A Preliminary Investigation of Impacts of ATV Activity on Breeding Birds in the Nash Stream State Forest, Coos County, New Hampshire

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August 2006

Final

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Executive Summary

A pilot study of breeding bird activity adjacent to ATV trails and gated roads on the Nash Stream State Forest in 2002 (prior to ATV activity) and 2003 (the first year of ATV activity) detected no negative impacts of the ATV trails during their first year of operation. However, information regarding the timing and frequency of ATV traffic is unavailable, making more general conclusions impossible.

Surveys of bird activity took place during June and July, biweekly in 2002 and weekly in 2003. Technicians surveyed bird activity on 300 m x 770 m study plots located immediately adjacent to the ATV trail or immediately adjacent to gated forestry roads with no public vehicular access. Surveys included four plots in 2002 and eight in 2003, with equal numbers on the ATV trail system and on gated roads. Surveys involved walking along flagged transects and documenting the species, location, and behavior of all birds detected. Data analysis for both years involved counting the total number of bird detections during each survey within 100 m of the roadside, between 100 and 200 m from the roadside, and between 200 and 300 m from the roadside. Analysis of 2003 data also included assessment of species-specific evaluation of both spatial distribution and breeding status on the plots. Statistical tests evaluated differences in detection rates between the ATV trails and gated roads, between the distance bands within plots, and between visiting and resident species within 100 m of the road or trail.

Surveys yielded 1005 bird detections in 2002, averaging 22 detections per plot visit, and 1714 detections in 2003, averaging 35 detections per plot visit. In 2003, surveys documented a total of 34 species, 29 on ATV trails and 29 on gated roads. Twelve species were resident on both ATV and gated road plots; two species were resident only on ATV plots and two only on gated road plots. Chi square goodness of fit tests indicate no significant differences in total bird detection rates or numbers of resident vs. visiting species within 100 of the roadside between ATV and control plots in either year. These tests indicate significantly higher detection rates within 100 m of the roadside than at greater distances for some ATV and some gated road plots.

ATV activity is most likely to affect breeding birds and other wildlife through direct mortality, physical habitat degradation, and noise disturbance. Noise disturbance has the potential to impact the largest numbers of individuals over the largest area. Many basic questions remain regarding impacts of ATV activity on native wildlife. These questions are of increasing importance to both public and private land managers as human pressures on large tracts of forest continue to grow. Future research must address characteristics of ATV use as well as wildlife activity patterns. Appropriate next steps include a comprehensive literature review and consideration of a collaborative research effort across multiple land ownerships.

adults with young or juveniles of species known to maintain a home range on the same plot were considered evidence of successful breeding.

Statistical analysis

We used chi square goodness of fit tests to test for the following:

Is there a significant difference in detection rates between treatments (ATV and control) in 2002 or 2003?

Is there a significant difference in detection rates between distance bands within any plot in either year?

Is there a significant difference in the number of visiting vs. resident species detected in the 0 to 100 m distance band between treatments?

Calculations and statistical tests were conducted in Microsoft Excel and Systat 11.

Results

Technicians attempted 44 surveys of the four plots in 2002 and 49 surveys of the eight plots in 2003. After eliminating surveys cut short by rain, 44 surveys in 2002 and 41 in 2004 provided data suitable for statistical analysis. These surveys yielded 1005 bird detections on four plots in 2002 (mean = 22 detections per plot visit) and 1714 detections on eight plots in 2003 (mean = 35 detections per plot visit).

Surveys in 2003 documented 34 species on at least one plot, 29 on one or more ATV plots and 29 on one or more control plots. Of these, 14 species maintained at least one home range on an ATV plots and 14 species maintained at least one home range on a control plot; 12 species maintained home ranges on both ATV and control plots. Appendix D provides status information for species detected on each plot.

Chi square goodness of fit tests indicate no significant differences in detection rates between ATV and control plots for 2002 ($p = 0.755$) or 2003 ($p = 0.383$). Table 1 provides details on surveys by plot and year.

Table 1. Survey numbers, total bird detections, and bird detection rates for study plots on ATV trails and gated forestry roads before and after the opening of an ATV trail on the Nash Stream State Forest, Coos County, New Hampshire.

	2002			2003		
Plot	Surveys	Detections	Rate	Surveys	Detections	Rate
ATV plots						
Andritz				5	130	32.5
Bordeau				5	236	47.2
West Side M	11	241	21.9	4	140	35.0
West Side N	12	290	24.2	4	191	47.8
Control plots						
East Side N	12	225	21.2	6	267	44.5
East Side S	10	219	21.9	7	278	39.7
Jimmy Cole				5	243	48.6
Picnic Loop				5	229	45.8

Chi square goodness of fit tests indicate significant differences in detection rates between distance bands on some ATV and some control plots. In all cases with significant differences, detection rates were significantly higher in the band nearest the road. Table 2 provides probability values for these tests.

Table 2. Chi square goodness of fit probability values for differences in bird detection rates between distance bands A (0-100 m), B (100-200 m), and C (200-300 m) within study plots along ATV trails and gated forestry roads before and after the opening of an ATV trail on the Nash Stream State Forest, Coos County, New Hampshire.

	2002		2003	
Plot	A:B	A:C	A:B	A:C
ATV plots				
Andritz			0.917	0.448
Bordeau			0.062	0.000*
West Side M	0.448		0.002*	
West Side N	0.494		0.000*	
Control plots				
East Side N	0.158		0.047*	
East Side S	0.596		0.134	
Jimmy Cole			0.165	0.165
Picnic Loop			0.938	

* Significant at 0.05 level

Chi square goodness of fit tests indicated no significant differences in the numbers of resident vs. visiting species detected within the 0-100 m distance band for ATV and control plots (p=0.307

for 2x2 table, p=0.241 for difference between status categories within treatments, p=0.806 for differences between treatments within status categories) (see Table 3).

