FACTORS AFFECTING HEN BLUE GROUSE RESPONSES TO HUMAN DISTURBANCE

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Abstract: Flushing counts are the preferred method for censusing blue grouse populations. Therefore it is important to know which factors affect flushing behavior. Little is known about the affects repeated exposure to humans has on blue grouse flushing behavior. Using a non-invasive behavioral test, I compared 11 habitat, environmental, and behavioral factors for 3 flushing behaviors (total distance moved, distance from observer at which a hen assumed an alert posture, and whether or not a flush occurred during a test). Time of day, age of chicks, cover type, and level of human contact affected flushing behavior. While cover type and level of human contact had the greatest affect on flushing rate, I recommend that flushing counts include data for these factors along with raw data.

Habituation is defined as a reduction in response to a stimulus following repeated exposure to the stimulus (Drickamer et al.1996, Barrows 2001). Drickamer et al. (1996) added that habituation is not merely a temporary change in displayed behavior, but rather involves, “persistent changes in the brain or spinal cord.” Animals learn which stimuli indicate the presence of danger and which do not. Subsequently, they learn to respond to stimuli that indicate danger and to ignore other, non-dangerous stimuli in their environment. Habituation is a normal learning process for most animals (Drickamer et al. 1996).

Many studies have been conducted on blue grouse (*Dendragapus obscurus*) behavior and most have examined intraspecific behavior, especially involving aggression and courtship displays (Blackford 1958, Blackford 1963, Falls and McNicholl 1979, Hannon 1980, Lewis 1984, Bergerud and Butler 1985). Only a few have addressed the subject of response to human intrusion (Bergerud and Hemus 1975, Zwickel et al. 1977, McNicholl 1983).

Bergerud and Hemus (1975) examined the distance male blue grouse flushed from a human observer and found no statistical difference between populations. Additionally, they indicated that cover density was the major factor affecting response to a human intruder.

During a study on the demography of 2 populations of blue grouse, Zwickel et al. (1977) concluded that birds at 1 site were "wilder" than birds at another site based on differences in the distance that birds flushed. The "wilder" birds had less contact with humans.

In observing aggressive behaviors male blue grouse display toward other males, McNicholl (1983) attempted to determine whether individuals would habituate to a human intruder over time. He developed a tameness scale to quantitatively determine whether habituation occurred. While his overall impression was that grouse did habituate, it could not be shown quantitatively.

Because flushing counts are the preferred method for censusing grouse populations, it is important to understand factors that may influence these counts. Traditionally cover classes or level of human contact have not been considered when data from flushing counts is compared between areas or between years (Martinka and Swenson 1981).

During the summer of 2001 I compared 2 populations of hen blue grouse in central Idaho for differences in flushing behavior. Three flushing behaviors were compared: total distance moved, distance from observer at which a hen assumed an alert posture, and whether or not a flush occurred during a test.

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STUDY AREA

The study area was centered at the Taylor Ranch Field Station of the University of Idaho, a 26-ha inholding along Big Creek near the center of the 951,045-hectare Frank Church-River of No Return Wilderness in central Idaho (N 45° 06' 08.8" W 114° 50' 59.3"). Elevations range from 1,040 m to 1,220 m. The landscape is dominated by Douglas fir (*Pseudotsuga menziesii*) Ponderosa pine (*Pinus ponderosa*) forest. Riparian vegetation includes wild rose (*Rosa* spp.), willow (*Salix* spp.), currant (*Ribes* spp.), red osier dogwood (*Cornus stolonifera*), hawthorn (*Crataegus* spp.), and birch (*Betula* spp.). A few grassy flats also exist along the creek which include blue bunch wheat grass (*Schizachyrium scoparium*), Idaho fescue (*Festuca idahoensis*), and cheat grass (*Bromus tectorum*). During August 2000, the Diamond Point Fire Complex burned lower Big Creek. In some areas the burn was nearly 100% and 1 year later many sites had failed to re-vegetate.

The experimental population of blue grouse were those birds living on and adjacent to the Taylor Ranch. Vegetation at the ranch consists of pastureland surrounded by typical Big Creek vegetation. In June hens bring their broods to the ranch to feed on grasshoppers, which are abundant in the pastures. During the summer, Taylor Ranch has an average of 20 human users per day. Because of this high concentration of people, hens regularly encounter humans while on ranch property.

The control population of blue grouse consisted of birds encountered more than 2 km from Taylor Ranch on the Big Creek Trail. The Big Creek Trail begins at the community of Big Creek, 56 km upstream and west of Taylor Ranch and converges with the Middle Fork Trail at the confluence of Big Creek and the Middle Fork of the Salmon River, 11.2 km east of Taylor Ranch. The Big Creek Trail receives little human use during the summer and blue grouse hens that live along the trail encounter humans infrequently.

