J. Field Ornithol., 67(4):542–548

IMPROVED METHODS FOR AGING SECOND-YEAR AND AFTER-SECOND-YEAR MALE BROWN-HEADED COWBIRDS

CATHERINE P. ORTEGA, JOSEPH C. ORTEGA,
STACIA A. BACKENSTO, AND
CRISTIN A. RAPP

Department of Biology
Fort Lewis College
Durango, Colorado 81301 USA

Abstract.—During the summers of 1993–1995, we banded Brown-headed Cowbirds (*Molothrus ater*) in La Plata County, Colorado. Of 11 birds banded during their hatch year (HY) that returned the following year, 4 (36.4%) had totally black underwing coverts, suggesting a complete first prebasic molt in these individuals. Additionally, all 11 known second-year (SY) males showed some pattern of medium to dark brown in their primaries: they were browner at the tips, browner at the tips with the innermost 1–3 all brown, or all primaries were browner than the secondaries. Another 101 males that had retained light-gray juvenal feathers under the wing and could safely be assumed to be SY, all showed the same pattern of brown in the primaries. All 59 known after-second-year (ASY) males had black primaries that did not differ in darkness from the secondaries. We suggest that totally dark underwing coverts are not a reliable characteristic for distinguishing ASY from SY males as previous studies suggested, at least in this population. If the underwing coverts are light gray, the individual can safely be assumed to be SY (or first year if before the second summer). However, if the underwing coverts are totally dark, the presence of brown in the primaries may be used to distinguish SY males.

MEJORAMIENTO DE METODOS PARA ESTIMAR LA EDAD DE *MOLOTHRUS ATER* EN SEGUNDO AÑO Y AÑOS POSTERIORES

Sinopsis.—Anillamos Individuos de *Molothrus ater* en el Condado de La Plata, Colorado, durante los veranos de 1993 y 1995. De 11 aves anilladas en su año de nacimiento (HY) que retornaron al año siguiente, 4 (36.4%) tenian las cubiertas internas de las alas completamente negras, sugiriendo que ocurrió una muda postjuvenil completa en esos individuos. Además, todos los machos conocidos de segundo año (SY) mostraron algún patrón de marrón entre oscuro y semioscuro en las primarias: eran más marrones en las puntas, marrones en las puntas y las más internas 1–3 totalmente marrones, o todas las primarias eran marrones al compararlas con las secundarias. Otros 101 machos que habían retenido plumas juveniles gris claro bajo el ala y se puede asumir sean SY mostraron el mismo patrón de marrón en las primarias. Todos los 59 machos mayores de dos años (ASY) tenían primarias negras que no diferían en oscuridad de las secundarias. Sugerimos que el que las cubiertas internas del ala sean totalmente oscuras no es una manera confiable para discriminar machos ASY y SY como se sugiere en otros estudios, al menos en esta población. Se puede asumir con toda seguridad que el ave es SY (o de primer año antes del segundo verano) si las cubiertas internas son gris claro. Sin embargo, si las cubiertas internas son totalmente oscuras, la presencia de marrón en las primarias se puede usar para distinguir machos SY.

The North American Bird Banding Techniques Manual (U.S. Fish and Wildlife Service 1986) suggests that adult male Brown-headed Cowbirds (*Molothrus ater*, hereafter referred to as cowbirds) can be aged accurately according to the color of their underwing coverts (excluding the greater coverts that are always gray to gray-brown). If the underwing coverts are uniformly gray or mixed black and gray, the individual is in its hatch year (HY) or second year (SY). If the underwing coverts are uniformly black,

the individual is after its second year (ASY) or at least after its hatch year. This is based on the assumption that underwing coverts are not all replaced during first prebasic molt (Baird 1958). Baird (1958) presumed that first prebasic molt in males is arrested at some stage and, therefore, because the underwing coverts are among the last areas to molt, almost all SY males will exhibit some retention (25% to 100%) of juvenal feathers in the underwing coverts. Baird (1958) further reported that 71% of 532 immature (first winter) males he examined in Rhode Island had all or most of the juvenal feathers in the underwing coverts. Similarly, Selander and Giller (1960) observed that only 1 of 49 (2%) first-year males from a wintering population in Texas had completely replaced the juvenal plumage. However, they based the age of individuals on the assumption that all birds with completely ossified skulls were >1-yr-old even though they described one individual as having juvenal underwing coverts with fully ossified skull.