Table 3. Visiting and resident bird species detected within 100 m of ATV trails and gated forest roads on the Nash Stream State Forest during the 2003 breeding season.

Plot	Visitor Species	Resident Species
ATV plots		
Andritz	8	6
Bordeau	10	12
West Side M	7	8
West Side N	9	6
Control plots		
East Side N	6	7
East Side S	6	7
Jimmy Cole	7	9
Picnic Loop	6	11

Discussion

None of the metrics tested suggest negative effects on breeding birds in the Nash Stream State Forest during the first year of ATV use there. Significantly higher bird detection rates within 100 m of trails in 2003 may have resulted from differences in weather conditions that led to increased bird activity along forest edges or from observer differences between years. It is possible that roadside brush clearing associated with trail improvements on the West Side Road ATV trail contributed to the increased bird activity along the trail in 2003. Increased wildlife abundance and diversity near the boundary between two habitat types (edge) has been recognized since the early days of wildlife management (Leopold 1933, Hunter 1990). Our data suggest that the influence of edge habitat outweighed any disturbance effects of ATV traffic in 2003.

It is important to recognize that specific data on frequency and timing of ATV activity are not available for 2003. As of 2006, the New Hampshire Trails Bureau estimates use levels at 6-10 riders/day on weekdays and 12-20 riders/day on weekends (C. Gamache, pers. comm.). It is unclear whether or not ridership levels were similar during the first season the trail was open. In either event, these levels may be well below a threshold for disturbance effects on breeding birds. In addition, within-day and within-season patterns of activity are unknown. ATV activity in May and June, when birds are establishing territories, constructing nests, and incubating eggs, would be more likely to have an effect than activity later in the summer. Since access to the Nash Stream trails exists only through a trail network on adjoining property, ATV activity on the Forest is most likely to occur during the middle of the day. This could also minimize impacts, if ATV activity was negligible during the early morning and late afternoon periods of most active foraging.

Impacts of human recreational activity on wildlife have received relatively little research attention from wildlife biologists compared to other human activities (e.g., agriculture, forestry, suburbanization). One reason is that outdoor recreational activities have increased dramatically since the conclusion of World War II, fueled by increases in disposable income, leisure time, and human mobility (Clawson and Harrington 1991). Another is that such impacts can be frustratingly difficult to document (Vaske et al. 1995). The difficulties flow from five major issues (Kuss et al. 1990 in Vaske et al. 1995):

- recreational activity generates multiple and interrelated environmental and behavioral responses;
- relationships between user density and impact severity are complex and unpredictable;
- wildlife responses to recreational activity are variable both among and within species;
- group size and behavior as well as equipment type can affect impacts of a given recreational activity
- impacts of recreational activity can differ with season and location.

In general, the most likely impacts of ATV activity on breeding birds include direct mortality, physical habitat degradation, and noise disturbance. Direct mortality may occur when flightless young of ground-nesting species such as Ruffed Grouse, Hermit Thrush, and Ovenbird venture into trails that are traveled at high speeds. Characteristics including small size, protective coloration, and the instinct to remain motionless when danger approaches contribute to their vulnerability. In addition, high speed riders are more likely to be alert for large hazards in the distance ahead than for small, well-camoflaged animals in their immediate path.

Physical habitat degradation is of less concern along through trails than in areas of off-trail activity, where ATVs can cause considerable damage to soils and vegetation. Nonetheless, air turbulence from passing traffic and gravel thrown to the side by wheels, as well as soil compaction and erosion, can change habitat conditions for invertebrates that provide important food resources for breeding birds.

Direct mortality and habitat degradation would most likely affect a small number of birds in very localized areas when considered at a landscape scale. Noise disturbance, however, has the potential to impact numbers of birds over a relatively large area.

Research indicates that birds are most vulnerable to human disturbance during the breeding season (Gabrielson and Smith 1995). At Nash Stream, this period may begin in April for resident species such as the Ruffed Grouse, and extends into mid-July, by which time most long-distance migrants have fledged young. Noise can present problems during territory establishment and pairing, when birds rely on vocalizations to communicate territory boundaries and to attract mates. Noise may cause incubating birds to leave the nest for a period of time, leaving eggs vulnerable to chilling and predation. An incubating bird startled by a sudden loud noise can knock one or more eggs from the nest as it flees, although such panic responses appear to be relatively rare (Bowles 1995). Birds can habituate to repeated noise that is not accompanied by direct harassment, and breeding birds in areas near human settlements show higher tolerance to the noise of vehicles than those in remote areas (Gabrielson and Smith 1995).

While research on effects of ATVs and other recreational traffic on wildlife has focused primarily on large mammals (e.g., Yarmoloy et al. 1988, Singer and Beattie 1986), the emerging field of road ecology has yielded insights into effects of traffic noise on birds (Forman et al. 2003). Studies of woodland and grassland birds in the Netherlands have demonstrated reduced densities and species richness near highways (Foppen and Reinjen 1994, Reijnen et al. 1994, 1995, 1996). Grassland birds in Massachusetts exhibited an avoidance zone adjacent to roads where both occurrence and regular breeding were significantly reduced (Forman et al. 2002).

Both traffic volume and speed influence the distance from a road at which effects are detected, as both factors contribute to noise levels. For humans, a sound pressure level in air of 70 dB is considered the safe limit for continuous noise, and the startle reflex stops habituating at 100dB (Bowles 1995). However, total woodland bird density in the Netherlands showed the beginnings of decline at 48 dB(A) and density of a particularly sensitive woodland species showed a density decline at 35 dB(A).

