

# Monitoring of Brown-headed Cowbird Impact on Nesting Neotropical Migrant Birds in Grand Canyon National Park

1995 Progress Report

GLEN CANYON ENVIRONMENTAL  
STUDIES OFFICE

OCT 13 1995

RECEIVED  
FLAGSTAFF, AZ



GCES OFFICE COPY  
DO NOT REMOVE!

Prepared by

Charles Drost and Mark Sogge

National Biological Service, Colorado Plateau Research Station  
Northern Arizona University, Flagstaff, Arizona

Prepared for  
*Expedition into the Parks*

A Joint Effort by

The National Park Foundation  
and  
Canon U.S.A. Corporation

Canon



The Clean  
Earth Campaign



\$65.00  
ENV-4.00  
C719  
23633

TERΦ1Φ4-cbrpt95

P15

## **EXPEDITION INTO THE PARKS:**

### **MONITORING OF BROWN-HEADED COWBIRD IMPACT ON NESTING NEOTROPICAL MIGRANT BIRDS IN GRAND CANYON NATIONAL PARK**

#### **Introduction**

In the arid Southwest, riparian habitats border streams and rivers that wind through a relatively dry landscape. These riparian areas provide wetter, cooler, and more sheltered environments than surrounding habitats, and often support as many as 70-80% of the breeding bird species in a given region (Johnson and Haight 1984, Johnson et al. 1987). Many birds, including a number of neotropical migrant species, are also riparian obligates and will breed in no other type of habitat (Best and Stauffer 1980, Gaines 1974, Rosenberg et al. 1991). Unfortunately, riparian ecosystems have been dramatically altered by water development and flood control, including large-scale loss of historic riparian areas (Johnson et al. 1987, State of Arizona 1990, Rolle and Hagenbuck 1995). Currently, riparian areas cover less than 5% of the land acreage in the west (Wilén 1995).

Prior to the construction of Glen Canyon Dam (which formed Lake Powell), the Colorado River flowing through the Grand Canyon supported very little in the way of riparian vegetation. The dynamic nature of the river's flows, including regular high-volume flood events, inhibited the development of riparian habitat. Construction and operation of the dam resulted in much more controlled and reduced river flow regimes, and significant amounts of wetland and riparian habitat became established along the river shore (Carothers and Brown 1991). In most areas, the newly developed riparian zone (Figure 1) is dominated by dense stands of salt-cedar (*Tamarix chinensis*), an introduced exotic plant. Still, the riparian zone supports a relatively large and diverse breeding bird community, and also functions as a migratory route for birds moving to and from other regions.

**Figure 1.** An example of the new riparian zone habitat found along the Colorado River in Grand Canyon National Park.



Brown-headed Cowbirds are nest parasites of other birds, laying their eggs in the nest of a "host" species (Figure 2) and then leaving the host to care for the cowbird young. Because the young cowbird is large and grows quickly (Figure 3), it may monopolize the food brought by the host parents, to the detriment of the host's own young. Prior to the 1800's, Brown-headed Cowbirds were limited in range to the open grasslands of central North America, where they were associated with the great bison herds that once roamed the plains. With human settlement of the continent, cowbirds have become much more widespread throughout the United States and southern Canada (Lowther 1993). They appear to have had adverse effects on native bird species in some of the areas that they have recently invaded, particularly in riparian habitats. Because breeding bird populations in riparian areas are concentrated in a small area at high densities, cowbird nest parasitism can affect a major part of the breeding bird community in the area. In fact, declines in many neotropical migrant bird populations over the past 50 years have been linked to cowbirds (Laymon 1987), and cowbirds are now considered one of the major threats to neotropical migrants on the breeding grounds (Robinson et al. 1993). Gaines (1974) demonstrated that virtually all of the riparian songbird species that have declined in the Sacramento Valley of California during this century are heavily parasitized by cowbirds.

**Figure 2.** Nest containing two host eggs (bottom) and one cowbird egg (top). Note that the cowbird egg is larger than those of the host.



**Figure 3.** A nestling brown-headed cowbird (top) and willow flycatcher (bottom). Both chicks are 8 days old, but the cowbird chick is much larger.