Contrarily, Dwight (1900) reported that the first basic plumage is acquired by a complete first prebasic molt, making younger males indistinguishable from ASY males. Apparently, cowbirds do not undergo a prealternate molt (Stone 1896). Therefore, individuals in their second summer (SY) will still have their first prebasic plumage and should be comparable to first-year birds after first prebasic molt.

The above studies are based upon presumed ages rather than known ages, and inaccuracies in aging methods can result in overestimation of ASY males in the population. In this paper, we report on plumage variation of known SY and ASY males as well as presumed SY and ASY males, and we suggest new methods of aging that can be used in addition to evaluating the color of the underwing coverts.

STUDY AREA AND METHODS

From early May through late July in 1993 and from early May through early August in 1994 and 1995, we captured cowbirds at the Colorado State University San Juan Basin Research Center, 8 km south of Hesperus, La Plata County, Colorado (37°14′N, 108°3′W). We used a 1.2 × 1.2 × 1.6-m decoy trap and four two-celled Potter traps to capture cowbirds. For all years, we banded cowbirds with United States Fish and Wildlife Service serially numbered bands. The one SY male that we banded as a HY in 1993 and that returned in 1994 had totally black underwing coverts and primaries that were brown at the tips. Therefore, in 1995, we quantified whether underwing coverts (excluding the greater coverts) of all adult males were mostly light gray (≥50% gray), partly light gray (<50% gray), or totally black (all feathers black). We also compared primaries with secondaries according to whether they were the same darkness, browner all over, browner at tips with 1–3 of the innermost primaries all brown, or browner only at tips. The brown described in the primaries was medium brown to dark brown and similar to the brown feathers on the head. Juvenal feathers have been variously described as gray, gray-brown, olive, olive-brown, and light brown. We appreciate these different descriptions

TABLE 1. Color of underwing coverts and primaries (compared with secondaries) of known SY, known ASY, presumed SY, and presumed ASY male Brown-headed Cowbird in La Plata County, Colorado, 1994–1995.

Number of individuals	Underwing coverts	Color of primaries relative to secondaries
Known SY		
2	mostly light gray (≥50%)	browner all over
1	mostly light gray (≥50%)	browner at tips only
1	mostly light gray (≥50%)	browner at tips with 1 innermost all brown
1	some light gray (1 feather)	browner at tips only
1	some light gray (2 feathers)	browner at tips only
1	some light gray (3 feathers)	browner at tips only
1	totally black	browner all over
3	totally black	browner at tips only
Known ASY		
59	totally black	totally black
Presumed SY[a]		
21	mostly light gray (≥50%)	browner all over
18	mostly light gray (≥50%)	browner at tips only
4	mostly light gray (≥50%)	browner at tips with 1–3 innermost all brown
30	some light gray	browner all over
21	some light gray	browner at tips only
7	some light gray	browner at tips with 1–3 innermost all brown
16	totally black	browner all over
29	totally black	browner at tips only
6	totally black	browner at tips with 1–3 innermost all brown
Presumed ASY[b]		
43	totally black	same

[a] Presumed SY if underwing coverts were light gray or if primaries were brown.
[b] Presumed ASY if underwing coverts were totally black and primaries were as black as secondaries.

because we have observed variation in our population. However, for simplicity and to distinguish clearly from discussion of brown in the primaries, we refer to all juvenal feathers in the underwing coverts as light gray.