A number of questions need to be answered before it will be possible to estimate the potential extent of ATV noise effects on breeding birds in the Nash Stream State Forest. Some of these include:

> At what noise levels do New Hampshire forest birds exhibit response to traffic noise? Which species of New Hampshire's forest birds are sensitive to traffic noise?
>
> What is the range of noise levels produced by a single ATV at trail speed? How do noise levels vary with speed? How does vehicle group size affect noise levels? How do topography and forest type and structure affect noise attenuation with distance from source?
>
> How is ATV activity on a specific trail system distributed in time – what is the typical traffic pattern at different times of day? for weekdays vs. weekends? over the course of the season?
>
> Do impacts on wildlife differ between linear, long-distance trails and high-density trail networks?

With the number and extent of large, undisturbed tracts of forest shrinking in the face of development and demand for opening public lands to ATV use growing, the importance of research to answer these questions is increasing steadily. Such research could inform land use decisions on both public and private lands not only in New Hampshire, but throughout the northeast region where vegetation, wildlife, and topography are relatively similar.

A collaborative of interested parties, potentially including federal (US Forest Service, US Fish & Wildlife Service) and state (NH Division of Forests and Lands, NH Trails Bureau, NH Fish & Game Department) agencies, academic institutions (UNH, PSC Center for the Environment) and interested non-governmental organizations (e.g., NH Wildlife Federation, NH Audubon) might join forces to design a comprehensive study and seek funding for its implementation.

Documentation of noise levels and traffic patterns, as well as wildlife activity (including mammals and herptiles as well as birds) are critical components of research on this issue.

One initial step could be a comprehensive review of available literature on the subject, which was not within the scope of this contract. A literature review would provide an essential first step in determining research needs and evaluating potential study designs.

Nash Stream State Forest does not provide an ideal location for studying wildlife impacts of ATV activity. Remote location, off-site trail access, and highly localized weather patterns create extremely challenging logistical conditions. The new Jericho Lake ATV Park, Connecticut Lakes Headwaters forestlands, the White Mountain National Forest and private timberlands in Coos County provide a variety of options for locating treatment and control plots with fewer logistical challenges.

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Appendix A.

Location information for bird study plots

Table A.1. Location information for bird study plots

Plot	Treatment	Compartment (Stand)[1]	Stand Type[1]	Elevation[2]	Latilong[3]
Andritz	ATV	2(970)	H4B	1700-3340 ft	44° 43' 06" N 71 26' 56" W
Bordeau	ATV	2(1690;1700;1710;1750)	HS3C,H1A, H3A,HS3B	1440-1610 ft	44° 39' 38" N 71 29' 15" W
East Branch Middle	Control	4(3000)	H3C	2120-2440 ft	44° 44' 52" N 71 23' 34" W
East Branch South	Control	4(3940)	H3C	1780-2110 ft	44° 44' 11" N 71 24' 28" W
Jimmy Cole	Control	1(1180;1200;1210;1220;1230)	H3C,H3A, SH3C,HS3C, H1A	1430-1760 ft	44° 38' 42" N 71 26' 28" W
Picnic Loop	Control	4(2180;2450)	H4B,H3C	1440-1610 ft	44° 39' 38" N 71 29' 15" W
West Side Middle	ATV	2(1590;1620)	H3C,HS3B	1320-1790 ft	44° 40' 16" N 71 27' 35" W
West Side North	ATV	2(1170;1240)	H3B,HS3B	1450-1750 ft	44° 42' 04" N 71 26; 50" W

[1] From compartment maps generated by New Hampshire GRANIT in December 1989 based on data from US Department of Agriculture, US Forest Service and NH Department of Resources and Economic Development, Division of Forests and Lands, 1988.

[2] Approximate to nearest 10 ft. from USGS topographic quadrangles.

[3] For approximate center of plot edge along trail.

Appendix B.

Field Survey Protocol for 2002 Field Season

Nash Stream Bird Monitoring

Protocol for 2002 Field Season

Carol R. Foss

20 May 2002

CHECKLIST OF FIELD EQUIPMENT

binoculars
metal clipboard with
    field notebook
    site maps
    instruction packet
pencils
watch
compass (for forest sites only)
thermometer
whistle
black marker

water bottle
snacks
rain gear
extra clothes
sunscreen
insect repellent
moleskin
Swiss Army knife or Leatherman tool
headnet
bandanas
First aid kit

INSTRUCTIONS FOR BEHAVIOR MAPPING

PRE-SURVEY PREPARATION

Before leaving for a survey, make sure you have grid paper for the site you will be surveying. Write the site name, date, and your initials in the margin of each sheet.

FIELD IMPLEMENTATION

Cover each site once a week during June, and twice a week in July. To minimize time bias, alternate the direction in which sites are run and the set of transects covered on successive visits. (E.g., on the first visit, cover the "50 lines," working from 50 to 650, and on the second visit, cover the "100 lines", working from 700 back to 00.

Traverse site on flagged lines, using a compass to navigate between marked points. [DRED *may* have flagged between grid points, which would make your life easier, but is much more time consuming for them.] Move quietly with moderate speed, as conditions allow. A minimum of 30 minutes per 300m is recommended for thorough coverage.

Confirm your location at each 50m grid point. Pause there briefly to listen for new detections, especially if it has been impossible to move quietly between points. Another advantage to mapping from these points is that you know precisely where you are. However, you should stop to record new detections between points immediately, as the bird may move or stop vocalizing by the time you reach the next grid point.