METHODS

Capture and Marking

Blue grouse hens were located at Taylor Ranch using a systematic search of the property from early June to early July 2001. Hens were captured using noose poles (Zwickel and Bendell 1967). Each hen was banded with a unique combination of colored, plastic leg bands as well as an aluminum Idaho Department of Fish and Game band.

Behavioral Testing

Hens were located using systematic searches of Taylor Ranch property and the Big Creek Trail. Initially, hens were approached to survey behaviors of individuals residing at the ranch. During this time, behaviors displayed by the hens were recorded each time they were approached. An actigram (adapted from Walter 1983) of over 30 behaviors and vocalizations was then developed for recording behaviors during the testing phase of the project (Table 1). From this actigram, and based on McNicholl (1983), a tameness scale was developed to quantify relative tameness or wildness between individuals (Table 2).

Throughout the summer banded experimental birds at Taylor Ranch, unbanded experimental birds at Taylor Ranch, and control birds on the Big Creek Trail were tested. Testing involved an observer walking toward the hen while I watched the hen. I signaled the observer to drop a marker when the hen displayed an alert posture. As the hen moved away from the observer the observer would continue to walk toward the point at which the hen had first been located. Once the observer reached the hen's initial location, the observer stopped and dropped a marker. The hen was then watched until she displayed calm behaviors and I recorded the time the hen resumed calm behavior. The observer then walked to that point and dropped a marker so that the total distance moved during the test could be measured and recorded. The distance between the observer and the location the hen assumed the alert posture was also measured and recorded. All distances were measured with a tape measure. I also recorded the escape behaviors the hen displayed and whether or not she flushed during the test.

Hens were tested under 11 different habitat, environmental, and behavioral factors to isolate those that affect the 3 flushing behaviors. Birds with different levels of human contact (banded experimental, unbanded experimental, and control) were tested by 6 different observers, for 4 weeks (to determine whether changes occurred over time), at different times of day (from 08:00 to 22:00), air temperature (measured at the time of testing using a small, portable mercury thermometer), in different cover types (pasture, tall grass, brush, forest, and edge), with different chick numbers (counted prior to beginning of test; from 1 to 7 chicks) and ages of chicks (based on size of chicks; from 3 to 8 weeks old), and when hens were involved in different activities prior to testing (feeding, preening, in sentinal position, dust bathing, etc.).

Data Analysis

The null hypothesis of this experiment was that the 3 flushing behaviors are independent of the habitat, environmental, or behavioral factors. SYSTAT 10 and Microsoft Excel computer programs were used to perform Chi-squared correlations and ANOVA tests, on the 3 flushing behaviors (total distance moved, distance from observer at which a hen assumed an alert posture, and whether or not a flush occurred during a test) for the 11 habitat, environmental, and behavioral factors: bird type (banded, unbanded, or control), observer, week of study period, time of day, air temperature, activity prior to disturbance, cover type prior to disturbance, age of chicks, number of chicks, and tameness scale score. A significance level of 0.100 was used in all tests.

RESULTS

Eighteen blue grouse hens were captured at Taylor Ranch during the summer of 2001. Forty-seven tests were performed on hen blue grouse in the study areas (26 on banded experimental birds, 12 on unbanded experimental birds, and 9 on control birds). All tests occurred during a 4-week period that lasted from mid-July to mid-August.

Of the 11 habitat, environmental, and behavioral factors tested only bird type was significant for all 3 flushing behaviors.

Alert Posture

Alert posture was characterized by a cessation in calm behavior and head held upright. Often the hen would look directly at the observer when assuming the alert posture. An ANOVA test was performed on each of the 11 factors, and of these, bird type (F=3.675, P=0.036) and age of chicks (F=3.633, P=0.041) were associated with alert posture.

Unbanded experimental birds assumed an alert posture at the greatest distance (47 m) from the observer (Figure 1). Banded and control birds allowed observers to approach to equally (30 m and 29 m, respectively) before they assumed an alert posture.

As chicks increased in age, hens assumed an alert posture at a greater distance (Figure 2). Hens with young chicks assumed an alert posture at <30 m while those with oldest chicks were alert at a mean distance of 48 m.

Total Distance Moved

Total distance moved was the straight-line distance between the hen's location at the beginning of the test and the point at which the hen resumed calm behaviors. Bird type (F=2.697, P=0.079) affected total distance moved. Banded experimental birds moved the shortest distance during testing (11 m) compared to unbanded experimental birds (15 m) and control birds (17 m; Figure 3).

