

Dear Earthwatcher,

Thank you for joining us in the field on the *Songbirds of the Tetons* project! I enjoyed meeting you and could not have completed the season without your dedication to our research.

Sixty-seven Earthwatch volunteers participated in our project this season, braving early mornings, field lunches, hours in rubber boots and (sometimes) snow. Collectively, volunteers spent 804 hours in the field. In other words, you and your colleagues completed five months of field work in just 36 field days. During your field time you located and monitored 83 nests of 19 species. Staff and volunteers also resighted 78 individual birds belonging to 10 different species. Yellow warblers were the most commonly resighted species followed by Song sparrows and Red-naped sapsuckers. This season's resight data will be combined with 2009 data to develop improved species-specific population models. These models will help researchers better understand long term population trends in the Jackson area and will highlight habitat conditions that may limit songbird populations.

Preliminary data analyses suggest lower nest success in sites surrounded by human development. This trend may be a result of increased nest predation or poor habitat quality near development. Subsequent analysis of the nest predator community will help us to better understand these patterns. We caught fewer aspen obligate birds at the banding stations this season relative to the past several years. This shift corresponds with region-wide decreases in the amount of aspen on the landscape and is valuable information for local land managers, developers and conservationists.

We continue to share our findings with local, regional and national audiences. This season Conservation Research Center (CRC) staff educated 586 students at the banding stations. In September, Jenny McCabe and I presented preliminary project results at a scientific conference. We also hosted an informal talk at the monthly Jackson Hole Bird Club meeting.

On a personal note, Megan Smith transitioned from seasonal Field Team Leader to a permanent Ecologist position with the CRC in September. She is a welcome addition to our staff! Jenny McCabe continues in her full-time position, and provides much-needed expertise on our field and GIS projects. As for myself, I am recently engaged! In addition to marrying my fiancée, I'm looking forward to winter research projects and to an outstanding collaboration with Earthwatch in 2009.

Thank you for your incredible contributions to our research. You made our project possible.

Sincerely,



Embere Hall
Research Director
Conservation Research Center of
Teton Science Schools



Songbirds of the Tetons

Date completed: 16 November 2008
Completed by: Embere Hall
Period covered by this report: 1 May 2008 to 18 June 2008
Project title: Songbirds of the Tetons

Research report

Objective 1: Survivorship

We continued our work on long-term avian survivorship patterns during the 2008 summer field season. Consistent with previous years, we operated all stations in cooperation with the Institute for Bird Populations' Monitoring Avian Productivity and Survivorship (MAPS) program. We captured 2,063 birds belonging to 72 different species at 6 sites from 1 June – 18 August. Most common captures included Yellow warbler (*Dendroica petechia*; 426), American robin (*Turdus migratorius*; 181), Pine siskin (*Carduelis pinus*; 161), Western tanager (*Piranga ludoviciana*; 82) and Song sparrow (*Melospiza melodia*; 81). Approximately 20% of our total captures were recaptured individuals. All captures were identified to species, age and sex. Staff recorded mass and wing chord length. If unmarked, we banded them with a uniquely numbered band, issued by the US Geological Survey. Ten focal species were also fitted with unique combinations of plastic colour bands that allowed staff and Earthwatch volunteers to identify individuals.

Capture rates (number adult birds captured/net hour) in 2008 were similar to previous years. Average capture rates of aspen obligates, including Warbling vireos (*Vireo gilvus*) and Dusky flycatchers (*Empidonax oberholseri*) continued to decline. Black-headed grosbeak (*Pheucticus melanocephalus*) and Yellow warbler capture rates increased over 2006 estimates. Both are riparian-nesting species.

We added two new banding stations this season to enhance sample sizes and to increase the rigor of our study. One site is located in Grand Teton National Park and is imbedded in a relatively undeveloped landscape. The second site is surrounded by urban development and is located in the town of Jackson. Conservation Research Center (CRC) staff banded 324 hours this season, for a total of 3000 net hours.

Color band Resighting

CRC staff color banded 10 focal species at each banding station (see above for details). Staff and volunteers resighted 78 individual birds belonging to 10 different species between 1 June and 18 August. Yellow warblers were the most commonly resighted species (37) followed by Song sparrows (14) and Red-naped sapsuckers (*Sphyrapicus nuchalis*; 6; Table 1).