The spread of Brown-headed Cowbirds in North America, and their increased numbers in many areas, is clearly of serious concern for many wild bird species. However, in many areas (particularly National Parks) there has been little survey and monitoring effort to assess the problem and determine the best actions for managing it. This study was undertaken by the Colorado Plateau Research Station in cooperation with Grand Canyon National Park. Funding and support were provided by the National Park Foundation and Canon U.S.A. Corporation, through their *Expedition into the Parks* program. There were three main objectives of this work: 1) to assess the present distribution and numbers of Brown-headed Cowbirds in Grand Canyon National Park, and their population trend; 2) to evaluate the level of cowbird nest parasitism on nesting riparian bird species in the Park; and 3) to track the movement of cowbirds that concentrate at horse corrals and other artificial food sources, and determine whether these cowbirds are moving out to riparian areas to parasitize the birds nesting there. The first two objectives have been accomplished, and are reported and discussed below. Because the study was started relatively late in the 1995 season, fieldwork could not be conducted on the third objective. Preparations have been made for that part of the study, and fieldwork will be carried out in spring and summer of 1996.

This report follows the "question and answer" format developed by the National Park Foundation. Questions and comments can be directed to either one of the authors at 520/556-7311.

---

1. What was found during the inventory phase.

We reviewed historical occurrence of Brown-headed Cowbirds in Arizona from published literature and unpublished reports. Regional accounts prior to the 1920's noted cowbirds as being restricted to areas of southern Arizona; they were not reported from northern Arizona (Merriam 1890, Swarth 1914). By 1930, there had been several sightings of Brown-headed Cowbirds on the north rim of Grand Canyon, and a single observation on the south rim (McKee 1930). In an annotated checklist of the birds of Grand Canyon National Park compiled in 1937, R. K. Grater (1937) described the Brown-headed Cowbird as a "rare transient visitant" to both the North and the South Rims of the Canyon. In the late 1930's, cowbirds were first reported from areas along the

**Figure 4.** A Southwestern Willow Flycatcher, an endangered riparian bird that is seriously impacted by cowbird nest parasitism in the Grand Canyon.