Pay special attention to simultaneous detections of a given species, particularly singing males. Even if the location of one or both individuals is a bit vague, such records document that two birds are present, and the general areas in which they occur. This information is **crucial** for accurate map analysis, especially for species that are abundant on the site (e.g., BTNW, AMRE, REVI, et al.). (Note that the sex of some species [e.g., flycatchers, chickadees] cannot be determined either by sight or by song, and two vocalizing individuals may indicate a pair, rather than independent home ranges. Other behavioral cues can help determine whether or not two birds represent a pair.)

Carefully record movements of individuals within their home ranges, particularly movements between grid cells. This is especially important for species that maintain sizeable home ranges. This information also is crucial in delineating home ranges during map analysis.

While you are not making a special effort to look for nests, you are likely to discover some serendipitously. Avoid disturbance to nesting birds and leave the area quietly. Note location (e.g., on ground or height above ground, tree or shrub species, etc., and contents.

When you detect begging calls, pinpoint the location and move quickly and quietly towards the sound. If fledglings stop vocalizing as you approach, sit or stand quietly when you think you are nearby and wait for vocalizing to begin again, scrutinizing the area carefully for adults and

fledglings. At least initially, you will need to make visual contact with all fledglings or family groups to verify your identification and gain experience with their behavior. In general, spend up to about 15 minutes following up on a particular detection before moving on. (If the vocalizations were totally unfamiliar and you suspect fledglings of a species you haven't encountered yet, you may want to spend more time following up.)

Some adults may call frequently while gathering food for fledglings, and a male may sing while the female and fledglings forage nearby. Once the fledging season starts, it is important to look beyond what would have been a simple "sing" or "call" record earlier in the season.

[You are unlikely to encounter fledglings of many species during Phase I. Species most likely to fledge before July 1 include HAWO, BCCH, WBNU, MYWA, HETH. I am planning to come up and do some additional training on fledgling detection in early July, and will provide a "fledgling manual" with notes on behavior and vocalizations of species we have experience with, which should include most, if not all, of the species you are dealing with.]

As you gain experience, visual contact with fledglings or families of common species for which you are confident of identification is not essential, especially when several family groups are competing for your attention simultaneously. Some species are quite distinctive and can be distinguished after a little practice. Others are so similar to one another that visual contact may always be essential.

When you detect begging calls from several directions at once, it can be difficult to decide which to follow up on, and any decision you make runs the risk of failure to make visual contact with your first choice and subsequent silence of the other(s). To help in making decisions, bear the following factors in mind:

A vocalization you have never heard before should take priority over a familiar species.

A species for which fledglings are not yet documented on the site should take priority over species with previously documented fledglings.

The closer a fledgling is, the better chance you have of making a visual detection, although the terrain and vegetation between you and the bird can change the odds!

RECORDING BEHAVIOR-MAPPING DATA IN THE FIELD

General guidelines

Use the alpha codes provided for species (in capital letters) to record all observations (e.g. HETH, LEFL, REVI).

Number all observations consecutively (e.g. 1HETH, 2LEFL, 3REVI) on a given survey.

NEVER GUESS at a species' identification. If you are not certain of a bird's identity, use the UNKN code. If you know the family but not the species, use the UN__ codes (e.g., UNWO for an unknown woodpecker, UNVI for an unknown vireo]. Write down a description of the song, plumage, behavior and/or any other potential clues to identification. You may be able to convert the UNKN code to a species code after making visual contact with another individual of the same species, listening to tapes, or conferring with someone familiar with the species.

Recording data on maps:

Use an "x" to mark observations of known location (i.e., known to be in a given 50m cell or on a particular property).

Use a " ● " to mark observations of uncertain location. This symbol should be used when you know the general vicinity of the individual but not the specific 50m cell or property. (Calling or drumming woodpeckers, drumming grouse, and screaming Blue Jays often require a " ● ")

NOTE: Especially at the beginning of the season when your distance estimation is still rusty, you will find yourself needing to change mapped locations when you get more accurate fixes on a bird. Don't let this bother you - this is one of the reasons we map in pencil! Some songs carry for surprising distances.

Use an encircled x to mark nest locations.

Record movement of an individual with a solid line between beginning and ending points or from beginning point with arrow in direction of movement when the end point is unknown.

Record simultaneous observations of multiple individuals with a ≠ sign in the notebook (e.g., 25REVI ≠ 14REVI. When creating species maps, connect the simultaneous detections with a dashed line.

Record members of the same pair with a wavy line connecting the two individuals.

Record family groups in a concentrated area with a dotted circle or oval indicating the area within which they are foraging. If the group moves off, indicate the direction with an arrow, and any new locations of the group with additional circles or ovals connected by arrows.

Record observations of scattered multiple fledglings (particularly useful for thrushes and woodpeckers) with a dotted line.

Recording data in the notebook:

Record site, date, start time, weather at start (see below), end time, weather at end.

It is helpful to record each 50m grid point and the time as you pass the point.

Birds

For all bird observations, record the following:

time of observation
observation number and species code
sex, if known
age of individual
(see age categories for fledglings)
behavior code(s) (see below)
number of individuals (if flock, family group; indicate p for pairs)
any pertinent comments

Nests

Record location, including approximate height above ground, fork or side branch, tree/shrub species, tree condition (dead or alive), etc.