Despite a steep learning curve, volunteers learned well and were able to complete tasks requiring bird identification skills, proficiency with binoculars and an ability to see small color bands by the end of the project. We will however reduce emphasis on this portion of the volunteer field work in 2009 and will assign staff to collect the majority of the resighting data so that volunteers can maximize data collection contributions in other areas of the project.

Winter Seasonal Survivorship

In addition to quantifying annual and summer-season survivorship trends, we will monitor color-banded resident species during the winter. Teton Science Schools' graduate students will complete this work, in cooperation with Dale Gentry. Work has not commenced on this sub-objective because the winter season has not yet arrived in Jackson Hole.

Table 1. Number of resighted individuals by species
1 June – 18 August, 2008 in Jackson Hole, Wyoming.

Species	Individuals Resighted
AMRO	2
BHGR	3
BHGR	5
DUFL	4
MGWA	2
MOCH	3
RNSA	6
SOSP	14
WAVI	2
YWAR	37

Objective 2: Productivity and Recruitment

Constant-effort Mist Netting

See *Objective 1 for 2008 capture trends and net hours*. Productivity estimates (ratio of hatch-year : after hatch-year captures) from 1993 – 2008 indicate marked variability in population trends by migratory guild. Short-distance and resident species show above-average productivity, while neo-tropical migrants demonstrate lower than expected young : adult numbers. Volunteers' nesting data help us to better understand both within and between season variability in productivity estimates. Nesting data also helps us quantify the effects of human development on avian survivorship and population trends.

Nest survival

During the mid-morning and early afternoon volunteers located and monitored songbird nests on four sites. Sites were arranged along a gradient of exurban housing density, with one site representing a low-development landscape, two sites representing moderate development, and one site representing high-density development. Staff and volunteers

found 83 active nests of 19 species, the most abundant being American robin (26), followed by Yellow warbler (22), Black-headed grosbeak (6) and Song sparrow (4; Table 2). American robins, Song sparrows and Yellow warblers nested on all sites. Black-headed grosbeak nests were not found at Black-tail ponds, our low-development site.

Overall nest survival was 57%. We were unable to determine nest fate for 2% of our total sample. A nest was considered successful if at least one nestling fledged. Apparent nest success (% of successful nests) was lowest in the most densely developed site (48%), and highest in a moderate-development site (68%). Preliminary analysis indicates that human development may reduce nest survival, though the mechanism responsible for decreased nest survival is not clear. Additional analysis of the nest-predator community in 2009 will allow us to quantify variability in predator abundance and community composition relative to human development. We will also improve our inference by adding two nest-searching sites in 2009.

Table 2. Number of active songbird nests found on each of four nest-searching sites 1 June – 18 August, 2008 in Jackson Hole, Wyoming

Species	Site				Total
	BLTP	JACK	KARN	TSS-	
AMRO	4	4	13	5	26
BCCH		1			1
BHGR		2	3	1	6
BRSP	1				1
BUOR		1	1		2
CEWA	1	2			3
CHSP	2				2
DOWO				1	1
DUFL				3	3
GRCA	1				1
HAWO		1		1	2
HOWR	1			2	3
RNSA	1			1	2
RSFL		1			1
SOSP	1	1	1	1	4
TRSW	1				1
WAVI				1	1
WEWP				1	1
YWAR	6	9	5	2	22
Total	19	22	23	19	83

Objective 3: Habitat use patterns

Color band resighting: territory mapping

Some volunteer difficulties associated with resighting color-banded birds meant that the objective of mapping territories of banded birds didn't progress as quickly as we had wished. In order to save volunteers the feeling of frustration, we will implement various improvements in the project activity next year.

Habitat quality

Volunteers and staff quantified vegetation structure and composition at each nest location (n=83) and at two new banding stations. These data will be used to evaluate habitat quality at each site. They will also be incorporated into more in-depth nest survival analyses that examine the effects of vegetation structure on the likelihood of nest success.

Objective 4: Ex-urban Development Parameter and Abiotic Stressors

Human development

We began digitizing houses from 2007 aerial imagery in September using ArcGIS 9.2. All houses within 500 m of two sites are digitized. We will complete the remaining sites by May 2009.

Abiotic stressors

We compiled temperature and precipitation data from existing weather stations in the Valley and will incorporate these data in population and nest survival analyses. We did not use Hobo Pro™ data loggers because of cost and the availability of weather data from existing sources.