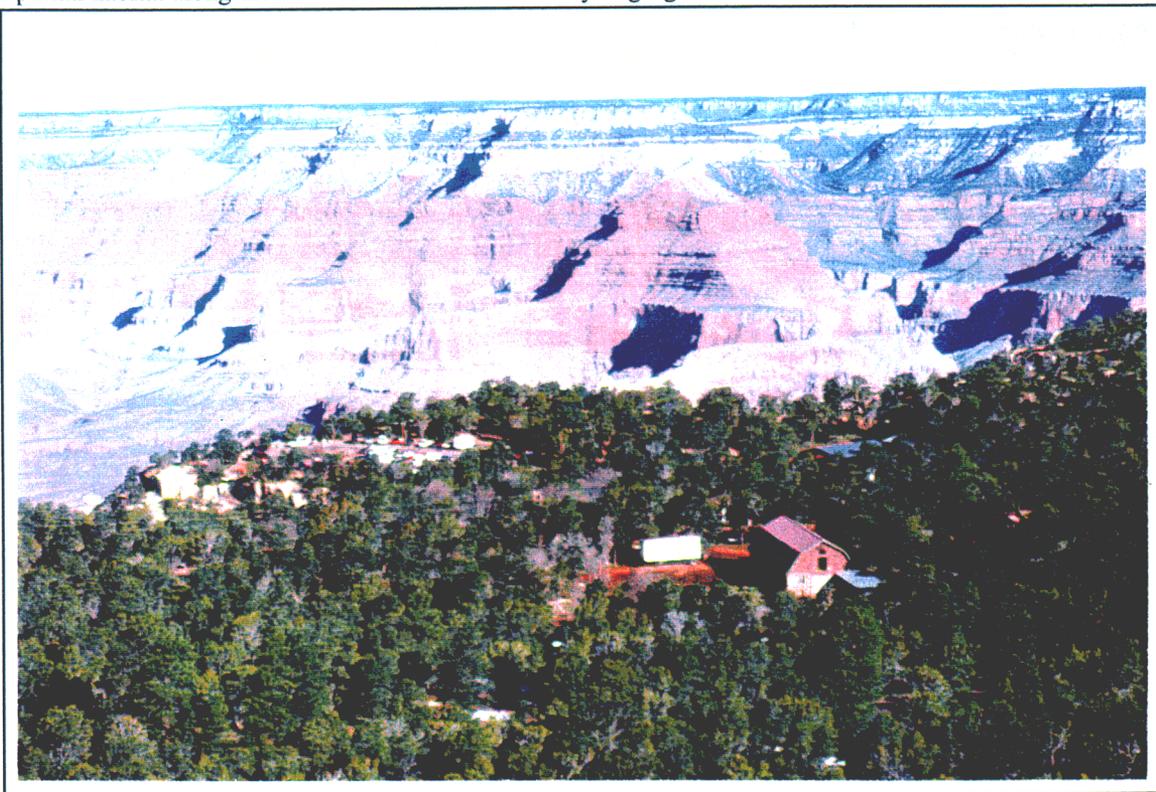


Colorado River in northern Arizona. These reports included the first note on riparian birds in this area suffering cowbird nest parasitism; a Willow Flycatcher nest containing a cowbird egg was found at Lee's Ferry in August 1938 (Woodbury 1945). By the 1980's, Brown-headed Cowbirds had become common summer residents on both the north and south rims, and "fairly common" summer residents along the river, with flocks of up to 100 birds seen at some of the horse corrals (Brown et al. 1987). Cowbird nest parasitism has been documented in a wide variety of riparian nesting birds (Brown 1994, Johnson and Sogge 1995), and is severely affecting the breeding population of the endangered Southwestern willow flycatcher (Figure 4: Sogge and Tibbitts 1994, Sogge 1995).

The recent occurrence of Brown-headed Cowbirds in northern Arizona and the Grand Canyon region is apparently linked to human modifications of the habitat. Specifically, humans have provided food and water sources for cowbirds that were not present previously, including feedlots and corrals, and artificial ponds for livestock. Some of the first occurrences of cowbirds in the vicinity of the Grand Canyon were at corrals near Kayenta (1934) and Marsh Pass (1936; Woodbury and Russell 1945).

During this study, we surveyed for cowbirds along the Colorado River in Grand Canyon, and along the south rim of the canyon. Most of the cowbirds that we recorded along the rim were also at corrals (Figure 5); these included flocks of up to 18 birds. The remainder of the cowbirds that we observed along the rim were associated with other manmade features and changes to the habitat, including parking lots, bird feeders, and livestock ponds.

**Figure 5.** The horse and mule corral at Yaki Point, along the south rim of Grand Canyon National Park. This is one of several corrals where cowbirds were found to congregate for feeding. Most of the corrals at the south rim are located very close to the canyon rim, and are within easy cowbird flight distance from riparian habitat along the river corridor within the canyon gorge.



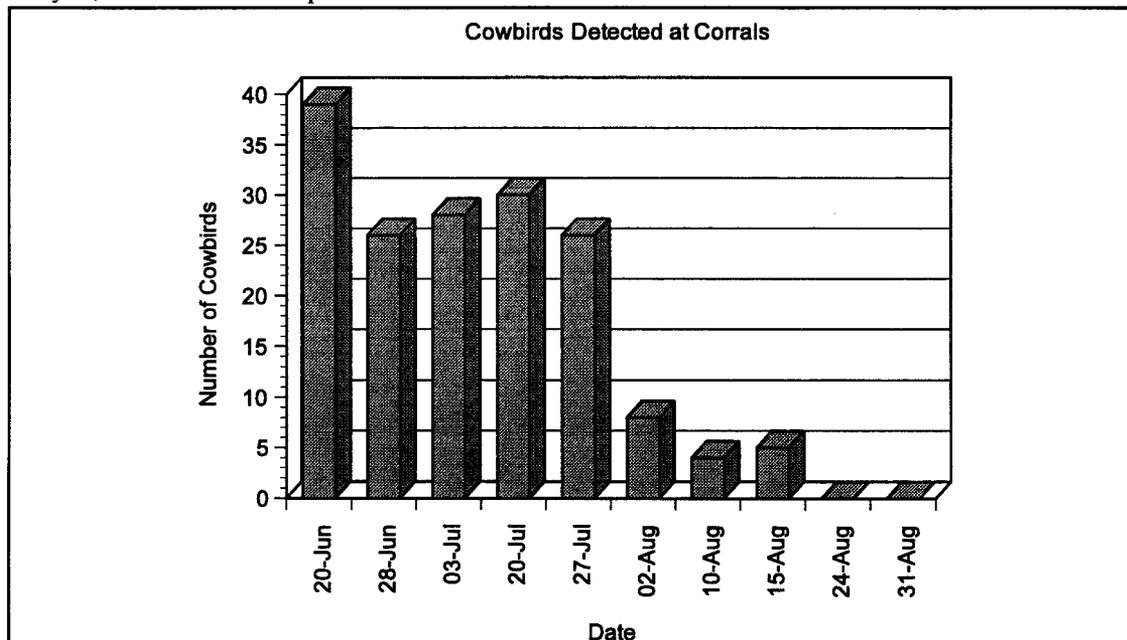
### Cowbird Distribution and Numbers

Our surveys of the Colorado River found cowbirds generally distributed along the entire river, from Glen Canyon dam and Lee's Ferry (the eastern end of Grand Canyon National Park) to Diamond Creek (the western end of the park). Cowbirds seen along the river were single birds, pairs, or groups of three (two males and one female). These birds were generally observed in the tops of riparian shrubs, where they were apparently watching for local nesting birds to parasitize. We did not see cowbirds feeding at any area along the river.