Assessing color variations is somewhat subjective and may vary among individuals. To minimize differences among individuals, during the first two weeks of the 1995 season, we discussed each individual bird among us until we were confident that we all quantified plumage similarly. All known SY males were inspected by CPO, and CPO regularly confirmed color assessments of recaptured birds.

RESULTS

All known ASY males (banded as adults in previous years) had totally dark underwing coverts and primaries that were equally dark as the secondaries (Table 1). We captured one known SY male in 1994 and ten known SY males in 1995. The amount of light gray in the underwing coverts and patterns of brown in the primaries of known SY males varied

widely, from mostly gray to all dark in the underwing coverts and from all brown primaries to brown only at the tips. Of 11 known SY males, four (36.4%) showed no retention of light gray juvenal feathers under the wing, and another three (27.3%) retained three or less juvenal feathers under the wing (Table 1). However, the primaries of all known SY males were either browner all over or browner at the tips than the secondaries (Table 1). Of 101 presumed SY males (not captured in the previous year) that retained some light gray feathers in the underwing coverts, all had browner primaries (either all over or at the tips), and 14 had ≤3 retained juvenal feathers under the wing. Considering all males, not captured in previous years, that had some amount of brown in the primaries, 51 (33.6%) had dark underwing coverts. This is similar to the proportion of dark-underwinged males known to be SY ($P > 0.75$, $\chi^2_c = 0.02$, Chi square goodness of fit with Yates correction; Zar 1984).

DISCUSSION

Totally dark underwing coverts are common among SY males in our population and are not reliable as a character to distinguish SY from ASY males. All known SY males and all presumed SY males with retained juvenal feathers in the underwing coverts had some pattern of brown in the primaries compared with the secondaries, and no known ASY males had brown primaries (they were all black). Therefore, we suggest that color of the primaries be evaluated in conjunction with the color of underwing coverts for all males with dark underwing coverts.

Our results differed markedly from those of Selander and Giller (1960) and Baird (1958), who reported that almost all males retained some, if not all, juvenal underwing coverts after their first prebasic molt. Selander and Giller (1960) also observed that older males tended to be darker and more glossy than first-year males, but they failed to find consistency in this character and did not report it other than in a qualifying statement. We attribute differences in our results with the other studies to three possibilities. (1) Selander and Giller (1960) based their study on specimens collected in November, and Baird (1958) based his study on birds examined during the winter and spring. It is possible that some of the birds they examined had not completed prebasic molt yet and that a proportion of these could have had totally dark underwing coverts by the following summer. (2) Baird (1958) conducted his study on *M. a. ater* in Rhode Island, and Selander and Giller (1960) based their study on a Texas population intermediate between *M. a. ater* and *M. a. obscurus*. Our population is in an area of apparent overlap among *M. a. ater*, *M. a. obscurus*, and *M. a. artemisiae* (unpubl. data). Differences in the amount of black feathers in the underwing coverts and brown in the primaries could be due to geographical variation. (3) Differences may be due to lack of known young individuals in the previous studies. Baird (1958) stated that "an important standard of reference of known adults was provided by the returning of males banded in previous years," but he did not elaborate on this or report separately on the returning males.

Why some males exhibit complete molt while others do not is not clear and warrants further investigation. Hormones, particularly luteinizing hormones, appear to be responsible for feather pigmentation in some birds (Payne 1972 and reference therein), and it would be worthwhile to track hormonal levels as molt progresses. It would also be of interest to determine if SY males with dark underwing coverts have greater mating success and are more dominant than SY males with light gray underwing coverts. Part of the male courtship includes a song spread (Darley 1978, 1982) in which the underwing coverts are exposed to the female. This same posture is assumed toward other males and together with song (Dufty 1986) may be important in establishment of dominance hierarchies. Experimental manipulation of the color of underwing coverts in SY and ASY males could reveal whether this character plays a role in establishing and maintaining dominance hierarchies and mating success.