Mechanism(s) of Populations Change Data Analysis

Work will not begin on this sub-objective until sufficient data are collected to support meaningful multivariate statistical analyses. We anticipate sufficient sample sizes for preliminary analyses after the 2009 field season.

Objective 5: Promote Responsible Stewardship and Natural Resource Management

Education

CRC staff continued to teach about avian natural history, population sampling and conservation through hands-on bird banding demonstrations starting 1 June and ending 18 August. This year staff educated 586 youth and adults, not including Earthwatch volunteers.

Citizen Science and Further Study

CRC staff worked with various education-based groups this season including Elderhostel, residential education program participants and TSS graduate students. We also hosted two part time, season long volunteers on the banding crew. Interactions with volunteers and Jackson-based education groups allowed us to teach local residents about avian ecology and to promote scientific literacy in the Jackson community.

Objective 6: Provide a Model to Improve Avian Monitoring Methods

Work not commenced on this objective: **has not commenced**

Expected date for commencement of work towards this objective: September 2009

Due to the difficulties associated with color band resighting outlined in Objective 1, we did not progress on this Objective. We will incorporate Objective 6 in 2009 using primarily staff-generated resight data.

Project development

Changes to project objectives

The original project objectives (1 – 6) largely will remain the same in 2009. Exceptions are noted below:

- **Objective 4:** Exurban Development Parameter and Abiotic Stressors
 - Abiotic stressors: We will not use Hobo Pro™ data loggers in subsequent project years because of cost and the availability of weather data from existing sources. We will continue to address abiotic stressors using publicly-available data from Historic Climate Network sites in the Jackson area.

- **Objective 2:** Productivity and Recruitment (*new sub-objective*)
 - Quantify the composition and abundance of the nest-predator community
 - Pending approval from the Earthwatch research team, we will quantify the songbird nest predator community at each nest-searching site (n=6), starting in 2009. Preliminary nest survival analyses indicate lower nest success in developed landscapes. Variation in the predator community may explain this trend and provide insight into the cascading effects of human development on natural systems. We will measure the predator community through the following field techniques
 - small mammal trapping
 - point counts (aerial predators, particularly corvids)
 - snake surveys (mark-recapture)

Improving the effectiveness of volunteers

Volunteers play an invaluable data collection role, and we are keen to continue improving their role and effectiveness:

Volunteer involvement in banding: Early in the season we realized that direct volunteer participation in the banding process was somewhat challenging to volunteers with no previous birding experience. The following text was included as a briefing update in July.

The research duties have proven to be fairly challenging for volunteers that do not have previous birding experience. In an effort to reduce the number of skills that need to be learned, and to ensure the best-possible environment for mist-netted birds, banding will serve as a training activity. Volunteers will not be removing birds from nets or banding birds. Volunteers will spend two mornings at the banding stations. Everyone will have a great opportunity to view birds up-close, to work on species ID and to learn more about the bird banding process. Volunteers that are comfortable with species ID may help with choosing color band combinations and recording band numbers. There may be opportunities for volunteers to release birds after they are banded.

Volunteer evaluations on the last day of each Team and written evaluations filed with Earthwatch indicate that one banding session may have been sufficient, given the revised goals for this activity. Next season each Team will spend one morning at the banding station learning to identify study species and developing a better understanding of the banding process. This will allow for more field time to be focused on volunteer-driven data collection.

Color-band resighting: Color-band resighting was difficult for many volunteers. It requires bird identification skills, proficiency with binoculars and an ability to see small color bands, all while navigating in the field. Volunteers were frustrated with the steep learning curve and substantial teaching investment necessary to facilitate meaningful data collection. Many volunteers indicated that they felt they were not contributing in a useful way to this project activity.

We will improve this project activity next year through the following steps:

- Project staff will take a larger role in resighting banded birds in 2009. Volunteers will resight birds, but will do so during the course of other research activities (e.g. nest searching).
- Staff will resight birds each week, and will orient volunteers to birds' territories.
- Staff will focus on more cryptic species, allowing volunteers to take the lead on conspicuous species that are easier to see.
- Post training materials on our project website, in cooperation with Earthwatch staff. These materials will allow volunteers to start learning bird identification before fielding and will reduce overall instruction time. Training materials will include
 - PowerPoint presentation that outlines identification tips for each species and associated quizzes
 - Audio tracks of focal species' vocalizations
 - Downloadable bird identification flash cards

Nest location descriptions: We will revise nest card data sheets in 2009 to require more specific location descriptions and map orientation. We will also provide examples of well-written nest cards so as to find nests more efficiently, maximizing the efficiency of valuable volunteer and staff time.