Weather data

Temperature
Wind (none, light, moderate, strong)
Sky (clear, partly cloudy, mostly cloudy, overcast, fog)
Precipitation (none, mist, showers, light rain, moderate rain, sleet, flurries)

Sex categories

f female
m male
p pair
b both (family groups)
u unknown

Age categories

ad adult
fl fledgling (or, if possible, use
rf recent fledgling (down present, barely flying)
of older fledgling (no down, flies well)
mx mixed (family groups)
un unknown

Behavior codes

agch	aggressive chase (interspecific or intraspecific)
agit	agitated
aggr	aggressive (toward observer) (RUGR, NOGO)
atfl	attending fledgling
cafe	carrying fecal sac(s)
cafo	carrying food
call	calling
canm	carrying nesting material
coch	courtship chase
cofe	courtship feeding
copu	copulation
cshp	(other) courtship activity
dist	distraction display
drum	drumming (grouse and woodpeckers)
exca	excavating
famg	family group
fefl	feeding fledgling
fldi	flight display (particularly for purple finch)
fled	unaccompanied fledgling(s)
fora	foraging
movi	moving (in or below canopy)
nebu	nest building
neeg	nest with eggs
nehe	nest with hatched eggs (particularly for grouse)
neyg	nest with young
onne	on nest (particularly for cavity nesters)
pequ	perched quietly
secr	secretive female
sing	singing
soli	soliciting (female)
unch	unknown chase
vins	visiting nest site (cavity or other hidden site)
vofl	(characteristic) fledgling vocalizations

Feel free to invent new codes if you feel that nothing fits!

POST-SURVEY DATA MANAGEMENT

Generating species maps from field maps

Each crew member is responsible for promptly transferring their behavior-mapping data to species maps.

After the first behavior-mapping survey, generate a separate map sheet for each species encountered on your site. On subsequent surveys, generate a map sheet for any species not previously encountered on the site.

When transferring data from the field map to the species map, include both the observation number and the date, and replace the species code with the behavior code. Be sure to transfer locations accurately.

As on the field maps, use "x" for known locations, " ● " for uncertain locations, and an encircled x for nest sites; indicate simultaneous observations with broken lines, movement of individuals with solid lines, members of a pair with a wavy line, scattered fledglings with dotted lines, and family groups with ovals.

SPECIES CODES

AMCR	American Crow
AMRE	American Redstart
AMRO	American Robin
AMWO	American Woodcock
BAOW	Barred Owl
BAWW	Black-and-White Warbler
BBCU	Black-billed Cuckoo
BCCH	Black-capped Chickadee
BTBW	Black-throated Blue Warbler
BTNW	Black-throated Green Warbler
BLJA	Blue Jay
BRCR	Brown Creeper
BHCO	Brown-headed Cowbird
BWHA	Broad-winged Hawk
CAWA	Canada Warbler
CEDW	Cedar Waxwing
CSWA	Chestnut-sided Warbler
CHSW	Chimney Swift
COGR	Common Grackle
COME	Common Merganser
CORA	Common Raven
COYE	Common Yellowthroat
COHA	Cooper's Hawk
DOWO	Downy Woodpecker
EAKI	Eastern Kingbird
EAPH	Eastern Phoebe
EAWP	Eastern Wood-Pewee
GRCA	Gray Catbird
GCFL	Great Crested Flycatcher
GHOW	Great Horned Owl
HAWO	Hairy Woodpecker
HETH	Hermit Thrush
LEFL	Least Flycatcher
MODO	Mourning Dove
MOWA	Mourning Warbler
NAWA	Nashville Warbler
NOFL	Northern Flicker
NOGO	Northern Goshawk
NOPA	Northern Parula
NSWO	Northern Saw-whet Owl
NOWA	Northern Waterthrush
OVEN	Ovenbird
PIWO	Pileated Woodpecker
RBNU	Red-breasted Nuthatch
REVI	Red-eyed Vireo
RSHA	Red-shouldered Hawk
RTHA	Red-tailed Hawk
RBGR	Rose-breasted Grosbeak
RTHU	Ruby-throated Hummingbird
RUGR	Ruffed Grouse
SCTA	Scarlet Tanager
SOVI	Solitary Vireo
SOSP	Song Sparrow
SPSA	Spotted Sandpiper
SSHA	Sharp-shinned Hawk
TRES	Tree Swallow
TUTI	Tufted Titmouse
VEER	Veery
WAVI	Warbling Vireo
WBNU	White-breasted Nuthatch
WTSP	White-throated Sparrow
WIWR	Winter Wren
WITU	Wild Turkey
WODU	Wood Duck
WOTH	Wood Thrush
YBSA	Yellow-bellied Sapsucker

Appendix C.

Field Survey Protocol for 2003 Field Season

Nash Stream Bird Monitoring

Protocol for 2003 Field Season

Carol R. Foss

20 May 2003

CHECKLIST OF FIELD EQUIPMENT

binoculars
metal clipboard with
    field notebook
    site maps
    instruction packet
pencils
watch
compass (for forest sites only)
thermometer
whistle
black marker

water bottle
snacks
rain gear
extra clothes
sunscreen
insect repellent
moleskin
Swiss Army knife or Leatherman tool
headnet
bandanas
First aid kit

INSTRUCTIONS FOR BEHAVIOR MAPPING

PRE-SURVEY PREPARATION

Before leaving for a survey, make sure you have enough rite-in-rain grid paper to cover the site. Write the site name, date, and your initials in the margin.

FIELD IMPLEMENTATION

Cover each site once a week during June and July. To minimize time bias, alternate the direction in which sites are run and the set of transects covered on successive visits. (E.g., on the first visit, cover the "50 lines," working from 50 to 650, and on the second visit, cover the "100 lines", working from 700 back to 00.

Traverse site on flagged lines, using a compass to navigate between marked points. Move quietly with moderate speed, as conditions allow. A minimum of 30 minutes per 300m is recommended for thorough coverage.

Confirm your location at each 50m grid point. Pause there briefly (1-2 minutes) to listen for new detections, especially if it has been impossible to move quietly between points. Another advantage to mapping from these points is that you know precisely where you are. However, you should record new detections between points immediately, as the bird may move or stop vocalizing by the time you reach the next grid point.

