

LEAST BELL'S VIREO MANAGEMENT BY COWBIRD TRAPPING

JOHN A. BEEZLEY, 6768 Solita Ave., San Diego, California 92115

JOHN P. RIEGER, Caltrans, 2829 Juan St., San Diego, California 92110

To promote the survival of the Least Bell's Vireo (*Vireo bellii pusillus*), the California Department of Transportation (Caltrans) began a program of trapping Brown-headed Cowbirds (*Molothrus ater*) on the Sweetwater River of San Diego County in 1986. The trapping was part of the mitigation required for a U.S. Army Corps of Engineers 404 permit to compensate for removal of 1 acre of vireo habitat for construction of a bridge. The U.S. Fish and Wildlife Service (USFWS) provided details of the trapping scheme through an inter-agency cooperation agreement.

This paper addresses the present USFWS management method for reducing brood parasitism of vireos through trapping of cowbirds. Such trapping should manage both the Least Bell's Vireo and Brown-headed Cowbird effectively, but we contend that the present program does not fully address the behavior or ecology of the latter species.

METHODS

In 1986, Caltrans placed 20 cowbird traps along a 3-mile stretch of the Sweetwater River, in accordance with USFWS conditions of the 404 permit; 15 traps were in the riparian/nesting area and 5 traps were in an adjacent horse stable where cowbirds feed. As in other trapping programs in southern California (B. Jones, unpubl. data), modified Australian crow traps with dimensions 6' x 6' x 8' were baited with one live male cowbird, wild birdseed, and water. Traps were in operation by 15 March and were attended once daily through 31 July, for a total of 108 days. Trapped female cowbirds were killed and kept for analysis. Trapped males were used to replace escaped decoy birds.

We divided the 108 days into two-week intervals and compared trap results from the riparian area to those from the vicinity of the horse stables. We excluded from comparison traps that were vandalized frequently or were not baited for at least 67% of the time.

Differences in the decline of numbers of males versus females trapped were compared by a *t* test of the regression lines (Zar 1983). A chi-square test for goodness of fit was used to compare the sex ratio of birds from San Diego County to ratios reported by others. A two-way *G* test of independence (Sokal and Rohlf 1981) was used to determine whether the sex ratio of birds trapped would be influenced by the location of the trap. A Mann-Whitney *U* test was used to compare total birds trapped per day in the riparian and horse-stable traps because these data were not normally distributed.

We investigated the relationship between cowbird breeding activity and trapping success by comparing the timing of ovarian development to the timing of trap yields. Exact correlation of these two activities is not possible since

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trapping data are from the Sweetwater River in 1986 while ovary data are from Camp Pendleton in 1983 and 1984.

Seventy-six female cowbirds trapped in 1983 and 71 females trapped in 1984 at Camp Pendleton were donated to the San Diego Natural History Museum (SDNHM). The donated birds from 1984 represent an unspecified subsample of the total birds trapped during that year. The museum's staff measured the maximum length and width of each bird's ovary, noted whether the follicles were developing or burst, and checked for the presence of an egg in the oviduct.

RESULTS

The number of cowbirds trapped per two-week period is plotted in Figure 1. Cowbirds were first trapped on 27 March, and the numbers trapped peaked by 14 April; few were seen in the project area after the end of June. The decline in the trap rate of the female birds appeared to be greater than that of the males (Figure 1), but slopes of the regression lines (regression coefficients -0.380 for males and 0.016 for females) do not differ significantly ($t_{crit} = 2.306 > 0.080$, $p > 0.05$).

The sex ratio of Brown-headed Cowbirds trapped in this study (Figure 1) does not appear to be representative of other wild populations. The plumage of 4316 first-year birds in west-central Kansas indicated a sex ratio of 1:1 (Hill 1976). Darley (1971) observed a ratio of 1.5 adult males to 1.0 adult females in western Ontario. Rothstein et al. (1986) reported the same ratio for parts of the U.S. In contrast, along the Sweetwater River 163 males and 46 females

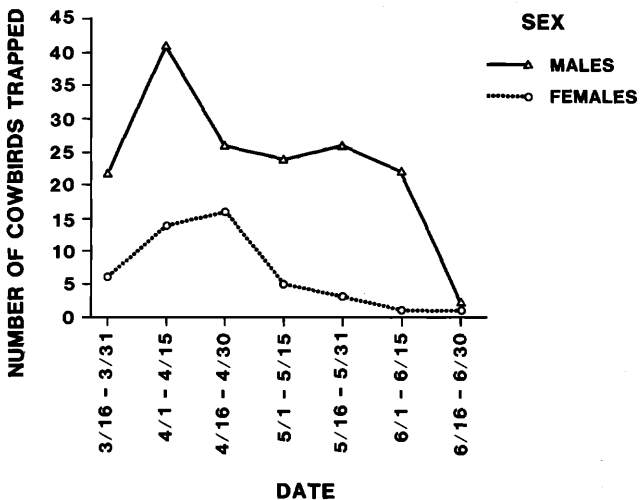


Figure 1. Total number of cowbirds trapped on the Sweetwater River, San Diego Co., 1986.