Summary of results

Long-Term Population Monitoring

Mist-netting

We captured 2,063 birds belonging to 72 different species at 6 sites from 1 June – 18 August 2008. Most common captures included Yellow warbler (426), American robin (181), Pine siskin (161), Western tanager (82) and Song sparrow (81). Approximately 20% of our total captures were birds that had been captured previously.

Capture rates (number adult birds captured/net hour) in 2008 were similar to previous years. Average capture rates of aspen obligates, including Warbling vireos and Dusky flycatchers continued to decline. Black-headed grosbeak and yellow warbler capture rates increased over 2006 estimates. Both are species that nest near streams and rivers. Additional information on nest survival and productivity (ratio of adult birds to juvenile birds) will help us to better understand declines in populations of birds that need aspen habitat.

Productivity estimates from 1993 – 2008 indicate marked variability in population trends by migratory guild. Short-distance and resident species show above-average productivity, while neo-tropical migrants demonstrate lower than expected young to adult numbers. Volunteers' nesting data help us to better understand both within and between season variability in productivity estimates. Nesting data also helps us quantify the effects of human development on avian survivorship and population trends.

Color-band resighting

Conservation Research Center (CRC) staff color banded 10 focal species at each banding station. Staff and volunteers resighted 78 individual birds belonging to 10 different species between 1 June and 18 August 2008. Yellow warblers were the most commonly resighted species (37) followed by Song sparrows (14) and Red-naped sapsuckers (6). This season's resight data will be combined with 2009 data to develop improved species-specific population models. These models will help researchers better understand long term population trends in the Jackson area and will highlight habitat conditions that may limit songbird populations.

Seasonal Productivity

Nest searching

Staff and volunteers found 83 active nests of 19 species in 2008, the most abundant being American robin (26), followed by Yellow warbler (22), Black-headed grosbeak (6) and Song sparrow (4). American robins, Song sparrows and Yellow warblers nested on all sites. Black-headed grosbeak nests were not found at Black-tail ponds, our lowest development site.

Overall nest survival was 57%. Apparent nest success (% of successful nests) was lowest in the most densely developed site (48%), and highest in a moderate-development site (68%). Preliminary analysis indicates that human development may reduce nest survival, though the mechanism responsible for decreased nest survival is not clear. Additional analysis of the nest-predator community in 2009 will allow us to quantify variability in predator abundance and community composition relative to human development.

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Volunteers and staff quantified vegetation structure and composition at each nest location (n=83) and at two new banding stations. These data will be used to evaluate habitat quality across a gradient of human development. They will also be incorporated in more in-depth nest survival analyses that examine the effects of vegetation structure on the likelihood of songbird nest success.

Education

CRC staff taught about avian natural history, population sampling and conservation through hands-on bird banding demonstrations starting 1 June and ending 18 August 2008. This year staff educated 586 youth and adults, not including Earthwatch volunteers. Interactions with Jackson-based education groups allowed us to teach local residents about avian ecology and to promote scientific literacy in the Jackson community.

Conservation Impacts

Data collected during the 2008 season will provide insight into the effects of exurban development on songbird populations in the Jackson area. Long-term population trends for aspen-obligate species suggest substantial regional declines. These declines may be attributable to decreasing aspen cover on the landscape and increased human development in sensitive ecological areas. Conservationists and land managers can use these data to support aspen inventories, sustainable development options and improved ecosystem management.

Significance and Benefits of Research

We actively share our avian population trend data with local policy makers, regional interest groups, state non-game biologists, academia and scientists around the globe. All of our banding data are available to the public through the Institute for Bird Populations (www.birdpop.org).

Local impacts

We facilitate local use of our data through collaboration with planners from the Town of Jackson and from the Teton County Planning Department. We present both our final-product research findings and project-status updates to planning staff. During these presentations we help planners understand how best to apply our data to planning issues. The CRC is also an active member of a local group designed to improve the dialogue between planners and scientists. This group provides an arena for planners and researchers to discuss how to incorporate science in local planning efforts and how to best use available ecological data.