Pay special attention to simultaneous detections of a given species, particularly singing males. Even if the location of one or both individuals is a bit vague, such records document that two birds are present, and the general areas in which they occur. This information is **crucial** for accurate map analysis, especially for species that are abundant on the site (BTNW, AMRE, REVI, et al.). (Note that the sex of some species [e.g., flycatchers, chickadees, nuthatches] cannot be determined either by sight or by song, and two vocalizing individuals may indicate a pair, rather than independent home ranges. Other behavioral cues can help determine whether or not two birds represent a pair.)

Carefully record movements of individuals within their home ranges, particularly movements between grid cells. This is especially important for species that maintain sizeable home ranges. This information also is crucial in delineating home ranges during map analysis.

Closely observe interactions between individuals to determine their species and sex. An aggressive chase (between two males of the same or different species) qualifies only as an established territory, while a courtship chase documents the presence of a pair.

While you are not making a special effort to look for nests, you are likely to discover some serendipitously. Avoid disturbance to nesting birds and leave the area quietly. Note tree/shrub species, height above ground, and any other distinguishing features.

When you detect begging calls: record time and pinpoint location. Move quickly and quietly toward the sound, then stop and sit quietly when you think you are close. At least initially, you should make visual contact with all fledglings and family groups to verify your identification and gain experience with their behavior. If fledglings stop vocalizing as you approach, sit or stand quietly when you think you are nearby and wait for vocalizing to begin again, scrutinizing the area carefully for adults and fledglings. In general, spend about 15 minutes following up on a particular detection before moving on. (If the vocalizations are totally unfamiliar and you suspect fledglings of a species you haven't encountered yet, you may want to spend more time following up.)

Once the fledging season starts (late June for cavity nesters), it is important to look beyond what would have been a simple "sing" or "call" record earlier in the season. Some adults may call frequently while foraging to feed fledglings, and a male may sing while the female and fledglings forage nearby.

As you gain experience, visual contact with fledglings or families of common species for which you are confident of identification is not essential, especially when several family groups are competing for your attention simultaneously. Some species are quite distinctive and can be distinguished after a little practice. Others are so similar to one another that visual contact may always be essential.

When begging calls are detected from several directions at once, it can be difficult to decide which to follow up on, and any decision you make runs the risk of failure to make visual contact with your first choice and subsequent silence of the other(s). To help in making decisions, bear the following factors in mind:

A vocalization you have never heard before should take priority over a familiar species.

A species for which fledglings are not yet documented on the site should take priority over species with previously documented fledglings.

A home range for which fledglings are not yet documented should take priority over a home range with previously documented fledglings.

The closer a fledgling is, the better chance you have of making a visual detection, although the terrain and vegetation between you and the bird can change the odds!

RECORDING BEHAVIOR-MAPPING DATA IN THE FIELD

General guidelines

Use the alpha codes provided for species (in capital letters) to record all observations (e.g. HETH, LEFL, REVI).

Number all observations consecutively (e.g. 1HETH, 2LEFL, 3REVI) on a given survey.

NEVER GUESS at a species identification. If you are not 98% certain of a bird's identity, use the UNKN code. If you know the family but not the species, use the UN__ codes. Write down a description of the song, plumage, behavior and/or any other potential clues to identification. You may be able to convert the UNKN code to a species code after making visual contact with another individual of the same species, listening to tapes, or conferring with the rest of the crew.

Recording data on maps:

Use an "x" to mark observations of known location (i.e., known to be in a given 50m cell).

Use a "." to mark observations of uncertain location. This symbol should be used when you know the general vicinity of the individual but not the specific 50m cell. (Calling or drumming woodpeckers, drumming grouse, and screaming Blue Jays often require a ".")

NOTE: Especially at the beginning of the season when your distance estimation is still rusty, you will find yourself needing to change mapped locations when you get more accurate fixes on a bird. Don't let this bother you - this is one of the reasons we map in pencil! Some songs carry for surprising distances.

Use an encircled x to mark nest locations.

For all bird, squirrel and chipmunk observations record "x" or "." in appropriate location, observation number, and species code.

Record movement of an individual with a solid line between beginning and ending points or from beginning point with arrow in direction of movement when the end point is unknown.

Record observation of members of the same pair with a wavy line connecting the two individuals.

Record family groups in a concentrated area with a dotted circle or oval indicating the area within which they are foraging. If the group moves off, indicate the direction with an arrow, and any new locations of the group with additional circles or ovals connected by arrows.

Record observations of scattered multiple fledglings (particularly useful for thrushes and woodpeckers) with a dotted line.

Recording data in the notebook:

Record site, date, start time, weather at start (see below), end time, weather at end.

Record each 50m point as you pass and your time of arrival at the point.

Birds

For all bird observations, record the following:

- time of observation
- species code and observation number
- sex (m, f, p, b, u) and age (ad, fl, mx, un) of individual
  - (see age categories for fledglings)
- behavior code(s) (see below)
- whether Seen, Heard, or Both (it's easiest to assume Heard unless otherwise noted)
- any pertinent comments

Record simultaneous observations of multiple individuals with a does-not-equal symbol. (i.e., 25REVI does not equal 14REVI. When creating species maps, connect the simultaneous detections with a dashed line.

Nests

Record location, including approximate height above ground, fork or side branch, tree/shrub species, tree condition (dead or alive), etc.

Fledglings

To the extent practical, record frequency and description of vocalizations, number of fledglings in group, sex of accompanying adult, unique plumage features, as well as species, observation code, behavior, and fledgling stage.

Native Mammals

For chipmunks and squirrels, record time of observation, species code, observation number, and number of individuals.