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were trapped, a ratio of 3.5 to 1.0. This ratio of males to females deviates significantly from the 1.5:1.0 ratio ($\chi^2 = 28.2$, $p < 0.001$). The sex ratio of all the 562 cowbirds trapped in San Diego County 1984-1986, 2.3:1.0, also differs significantly from the 1.5:1.0 ratio ($\chi^2 = 20.7$, $p < 0.001$) (Table 1).

A two-way G test of independence indicates that the sex of the cowbirds trapped was independent of the type of area in which the trapping was done ($\chi^2 = 3.00 < 3.841$, $p > 0.05$). Along the Sweetwater River more males than females were trapped per trap day both in riparian woodland and around stables (Table 2). Significantly more birds per trap day were trapped in the foraging area than in the riparian area ($U = 60.5 > 57$, $p < 0.05$).

In this study trapping yield of female Brown-headed Cowbirds was highest in April. The cowbirds donated to the San Diego Natural History Museum from Camp Pendleton in 1983 and 1984 showed a similar trend, but the subsample that was donated may not be representative of the trapped population.

A plot of ovary size versus time indicates that ovary recrudescence begins by April (Figure 2). The first burst follicles appear in late April, indicating that egg laying has begun by that time. The decline in numbers of cowbirds trapped appears to coincide with the onset of breeding.

DISCUSSION

Lower-than-expected numbers of females trapped in both areas suggest trap bias—the probability of trapping a female being lower than the fraction of females in the population—or that the local populations have a larger percentage of males than those reported by Darley (1971) and others. Roth-

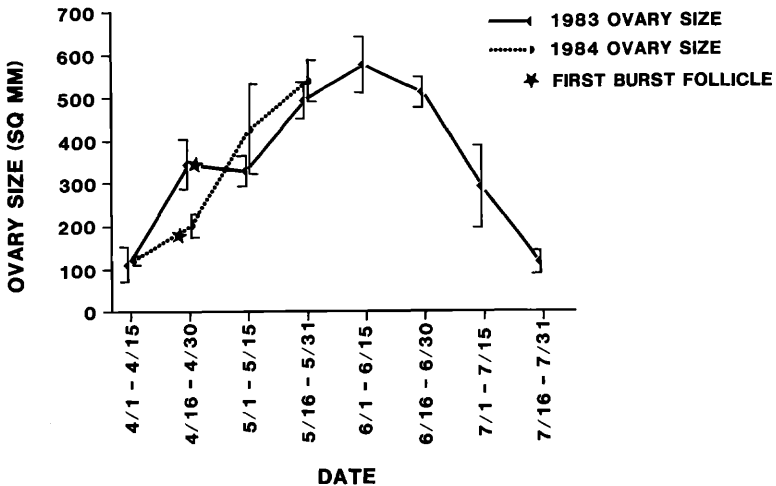


Figure 2. Cowbird ovarian development at Camp Pendleton, San Diego Co., 1983 and 1984. Error bars represent the standard error of the mean.

Table 1 Ratios of Male to Female Brown-headed Cowbirds Trapped in San Diego County.

Year	Trapping area	Total cowbirds	Males	Females	Ratio M:F	Source
1986	Sweetwater River	209	163	46	3.5:1	This study
1984	San Diego River	49	33	16	2.1:1	B. Jones, unpubl.
1985	San Diego River	151	93	58	1.6:1	B. Jones, unpubl.
1985	Sweetwater River	87	57	30	1.9:1	B. Jones, unpubl.
1985	San Luis Rey River	66	44	22	2.0:1	B. Jones, unpubl.

Table 2 Cowbirds Trapped in Riparian and Foraging areas, Sweetwater River, San Diego County, 1986

Trap Location	Total trap days	Total males trapped	Total females trapped	Females per trap day	Males per trap day	Total cowbirds per trap day
Riparian	973	50	24	0.025	0.051	0.076
Foraging	321	113	22	0.069	0.352	0.421
Total	1294	163	46			

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stein et al. (1980) reported higher ratios of males to females (3:1 to 6:1) in the Sierra Nevada. Sex ratios in San Diego County cowbird populations have not been determined so bias cannot be demonstrated conclusively. Traps that rely on decoys, however, have been shown to catch a biased ratio of icterines in Quebec (Weatherhead and Greenwood 1981).

