 255–261.

Mayfield, H. 1975. Suggestions for calculating nest success. Wilson Bulletin 87: 456–466.

Mendall, H. L. 1944. Food of hawks and owls in Maine. Journal of Wildlife Management 8: 198–208.

Ringelman, J. K. 1980. The breeding ecology of the Black Duck in south-central Maine. Ph.D. thesis. University of Maine, Orono. 89 pp.

Ringelman, J. K., and **J. R. Longcore.** 1980. Computer simulation models as tools for identifying research needs: a Black Duck population model. Proceedings of the Northeast Wildlife Conference 37: 182–193.

Ringelman, J. K., and **J. R. Longcore.** 1982. Survival of juvenile Black Ducks during brood rearing. Journal of Wildlife Management 46: 622–628.

Schladweiler, J. L., and **J. R. Tester.** 1972. Survival and behavior of hand-reared Mallards released in the wild. Journal of Wildlife Management 36: 1118–1127.

Stotts, V. D. 1959. A study of the breeding ecology of Black Ducks on the upper eastern shore of the Chesapeake Bay in Maryland from 1953 to 1959. Pittman-Robertson Report W-30-R-7. 231 pp.

Stotts, V. D., and D. E. Davis. 1960. The Black Duck in the Chesapeake Bay of Maryland: breeding behavior and biology. Chesapeake Science 1: 127–154.

Stout, I. J., and G. W. Cornwell. 1976. Nonhunting mortality of fledged North American waterfowl. Journal of Wildlife Management 40: 681–693.

Wright, B. S. 1954. High tide and an east wind. Stackpole Company, Harrisburg, Pennsylvania, and the Wildlife Management Institute, Washington, D.C. 162 pp.

Received 7 October 1981
Accepted 19 October 1982