Many studies over the last three decades have been based on the aging method of Selander and Giller (1960). If a similar proportion of SY males (36.4%) in these other studies replaced all juvenal feathers in their underwing coverts and were misidentified, our understanding of cowbirds may be inaccurate. If SY males are included in an ASY sample, SY to ASY ratios are underestimated (Darley 1971, Dufty 1982, Goddard 1971), mortality estimates among SY and ASY males may be affected (Darley 1971, Johnson et al. 1980), and, in general, mensural data may be underestimated for ASY males (Dufour and Weatherhead 1991, Dufty and Wingfield 1986). It is less clear how misidentification of SY males in some studies would affect our understanding of other aspects of cowbirds, such as how perched song (Johnsrude et al. 1994, O'Loghlen and Rothstein 1993) and flight whistles (O'Loghlen and Rothstein 1995, Rothstein and Fleischer 1987) are learned. Incorrect identification of SY males may also confound our understanding of differences between SY and ASY males in mating success (Ankney and Scott 1982, Darley 1978), dominance (Rothstein et al. 1986, Teather and Weatherhead 1995, Weatherhead and Teather 1987, Yokel 1989), movement patterns (Rothstein et al. 1984), propensity to enter traps (Dufour and Weatherhead 1991, Rothstein et al. 1987), prevalence of internal parasites (Weatherhead and Bennett 1992), and patterns of circulating hormones (Dufty and Wingfield 1986).

It is possible that both the proportion of SY males replacing all juvenal wing coverts and the pattern of SY plumage varies geographically; therefore, we encourage repeated studies in other localities. In our population the following aging method is applicable. If the underwing coverts have retained light gray feathers, the individual can be classified as a SY. However, if the underwing coverts are totally dark, this does not imply that the individual is ASY, and the color of the primaries should be evaluated. If they are browner all over compared to the secondaries, or if the primaries are browner at the tips, we suggest it is probably a SY. If both the underwing coverts and primaries are totally black, then the individual is ASY.

ACKNOWLEDGMENTS

We thank David Schafer and Al Denham for access to the Colorado State University San Juan Basin Research Center. This research was funded by a Howard Hughes Medical Institute Grant to the Departments of Chemistry and Biology, Fort Lewis College, and by a Ford Foundation Fellowship (administered by the National Research Council) to J. C. Ortega. We also appreciate additional field assistance from Dawn Sekayumptewa in 1992, Thomas Kreykes in 1992–1993, Susan Allerton and Shawchyi Deng in 1993, and Donald W. Palmer in 1994.

LITERATURE CITED

ANKNEY, C. D., AND D. M. SCOTT. 1982. On the mating system of Brown-headed Cowbirds. Wilson Bull. 94:260–268.

BAIRD, J. 1958. The postjuvenal molt of the male Brown-headed Cowbird (*Molothrus ater*). Bird Banding 29:224–228.

DARLEY, J. A. 1971. Sex ratio and mortality in the Brown-headed Cowbird. Auk 88:560–566.

———. 1978. Pairing in captive brown-headed cowbirds (*Molothrus ater*). Can. J. Zool. 11: 2249–2252.

———. 1982. Territoriality and mating behavior of the male Brown-headed Cowbird. Condor 84:15–21.

DUFOUR, K. W., AND P. J. WEATHERHEAD. 1991. A test of the condition-bias hypothesis using brown-headed cowbirds trapped during the breeding season. Can. J. Zool. 69:2686–2692.

DUFTY, A. M., JR. 1982. Movements and activities of radio-tracked Brown-headed Cowbirds. Auk 99:316–327.

———. 1986. Singing and the establishment and maintenance of dominance hierarchies in captive brown-headed cowbirds. Behav. Ecol. Sociobiol. 19:49–55.

———, AND J. C. WINGFIELD. 1986. Temporal patterns of circulating LH and steroid hormones in a brood parasite, the brown-headed cowbird, *Molothrus ater*. I. Males. J. Zool. (Lond.) 208:191–203.