Weather data

Temperature
Wind (none, light, moderate, strong)
Sky (clear, partly cloudy, mostly cloudy, overcast, fog)
Precipitation (none, mist, showers, light rain, moderate rain, sleet, flurries)

Sex categories

f female
m male
p pair
b both (family groups)
u unknown

Age categories

ad adult
fl fledgling (or, if possible, use
rf recent fledgling (down present, barely flying)
of older fledgling (no down, flies well)
mx mixed (family groups)
un unknown

Fledgling characteristics

bp	begging posture
cl	clumsy landing
dp	down present
eg	expanded gape
fw	flying well
nf	not capable of sustained flight
st	stubby tailed

Behavior codes

agch	aggressive chase (interspecific or intraspecific)
agit	agitated
aggr	aggressive (toward observer)
atfl	attending fledgling
cafe	carrying fecal sac(s)
cafo	carrying food
call	calling
canm	carrying nesting material
coch	courtship chase
cofe	courtship feeding
copu	copulation
cshp	(other) courtship activity
dist	distraction display
drum	drumming (grouse and woodpeckers)
exca	excavating
famg	family group
fefl	feeding fledgling
fldi	flight display (particularly for purple finch)
fled	unaccompanied fledgling
fora	foraging
movi	moving (in or below canopy)
nebu	nest building
neeg	nest with eggs
nehe	nest with hatched eggs (particularly for grouse)
neyg	nest with young
onne	on nest (particularly for cavity nesters)
pequ	perched quietly
secr	secretive female
sing	singing
soli	soliciting (female)
unch	unknown chase
vins	visiting nest site (cavity or other hidden site)
vofl	(characteristic) fledgling vocalizations

If you observe a behavior that does not easily fit into one of the above categories, describe it in your notebook and discuss the possibility of adding a new behavior code with your supervisor.

POST-SURVEY DATA MANAGEMENT

Generating species maps from field maps

Each crew member is responsible for promptly transferring their behavior-mapping data to species maps.

After the first behavior-mapping survey for a site, generate a separate map sheet for each species encountered on the site. On subsequent surveys, generate a new map sheet for any species not previously encountered.

When transferring data from the field map to the species map, include both the observation number and the date, and replace the species code with the behavior code. Be sure to transfer locations accurately.

As on the field maps, use "x" for known locations, "." for uncertain locations, and an encircled x for nest sites. Indicate simultaneous observations with dashed lines, movement of individuals with solid lines, members of a pair with a wavy line over a dashed line, scattered fledglings with dotted lines, and family groups with ovals.

SPECIES CODES

AMCR	American Crow
AMRE	American Redstart
AMRO	American Robin
AMWO	American Woodcock
BAOR	Baltimore Oriole
BANS	Bank Swallow
BAOW	Barred Owl
BAWW	Black-and-White Warbler
BCCH	Black-capped Chickadee
BTBW	Black-throated Blue Warbler
BTNW	Black-throated Green Warbler
BLJA	Blue Jay
BRCR	Brown Creeper
BWHA	Broad-winged Hawk
CAWA	Canada Warbler
CEDW	Cedar Waxwing
CSWA	Chestnut-sided Warbler
CHSW	Chimney Swift
CHSP	Chipping Sparrow
CORA	Common Raven
COYE	Common Yellowthroat
COHA	Cooper's Hawk
DOWO	Downy Woodpecker
EAKI	Eastern Kingbird
EAWP	Eastern Wood-Pewee
GRCA	Gray Catbird
GCFL	Great Crested Flycatcher
GHOW	Great Horned Owl
HAWO	Hairy Woodpecker
HETH	Hermit Thrush
LEFL	Least Flycatcher
MALL	Mallard
MODO	Mourning Dove

NAWA	Nashville Warbler
NOFL	Northern Flicker
NOGO	Northern Goshawk
NSWO	Northern Saw-whet Owl
OVEN	Ovenbird
PIWO	Pileated Woodpecker
RBNU	Red-breasted Nuthatch
REVI	Red-eyed Vireo
RSHA	Red-shouldered Hawk
RTHA	Red-tailed Hawk
RBGR	Rose-breasted Grosbeak
RTHU	Ruby-throated Hummingbird
RUGR	Ruffed Grouse
SCTA	Scarlet Tanager
SOVI	Solitary Vireo
SOSP	Song Sparrow
SSHA	Sharp-shinned Hawk
TRES	Tree Swallow
TUTI	Tufted Titmouse
VEER	Veery
WAVI	Warbling Vireo
WBNU	White-breasted Nuthatch
WTSP	White-throated Sparrow
WIWR	Winter Wren
WITU	Wild Turkey
WOTH	Wood Thrush
YBSA	Yellow-bellied Sapsucker

UNKNOWN SPECIES CODES

UNFL	Unidentified flycatcher
UNNU	Unidentified nuthatch species
UNSP	Unidentified sparrow species
UNTH	Unidentified thrush species
UNVI	Unidentified vireo species
UNWA	Unidentified warbler species
UNWO	Unidentified woodpecker species

MAMMAL CODES

GRSQ	Gray squirrel
RESQ	Red squirrel
EACH	Eastern chipmunk

Sites:

All sites are 700 m long by 300 m deep and are oriented along a road.

ATV trail sites

- Andritz Trail
- Bordeau Trail
- West Side Middle
- West Side North

Control sites

- East Branch Middle
- East Branch South
- Jimmy Cole
- Picnic Loop

Pairings for field work

West Side Middle
Bordeau Trail

West Side North
Andritz Trail

East Branch Middle
East Branch South

Jimmy Cole
Picnic Loop

Appendix D.