In contrast, cowbirds along the canyon rim occurred in flocks of 5 to 10 or more birds at several of the corral areas, and the parking area at the Desert View overlook. A few additional birds were noted at artificial livestock ponds. These birds spent most of their time foraging, walking along the ground pecking at seeds, or sitting on fences and trees surrounding the corral or parking lot. We noted some pursuit and courtship behavior among males and females in the flocks, but did not see any behavior that appeared to be searching for host species nests. These observations suggest that cowbirds at Grand Canyon have a lifestyle in which they feed in particular, food-rich areas, then move to other areas to search for host bird nests in which to lay their eggs. This pattern has been observed in other areas where cowbirds have been studied (Rothstein et al. 1984).

Because of the late start of this study in 1995, we missed the first part of the cowbird nesting season at Grand Canyon. Cowbirds at the corrals were at peak numbers when our counts began, and numbers generally declined through the season (Figure 6). Highest numbers were at the large corral at Grand Canyon Village, with consistently lower numbers at other areas. Males generally outnumbered females in the counts made. Juveniles (young birds raised this season) were first noted on the south rim on July 27.

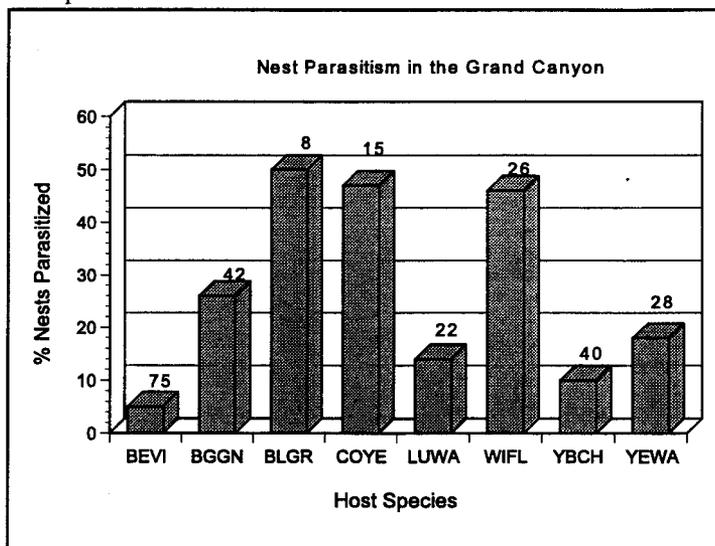
**Figure 6.** The number of cowbirds detected during surveys at corrals along the south rim of the Grand Canyon, 1995. Numbers represent combined totals for all corrals.