National / Regional impacts

Jackson Hole is an ideal location to research the effects of exurban development on songbird populations because developed land interfaces directly with large tracts of intact landscapes. In fact the Greater Yellowstone Ecosystem, of which Jackson Hole is a part, is one of the largest remaining temperate zone ecosystems on Earth. Avian responses to development in this habitat matrix should be similar to responses in other front-range communities in the Intermountain west. Our banding data are permanently archived and accessible to the public through the Institute for Bird Populations (www.birdpop.org). Researchers, interested citizens and wildlife managers throughout the US can request and use our data free of charge.

International impacts

Recent analyses of long-term, large scale avian monitoring data demonstrate that many land bird species have experienced pronounced population declines during the past 30 years. Given global human population growth and rates of land conversion, a thorough understanding of avian population dynamics in human-dominated landscapes is crucial to the conservation of important breeding habitats. Our work generates a better understanding of the mechanisms driving population change in developing landscapes.

Declining global population trends can best be reversed by identifying causal mechanisms on local scales. Our banding stations and associated projects will be used as a model for individual station operators in the MAPS network to ask relevant research questions of local interest, while simultaneously participating in continent-wide avian monitoring.

Communication of results

We are revising the Teton Science Schools website. The new web interface will provide more information on the applied research program and will feature a summary of each research project. Each project page will include a description of research need, methods, data collected, preliminary findings and project partners.

We presented results from our MAPS banding efforts from 1991 – 2008 to the Western Bird Banders Association and to the Jackson Hole Bird Club. Earthwatch was acknowledged in both PowerPoint presentations.

REFERENCE

McCabe, J. and E. Hall. The effects of human development on songbird populations along

riparian corridors in Jackson Hole Wyoming. Oral presentation, Western Bird Banders Conference (2008).

Hall, E. and J. McCabe. Bird banding in Jackson Hole: Science meets Education. Oral presentation, Jackson Hole Bird Club (2008).

Teton Science Schools Bird Banding Journal – interactive journal provided to all groups visiting our bird banding stations. The journal includes pictures to help identify commonly captured species and puzzles that can be completed with the knowledge gained during the banding experience. Earthwatch is not acknowledged, but will be in revised editions.

REFERENCE

Humphries, S., J. McCabe and E. Hall. 2008. Bird Banding Journal. Teton Science Schools, Jackson WY. 12pp.

Educational Opportunities

Our project directly involves local communities, K-12 students, early career scientists and graduate students in field research.

Local communities

We offer 6 open-enrollment bird banding experiences to Jackson community members each year. We recently applied for funds to support four additional community programs. Participants interact with staff ornithologists, observe the bird banding process and learn about local conservation issues. The more exposure that people have to the outdoors, the more they report attachment to place, civic engagement and environmental stewardship.

Students

Students of all ages participate in bird-banding demonstrations at two of our banding stations. This year CRC staff educated 586 youth and adults about the bird banding process, avian ecology, conservation issues in the Greater Yellowstone Ecosystem and applications of field science. We will expand our education program next year to include 16 additional education time slots at the Jackson station. These slots will allow us to educate more program participants and to better meet program demand from the community.

Early career scientists

This season we hired 4 banding staff, a program host and a Field Team Leader to support our project. In 2009 we plan to hire at least one additional field technician to assist with data collection and group management. While most of our staff are experienced field biologists, we hire one person each year on the banding crew that is early in their career. During the course of their 3-month position they learn valuable research skills and develop important connections with professional scientists.

Other groups

We encourage Teton Science Schools' administrative staff, teachers, faculty, and graduate students to join us at the banding stations each season. Bird banding demonstrations improve understanding of field science, bird conservation and avian ecology. Graduate students, teachers and faculty share their experiences with student groups that they teach throughout the year.

We did not incorporate graduate-level research in our project this season. We will incorporate additional graduate student research in subsequent seasons as time and funding allow. Teton Science Schools' graduate program may offer an 8-week capstone field research opportunity to students in 2009. Our project would support one or two students enrolled in this elective.

Acknowledgements

Teton Science Schools, the Earthwatch Institute and two private donors funded this work. We thank Grand Teton National Park and the Teton County Parks and Recreation Department for allowing us to study birds within their administrative boundaries. This project would not have been possible without the support, dedication and hard work of 67 Earthwatch volunteers that joined us in the Tetons this season. Field staff contributions to this project can not be overstated. Special thanks to C.Hansen, S. Humphries, E. McCleod, J. Runnels and M. Smith.