Status of bird species detected on study plots

Table D.1. Status of bird species detected on study plots adjacent to ATV trails and gated forestry roads on Nash Stream State Forest during 2003 breeding season. (ESHR: male with established home range; PAIR: pair present; NEST: nesting evidence observed; SUFL: successful fledging documented)

Species	AND	BOR	WSM	WSN	ESM	ESS	JC	PL
AMRE	ESHR	ESHR	ESHR	ESHR	PAIR	ESHR	ESHR	ESHR
AMRO	–	ESHR	NEST	ESHR	NEST	VISI	PAIR	VISI
BAOW	–	–	–	–	–	–	VISI	–
BAWW	–	–	VISI	VISI	ESHR	–	–	–
BBWA	VISI	VISI	VISI	–	–	–	VISI	VISI
BCCH	VISI	VISI	VISI	VISI	SUFL	SUFL	VISI	SUFL
BHVI	–	VISI	–	–	–	–	VISI	–
BLJA	VISI	VISI	SUFL	VISI	–	VISI	–	VISI
BRCR	–	VISI	–	–	–	–	–	–
BTBW	ESHR	ESHR	VISI	ESHR	ESHR	PAIR	ESHR	ESHR
BTNW	ESHR	ESHR	SUFL	SUFL	ESHR	SUFL	ESHR	SUFL
BWHA	VISI	–	–	–	VISI	–	–	–
CEDW	–	VISI	VISI	VISI	–	VISI	VISI	–
COYE	VISI	–	VISI	VISI	–	–	–	–
CSWA	–	–	VISI	–	–	–	–	–
DOWO	–	VISI	–	–	–	–	VISI	NEST
EAWP	–	VISI	–	–	–	–	–	VISI
GRJA	VISI	–	–	–	–	–	–	–
HAWO	–	SUFL	–	VISI	VISI	VISI	–	NEST
HETH	ESHR	SUFL	ESHR	VISI	VISI	NEST	SUFL	SUFL
NAWA	–	–	–	–	–	–	–	VISI
NOFL	–	–	VISI	VISI	–	–	–	–
OVEN	ESHR	NEST	ESHR	ESHR	ESHR	ESHR	ESHR	NEST
PUFI	–	–	–	–	–	–	–	VISI
REVI	ESHR	SUFL	ESHR	PAIR	ESHR	ESHR	ESHR	ESHR
RUGR	VISI	SUFL	–	VISI	VISI	VISI	SUFL	NEST
SCTA	VISI	VISI	ESHR	VISI	VISI	VISI	VISI	–
SWTH	VISI	ESHR	–	VISI	–	–	–	VISI
VEER	VISI	–	–	VISI	VISI	VISI	–	–
WBNU	VISI	VISI	–	–	–	–	VISI	VISI
WIWR	–	ESHR	–	VISI	VISI	VISI	VISI	ESHR
WTSP	–	–	–	–	VISI	–	–	–
YBSA	–	NEST	–	VISI	–	–	SUFL	VISI
YRWA	–	–	–	–	VISI	VISI	–	–

Table D.2. Alpha codes, common names, scientific names, and 1994 phenological data for bird species detected on study plots adjacent to ATV trails and gated forestry roads on Nash Stream State Forest during 2003 breeding season.

Alpha code	Common name	Scientific name	Evidence of nest with eggs or young	Evidence of fledged young
AMRE	American Redstart	*Setophaga ruticilla*		
AMRO	American Robin	*Turdus migratorius*		
BAOW	Barred Owl	*Strix varia*		
BAWW	Black-and-White Warbler	*Mniotilta varia*		25 July
BBWA	Bay-breasted Warbler	*Dendroica castanea*		
BCCH	Black-capped Chickadee	*Poecile atricapillus*		13-15 July
BHVI	Blue-headed Vireo	*Vireo solitarius*		
BLJA	Blue Jay	*Cyanocitta cristata*		21 July
BRCR	Brown Creeper	*Certhia americana*		
BTBW	Black-throated Blue Warbler	*Dendroica caerulescens*		2 July – 9 August
BTNW	Black-throated Green Warbler	*Dendroica virens*		24 June – 20 July
BWHA	Broad-winged Hawk	*Buteo platypterus*		
CEDW	Cedar Waxwing	*Bombycilla cedrorum*		13-27 July
COYE	Common Yellowthroat	*Geothlypis trichas*		2-27 July
CSWA	Chestnut-sided Warbler	*Dendroica pensylvanica*		2-24 July
DOWO	Downy Woodpecker	*Picoides pubescens*		
EAWP	Eastern Wood-Pewee	*Contopus virens*		6-25 July
GRJA	Gray Jay	*Perisoreus canadensis*		
HAWO	Hairy Woodpecker	*Picoides villosus*	6 June – 14 July	
HETH	Hermit Thrush	*Catharus guttatus*	23-30 July	
NAWA	Nashville Warbler	*Vermivora ruficapilla*		
NOFL	Northern Flicker	*Colaptes auratus*		
OVEN	Ovenbird	*Seirus aurocapillus*		2 July – 9 August
PUFI	Purple Finch	*Carpodacus purpureus*		
REVI	Red-eyed Vireo	*Vireo olivaceus*		9 August
RUGR	Ruffed Grouse	*Bonasa umbellus*	30 May	13 July
SCTA	Scarlet Tanager	*Piranga olivacea*		
SWTH	Swainson's Thrush	*Catharus ustulatus*	9 June – 6 July	25 July
VEER	Veery	*Catharus fuscescens*		6-21 June
WBNU	White-breasted Nuthatch	*Sitta carolinensis*		
WIWR	Winter Wren	*Troglodytes troglodytes*		20-25 July
WTSP	White-throated Sparrow	*Zonotrichia albicollis*	15 June	2-25 July
YBSA	Yellow-bellied Sapsucker	*Sphyrapicus varius*		6 July
YRWA	Yellow-rumped Warbler	*Dendroica coronata*		