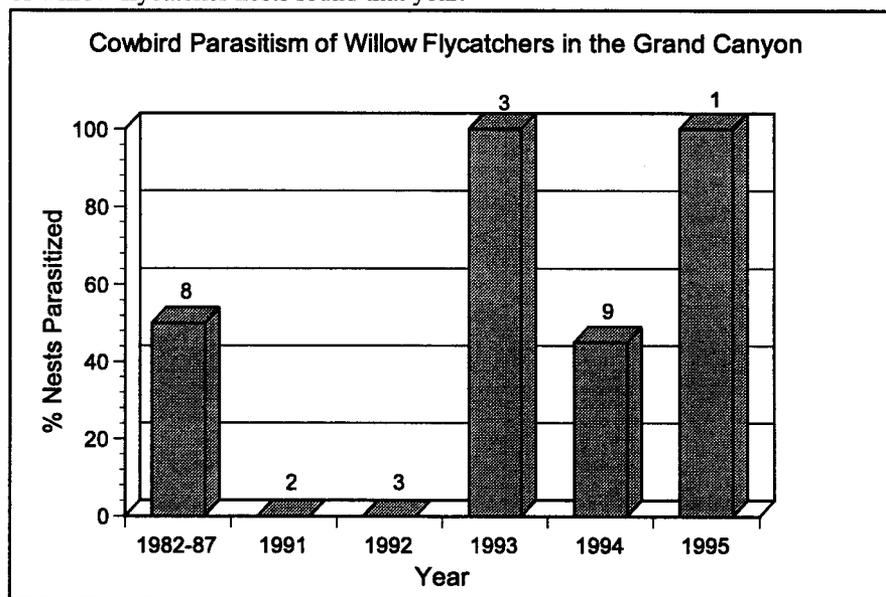
### Nest Parasitism Rates

We surveyed nesting birds to determine the extent of Brown-headed Cowbird parasitism in these areas. Most nest searches were in riparian habitats along the river, because of special concern about this habitat and the bird species that depend on it. A total of 190 hours were spent surveying for nests, with a total of 45 nests found. Of all of the nests found, 7% had been parasitized by cowbirds. The nest parasitism rate varied widely among species, with some birds suffering little or no parasitism, and other species having 50% or more of their nests parasitized (Figure 7). Of particular concern among the species parasitized is the Southwestern Willow Flycatcher. This recently listed Endangered Species occurs in very low numbers in the riparian habitats at Grand Canyon. The single nest found in Grand Canyon in the 1995 nesting season had been parasitized, and over the past 10 years, approximately half of flycatcher nesting attempts have had cowbird parasitism, generally causing the loss of the flycatcher's own young (Figure 8; Sogge 1995).

**Figure 7.** Rates of cowbird nest parasitism on riparian-breeding birds along the Colorado River in Grand Canyon National Park, 1983-1995. Species are Bell's Vireo (BEVI), Blue-gray Gnatcatcher (BGGN), Blue Grosbeak (BLGR), Common Yellowthroat (COYE), Lucy's Warbler (LUWA), Willow Flycatcher (WIFL), Yellow-breasted Chat (YBCH), and Yellow Warbler (YEWA). Numbers above the shaded bars indicate the total number of nests found for that species.



**Figure 8.** Rates of cowbird nest parasitism on Southwestern Willow Flycatchers in the Grand Canyon. Numbers above the shaded bars indicate the total number of willow flycatcher nests found that year.



2. General statistics describing project.

Fieldwork on this project spanned from June 20 to September 11, 1995. This included general surveys, counts, and nest searches along the Colorado River and on the south rim of Grand Canyon National Park. Work at five sites on the south rim was conducted over a total of 23 days from June through September. The area of river surveyed extends for 360 km (226 miles) and is only accessible by raft. For this reason, fieldwork on the river was limited to two intensive trips of seven days each in June and July.

Volunteers were extensively involved in fieldwork on the south rim and along the river, and in support work such as preparing equipment. Eight volunteers contributed a total of 225 hours of time (valued at \$2,460) over the course of the project. The volunteers included three members of the general public (who contributed a total of 85 hours), four Federal agency employees contributing off-duty time (132 hours), and a foreign exchange student from China (8 hours).

This project benefits from and extends research and resource management partnerships in the Grand Canyon region, building upon several previous and ongoing biological investigations of the region's bird community. Since 1992, the Colorado Plateau Research Station has coordinated a multi-year interagency research and monitoring program designed to inventory the status and distribution of breeding songbirds (including the endangered Southwestern Willow Flycatcher) along the Colorado River corridor, and to determine the environmental factors that influence the breeding bird community. The cooperating agencies include the National Park Service, National Biological Service, Arizona Game and Fish Department, U.S. Bureau of Reclamation, and the U.S. Fish and Wildlife Service.

This *Expedition into the Parks* program has allowed us to use volunteers to expand an investigation of the nature and extent of the cowbird nest parasitism problem. In addition, it allows us to continue cowbird monitoring at the Grand Canyon South Rim pack animal corrals where cowbirds are known to concentrate. This is a continuation of a joint National Park Service and National Biological Service monitoring program that was conducted in 1993. Finally, the cowbird radio-tracking effort supported by this *Expedition into the Parks* grant will allow us to integrate our riparian bird and cowbird monitoring programs by determining whether the cowbirds we have found concentrating at the rim are the same birds that are parasitizing host nests along the river corridor. This has tremendous ramification with regard to possible management efforts to mitigate the negative effects of cowbird parasitism.