DWIGHT, J., JR. 1900. The sequence of plumages and moults of the passerine birds of New York, Ann. New York Acad. Sci. 13:73–360.

GODDARD, S. V. 1971. Size, migration pattern, and structure of fall and early winter blackbird and starling populations in western Oklahoma. Wilson Bull. 83:371–382.

JOHNSON, D. M., G. L. STEWART, M. CORLEY, R. GHRIST, J. HAGNER, A. KETTERER, B. MCDONNELL, W. NEWSOM, E. OWEN, AND P. SAMUELS. 1980. Brown-headed Cowbird (*Molothrus ater*) mortality in an urban winter roost. Auk 97:299–320.

JOHNSRUDE, I. S., D. M. WEARY, L. M. RATCLIFFE, AND R. G. WEISMAN. 1994. Effect of motivational context on conspecific song discrimination by brown-headed cowbirds (*Molothrus ater*). J. Comp. Psychol. 108:172–178.

O'LOGHLEN, A. L., AND S. I. ROTHSTEIN. 1993. An extreme example of delayed vocal development: Song learning in a population of wild brown-headed cowbirds. Anim. Behav. 46:293–304.

———. 1995. Culturally correct song dialects are correlated with male age and female song preferences in wild populations of brown-headed cowbirds. Behav. Ecol. Sociobiol. 36: 251–259.

PAYNE, R. B. 1972. Mechanisms and control of molt. Pp. 103–155, *in* D. S. Farner, J. R. King, and K. C. Parkes, eds. Avian biology, Vol. 2. Academic Press, New York, New York.

ROTHSTEIN, S. I., AND R. C. FLEISCHER. 1987. Brown-headed Cowbirds learn flight whistles after the juvenile period. Auk 104:512–516.

———, J. VERNER, AND E. STEVENS. 1984. Radio-tracking confirms a unique diurnal pattern of spatial occurrence in the parasitic Brown-headed Cowbird. Ecology 65:77–88.

———, ———, ———, AND L. V. RITTER. 1987. Behavioral differences among sex and age classes of the Brown-headed Cowbird and their relation to the efficacy of a control program. Wilson Bull. 99:322–337.

———, D. A. YOKEL, AND R. C. FLEISCHER. 1986. Social dominance, mating and spacing systems, female fecundity, and vocal dialects in captive and free-ranging Brown-headed Cowbirds. Curr. Ornithol. 3:127–185.

SELANDER, R. K., AND D. R. GILLER. 1960. First-year plumages of the Brown-headed Cowbird and Red-winged Blackbird. Condor 62:202–214.

STONE, W. 1896. The molting of birds with special reference to the plumages of the small land birds of eastern N. Amer. Proc. Philadelphia Acad. Nat. Sci. XLVIII.

TEATHER, K. L., AND P. J. WEATHERHEAD. 1995. The influence of age and access to females on dominance in captive male brown-headed cowbirds (*Molothrus ater*). Can. J. Zool. 73:1012–1018.

U.S. FISH AND WILDLIFE SERVICE. 1986. North American Bird Banding Techniques. Part 6. U.S. Fish and Wildlife Service, Department of Interior, Washington, D.C.

WEATHERHEAD, P. J., AND G. F. BENNETT. 1992. Ecology of parasitism of brown-headed cowbirds by Haematozoa. Can. J. Zool. 70:1–7.

———, AND K. L. TEATHER. 1987. The paradox of age-related dominance in brown-headed cowbirds (*Molothrus ater*). Can. J. Zool. 65:2354–2357.

YOKEL, D. A. 1989. Payoff asymmetries in contests among male Brown-headed Cowbirds. Behav. Ecol. Sociobiol. 24:209–216.

ZAR, J. H. 1984. Biostatistical analysis, 2nd ed. Prentice Hall, Inc., Englewood Cliffs, New Jersey. 718 pp.

Received 10 Oct. 1995; accepted 5 Dec. 1995.