The sex of trapped cowbirds has important implications for the effectiveness of trapping as a management tool. Females are the brood parasites, so their removal would reduce the rate of parasitism more than the removal of males. A reduction in numbers of males is essentially unimportant as long as sufficient numbers remain to fertilize the available females. Cowbirds in central California appear to have a monogamous mating system with the dominant males guarding their mates from other males (Rothstein et al. 1986), but this system does not preclude a female's remating in the event of the loss of her mate.

Bias may be related to cowbird behavior in the breeding range, or it may be inherent in the trapping scheme.

Cowbirds typically maintain two ranges. The roosting area is separate from the foraging area, requiring that the birds commute daily. Cowbirds roost in riparian habitats during the night and females parasitize nests in the morning. During the afternoon the birds forage in communal groups. Rothstein et al. (1984) reported commuting distances of up to 7 km during the breeding season in the Sierra Nevada of California.

Radiotelemetry of cowbirds showed that males returned to riparian areas much less consistently than did the females. Only four of the eight males equipped with radio transmitters by Rothstein et al. (1984) returned to the egg-laying sites in the evening, whereas all five of the marked females returned every evening. Because of this behavior, female cowbirds might be expected to be more abundant than males in riparian traps. However, while laying eggs, females forage very little; Rothstein et al. (1980) rarely observed cowbirds on the ground in the breeding sites. Mate guarding by the males may keep the dominant males away from the traps in the areas where their mates are laying eggs. If this is so, subordinate males are more likely to forage in the morning in either breeding or foraging areas than the females or the dominant males.

If in southern California cowbirds behave as they do in the Sierra Nevada, trapping in the riparian areas would be less effective at removing females than trapping in the foraging area. In this study the lower numbers of females per trap day in both areas suggests trap bias.

The breeding season may not be the optimal time for trapping, especially if trapping is conducted in the riparian (breeding) areas. The ovaries of the female cowbirds dissected at the San Diego Natural History Museum were only beginning to recrudescence at the time of year when the Sweetwater River traps were most successful. Following the onset of egg laying, indicated by the first appearance of burst follicles, the numbers of both sexes trapped declined. The population may have decreased as a result of the trapping effort; alternatively, the cowbirds may be less attracted to the traps while they are concentrating on egg laying. If the latter hypothesis is true, deployment of traps prior to the breeding season would be more effective in reducing numbers of cowbirds.

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Cowbirds show marked regional variation in mating, territorial, and host-selection behavior (P. Mason, pers. comm.). Without some knowledge of their local habits, designing a program for management would be difficult.

In areas where cowbird trapping has been pursued, the cowbirds' foraging areas and commuting patterns remain unknown. More information on sexual differences in cowbird behavior could help improve the efficiency of a management program, but no studies of cowbird biology have been conducted in southern California.

CONCLUSIONS AND MANAGEMENT RECOMMENDATIONS

Along the Sweetwater River, trapping in the foraging area yielded more cowbirds of both sexes per trap day than did trapping in the riparian area. The highest trapping success was in April just after the cowbirds arrived and before they began intensive breeding.

The apparent sex bias in the trapping results may be the consequence of the trap design. A trap baited with a single male bird may be insufficient to attract females. Providing a lek-like situation of several males might give females more incentive to enter the trap. Conversely, females forage together before the breeding season (personal observation). If traps are deployed at that time female decoys might be more effective than males in attracting other females. We recommend that

1. Brown-headed Cowbird population size, site fidelity, and host selection be studied in an area where a trapping scheme is proposed before the trapping is begun.
2. Cowbirds be trapped in areas and at times when the probability of reducing numbers of females is greatest; traps should be placed in foraging areas and should be operating well in advance of the breeding season.
3. Alternative cowbird trapping or removal methods be tested. A Potter trap may bias trapping in favor of females (Darley 1971).

ACKNOWLEDGMENTS

We thank Gerald Collier and his staff at San Diego State University for providing trap data and Amadeo Rea and Stephen Gustafson of the San Diego Natural History Museum for providing the ovarian measurements. Stephen Rothstein and Paul Mason of the University of California, Santa Barbara, provided invaluable insights. Collier, Paul Fromer, Barbara Kus, Abby White, John Griffith, and especially Ted Beedy reviewed the manuscript and provided useful suggestions. Funding for the Sweetwater River trapping was provided by the California Department of Transportation.

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Brown-headed Cowbird

Sketch by Brian Evans

Use of skin for drawing courtesy of Museum of Southwestern Biology (Albuquerque, New Mexico)