---

3. Further research needs.

The third objective of this study is to evaluate cowbird movement patterns within Grand Canyon National Park. This aspect of the study could not be undertaken in 1995 because of the late start of the project. Instead, we plan to conduct this part of the work beginning in spring 1996. The apparent pattern is one of cowbirds feeding at corrals and other artificial sources, then flying to

riparian areas along the river to search for host bird nests to parasitize. Planned radiotelemetry studies and color banding of cowbirds captured at corrals (Figure 9) and other feeding sites on the canyon rim will provide this information. This phase of the research will indicate whether or not the large numbers of cowbirds concentrating at sites along the canyon rim are the source of the cowbirds parasitizing breeding birds along the river.

This information will provide strong support for planned management

action, potentially involving trapping cowbirds at corrals and other concentration points, to prevent them from moving down to the river to parasitize the birds there. This management program would be conducted as an experiment, with continued monitoring of nesting birds along the river to determine if the trapping program increases nesting success. Nest monitoring will be carried out cooperatively with Grand Canyon National Park, and will concentrate on the small population of endangered Southwestern Willow Flycatchers.

**Figure 9.** Example of a live-trap that will be used to capture cowbirds. Cowbirds will be outfitted with color bands and radio transmitters to allow researchers to track their movements.



---

4. Transferability of methods and data to other Parks with similar resource issues:

An important result of this research will be information on distance of cowbird movements, and impacts of cowbirds from particular concentration points on nesting birds in the surrounding area. This will have wide applicability to other areas where cowbird parasitism on nesting birds is a concern. Recent spread and increase of Brown-headed Cowbirds, and parasitism of local nesting species, is recognized as a problem in California, Arizona, and other parts of the west (Franzreb 1987, Laymon 1987), and the National Park Service recently initiated surveys at several western Parks to evaluate the seriousness of the problem in those areas. From a management standpoint, the information on success of the cowbird trapping and removal program on nesting success of locally breeding birds will likewise be valuable to other areas with similar problems, including other parks, refuges, and other natural preserves.

5. Resource problems uncovered.

The following are important natural resource concerns that were uncovered in the habitats and area that were studied:

- \* the increase in distribution and numbers of cowbirds in the region over the last 50 years;
- \* the association of cowbird concentrations with human modifications of the habitat, including horse corrals and associated feedlots, livestock ponds, and bird feeders.
- \* extensive Brown-headed Cowbird nest parasitism of several riparian bird species, particularly the Southwestern Willow Flycatcher; and
- \* the likely importance of cowbird nest parasitism in reducing nesting success.

This information, taken together, identifies both an important natural resource problem (the threat to riparian nesting bird species, including an endangered species) and some biological aspects of the problem that provide a link to successful management of the problem. Cowbird dependence on, and concentration at, artificial feeding stations may provide opportunities for effective control of the species, and reduction of their impact on nesting riparian birds.

---

6. Use of information to resolve resource management issues.

The adverse effect of cowbird parasitism is an important concern of Grand Canyon National Park, and other areas concerned with protecting riparian habitats and the bird species that depend on them. This study provides data documenting the nature and extent of the problem, and will also provide detailed information on a management technique for alleviating the problem. Grand Canyon National Park has supported the project from the outset, in anticipation of research results to guide management and protection of native bird species in riparian areas of the Park. Pending results of this study, Park Resources staff are committed to control of cowbirds to protect native bird species.

7. Publication plans.

In addition to the reports that we will prepare for the National Park Foundation, Canon U.S.A. Corporation, and Grand Canyon National Park, we plan to prepare the following manuscripts for professional journals:

1) Study of cowbird movements in relation to man-made concentration and feeding areas, and areas where the cowbirds prospect for nests to parasitize. This will include data from color-banding and radiotelemetry of cowbirds trapped at corrals and similar concentration areas. - **Condor** or other major Ornithology journal.

2) Management of cowbirds in Grand Canyon, including historical review of cowbird occurrence and numbers in Arizona, data on manmade features that concentrate cowbird numbers, effects of these cowbirds on nesting birds in the surrounding area, and success of control efforts aimed at cowbird concentration points - **Biological Conservation** or **Ecological Applications**.

This study should also have considerable interest for the general public. There are a great many people who maintain bird feeders or who study birds for pleasure. We will prepare a "popular" article about the project for one of the magazines such as **Birding**, or **Birder's World**, which serve this audience.

---

8. Plans to educate the public.

In a large, heavily-visited Park such as Grand Canyon, a highly-visible project such as this requires a high level of public information and education if it is to receive support. At the same time, there is a great deal of popular interest in wild birds, and in programs for their conservation. Studies such as this are of interest to both Park visitors and to the general public. Hence, this project affords an excellent opportunity to provide interesting and valuable information to a wide variety of people. Educational plans in conjunction with this project have the enthusiastic support of the Grand Canyon National Park Interpretation Division, and include:

1) On-site signs discussing Brown-headed Cowbirds, their nesting biology and relationship to other native bird species, threats to bird species in the Grand Canyon, the objectives of the present research, and the innovative sponsorship of the project by Canon Corporation and the National Park Foundation;

2) Press releases discussing threats to riparian bird species in the Southwestern United States in general, and in the Grand Canyon area in particular, focusing on threats from Brown-headed Cowbirds. The press release will highlight the research that is being conducted, possible management alternatives, and the sponsorship of the project by Canon Corporation and the National Park Foundation.

3) A site bulletin (to be prepared with Grand Canyon Interpretation Division) discussing Brown-headed Cowbirds, concerns about adverse effects on native bird species (particularly riparian species) and the goals of this program of research and management.

4) An interpretive program discussing trapping, banding, and use of radiotelemetry with cowbirds trapped at corrals (in conjunction with Grand Canyon National Park Interpretation Division).

---

9. Conservation and restoration work.

As discussed above, the major management need being evaluated by this study is whether trapping of Brown-headed Cowbirds at corrals and other concentration areas will reduce the number of cowbirds that parasitize the nests of riparian birds in the Park. Cowbirds have invaded the area and have increased in numbers because of artificial food sources, and other human-caused modifications of the habitat. This has resulted in unnatural impacts on birds in adjacent areas, which had not previously suffered nest parasitism. The problem is especially acute for the Southwestern Willow Flycatcher, which has very small populations in the area, and is parasitized heavily by cowbirds. Some other management measures are possible, such as using different feeds at the corrals in an effort to reduce the amount of food available to cowbirds. However, large domestic animals in themselves are an attractant to cowbirds, whether in corrals or in open pastures. Horses, mules, cattle, and other domestic animals will not be removed from the Grand Canyon area in the foreseeable future (if ever). Hence, active control of cowbirds through trapping may be the best management option for reducing impacts of nest parasitism on riparian birds.

---

10. Type of data collected.

Description	Data Type	Repository
Historical information on cowbird occurrence	Final Project Report	GRCA and other final report recipients
Cowbird abundance (count) data at corrals	Final Project Report and computer database	GRCA and other final report recipients
Abundance data for other bird species noted at corrals	Computer database	GRCA, CPRS
Nest search data (type of nest, evidence of parasitism, etc.)	Final Project Report and computer database	GRCA and other final report recipients
Cowbird movement data	Final Project Report and computer database	GRCA and other final report recipients

GRCA = Grand Canyon Science Center, Grand Canyon National Park  
 CPRS = Colorado Plateau Research Station, Northern Arizona University

11. Unexpected results or developments:

Concentrations of cowbirds at horse corrals at Grand Canyon had been documented previously (Brown et al. 1987, Johnson and Sogge 1995). The occurrence of cowbirds at stock ponds and bird feeders, while not totally unexpected, was new information discovered in the course of this study. This information will be important in carrying out effective cowbird control.

Cowbird numbers were relatively low in the Grand Canyon area in 1995, and they were also low in some other areas of the southwestern United States (M. Johnson, pers. comm.). In spite of this, parasitism rates on some of the nesting birds in the area were still high. Such information on annual variation in cowbird numbers, and its relationship to nest parasitism rates, is largely unavailable. This data, too, is potentially important in carrying out management efforts for the cowbird problem.

---

12. Anything else you want to tell us:

This research project, and the management program which will be developed from it, focuses on a management concern which has been recognized for several years. The Colorado Plateau Research Station and Grand Canyon National Park Resource Management have recognized and discussed the importance of such research since an initial study that was conducted in 1993. However, a source of funding for the project could not be found. Thanks to this innovative and generous program developed by Canon U.S.A. Corporation and the National Park Foundation, we are now able to conduct this research and provide a sound basis for a cowbird management program at Grand Canyon. The *Expedition into the Parks* is a very valuable and important program, both in the work it accomplishes directly, and in the example it provides for future cooperative research and management efforts.

---

Literature Cited

- Beezley, J. A., and J. P. Rieger. 1987. Least Bell's Vireo management by cowbird trapping. *Western Birds* 18:55-61.
- Best, L. B. and D. F. Stauffer. Factors affecting nesting success in riparian bird communities. *Condor* 82:149-158.
- Brown, B. T., S. W. Carothers, and R. R. Johnson. 1987. Grand Canyon birds. University of Arizona Press, Tucson. 302 pp.
- Carothers, S. W. and B. T. Brown. The Colorado River through Grand Canyon. University of Arizona Press, Tucson. 235 pp.

- Franzreb, K. E. 1987. Endangered status and strategies for conservation of the least Bell's Vireo. *Western Birds*, 18:43-49.
- Gaines, D. 1974. A new look at the nesting riparian avifauna of the Sacramento Valley, California. *Western Birds* 5:61-81.
- Grater, R. K. 1937. Check-list of birds of Grand Canyon National Park. *Natural History Bulletin* No. 8, Grand Canyon Natural History Association.
- Johnson, R. R. and L. T. Haight. 1984. Riparian problems and initiatives in the American Southwest: a regional perspective. Pages 404-412 in *California riparian systems: ecology, conservation, and productive management* (R.E. Waner, eds.). University of California Press, Berkeley. 1035 pp.
- Johnson, R. R., L. T. Haight, and J. M. Simpson. 1987. Endangered habitats versus endangered species: a management challenge. *Western Birds* 18:89-96.
- Johnson, M. J. and M. K. Sogge. 1995. Cowbird concentrations at livestock corrals in Grand Canyon National Park. Pages 275-284 in van Riper, C. III, editor. *Proceedings of the Second Biennial Conference on Research in Colorado Plateau National Parks*. 25-28 October 1993. National Park Service Transactions and Proceedings Series NPS/NRNAU/NRTP-95/11.
- Laymon, S. A. 1987. Brown-headed Cowbirds in California: historical perspectives and management opportunities in riparian habitats. *Western Birds* 18:63-70.
- Lowther, P. E. 1993. Brown-headed Cowbird (*Molothrus ater*). No. 164 in *The Birds of North America* (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, DC.
- McKee, E. D. 1930. Preliminary Check List of Birds, Grand Canyon. Unpublished report, U.S. Dept. of Interior, National Park Service, Grand Canyon National Park.
- Robinson, S. K., J. A. Grzybowski, S. I. Rothstein, M.C. Brittingham, L.J. Petit, and F.R. Thompson. 1993. Management implications of cowbird parasitism on neotropical migrant songbirds in *Status and management of neotropical migratory birds*. USDA Forest Service Technical Report RM-229.
- Rolle, J. E. and W. W. Hagenbuck. 1995. Surface cover changes in the Rio Grande floodplain, 1935-89. Pages 290-292 in LaRoe, E.T., G.S. Farris, C.E. Puckett, P.D. Doran, and M.J. Mac, eds. 1995. *Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems*. U.S. Department of the Interior, National Biological Service, Washington, DC. 520 pp.
- Rosenberg, K. V., R. D. Ohmart, W. C. Hunter and B. W. Anderson. 1991. *Birds of the lower Colorado River valley*. University of Arizona Press, Tucson.

- Sogge, M. K. 1995. Southwestern Willow Flycatchers in the Grand Canyon. Pages 89-91 in LaRoe, E.T., G.S. Farris, C.E. Puckett, P.D. Doran, and M.J. Mac, eds. 1995. Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U.S. Department of the Interior, National Biological Service, Washington, DC. 520 pp.
- Sogge, M. K. and T. J. Tibbitts. 1994. Distribution and status of the Southwestern Willow Flycatcher along the Colorado River in the Grand Canyon - 1994. Summary Report. National Biological Service Colorado Plateau Research Station/Northern Arizona University and U.S. Fish and Wildlife Service, Phoenix. 37 pp.
- State of Arizona. 1990. Final report and recommendations of the Governor's riparian habitat task force. Executive Order 89-16. Streams and riparian resources. Phoenix, Arizona. October 1990. 28 pp.
- Swarth, H. S. 1914. A distributional list of the birds of Arizona. *Pacific Coast Avifauna* 10, 117 pp.
- Wilen, B. O. 1995. The nation's wetlands. Pages 473-476 in LaRoe, E.T., G.S. Farris, C.E. Puckett, P.D. Doran, and M.J. Mac, eds. 1995. Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U.S. Department of the Interior, National Biological Service, Washington, DC. 520 pp.
- Woodbury, A. M., and H. N. Russell, Jr. 1945. Birds of the Navajo Country. *Bulletin Of the University Of Utah* 35(14).