Flushing Rate

Flushing rate was recorded as "flush did not occur" or "flush occurred." Bird type, tameness scale score, time of day, and cover type prior to disturbance all had $P <$ 0.100 and followed predictable trends.

Control birds flushed in 56% of tests compared to 15% and 8% for banded experimental and unbanded experimental birds, respectively (Figure 4). Furthermore, flushing rate was positively correlated with tameness scale score (higher tameness scale scores indicate "wilder" birds; Figure 5).

Flushing rate decreased later in the day (Figure 6). Hens flushed only during the morning hours. Hens flushed in 75% of tests performed in forested areas (Figure 7) and hens were least likely to flush in pastures (7%).

DISCUSSION

Different observers had no detectable affect on the 3 flushing behaviors, indicating that hens did not react to individual observers. Therefore, all tests could be grouped together without consideration of observer. Air temperature also had no detectable affect on flushing behavior.

Level of habituation did not significantly change during the testing period. Any habituation that existed must have occurred in the 6 weeks between the hens arriving at Taylor Ranch and the beginning of testing.

Activity prior to disturbance also was not related to flushing behaviors. It was apparent that once a hen became aware of an approaching human, she reacted to intrusion in the same way regardless of her activity prior to the disturbance.

Time of day was related to flushing behaviors. Hens seemed less alert at mid-day, moved further later in the day, and flushed only in the morning. Hens may not flush late in the day because there would not be enough time to re-locate their chicks prior to roosting for the night. While there was no single, underlying pattern related to time of day, it should be considered when comparing flushing count data between areas or years.

Age of chicks was positively correlated with increasing severity of reaction (assumed an alert posture at greater distances, moved further, and had a higher flushing rate) to human intrusion. Furthermore, older chicks flushed along with hens more often. Therefore, number of weeks post-hatch may also need to be considered when interpreting flushing count data. Number of chicks did not affect any of the flushing behaviors. Hens apparently react to human intrusion independently of the number of chicks in their brood.

While cover type and bird type both seemed to affect flushing rate, they were closely related. Of the 47 tests conducted, 29 were in pastured areas. Only 1 of the 29 tests conducted in pastured areas was with a control bird. Both experimental birds and birds in pastured areas flushed much less often than control birds and birds in other cover types. From this it is difficult to determine whether flushing rate was more closely related to cover type or level of human contact.

Cover type undoubtedly had a major affect on the flushing behavior of hen blue grouse. Bergerud and Hemus (1975) and Martinka and Swenson (1981) also suggested that density of cover has a large affect on grouse flushing behavior. Birds were more likely to flush if sufficient cover was available to flush toward. Birds in the middle of pastures or large, grassy flats simply moved away from human intruders making detection of these birds more difficult.

Tameness scale score provided evidence that bird type is the proximal cause of differences in flushing rate. "Tamer" birds were less likely to flush, suggesting that bird type (and therefore level of human contact) had an affect on flushing rate as well as cover type. This corroborates Zwickel et al. (1977) and McNicholl (1983) findings that blue grouse do habituate to humans.

MANAGEMENT IMPLICATIONS

Variables that influence flushing behavior of blue grouse should remain constant between survey areas and years (Martinka and Swenson 1981). Observer, week of study period, activity prior to disturbance, air temperature, and number of chicks did not affect flushing behavior of hen blue grouse and therefore do not need to be considered when examining flushing count data. Time of day and age of chicks both were important factors influencing flushing behavior and may need to be consistent for flushing count data.

Results indicate that cover type and level of human contact had significant influences on flushing behavior, especially flushing rate. Managers should bear in mind that these 2 factors seem to influence blue grouse behavior a great deal. Flushing counts should include data on these 2 factors along with raw counts in the future.

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Table 1. Actigram of blue grouse hens from central Idaho, summer 2001 (adapted from Walter 1983).

CALM BEHAVIORS		AGGRESSIVE/DISPLAY BEHAVIORS		ESCAPE BEHAVIORS	
Behavior	Symbol	Behavior	Symbol	Behavior	Symbol
sentinal	Cs	alert posture	Aa	crouch posture	Ec
neutral	Cn	crest raised	Acr	walk away	Ew
feeding	Cf	neck stretched	Ans	run away	Er
calm walk	Cw	neck fluffed	Anf	herding chicks	Eh
preening	Cp	tail raised	Atr	chick flush	Eb
dust bathing	Cd	tail fanned	Atf	short flush (<10 m)	Es
hunched	Ch	whole body fluffed	Afb	full flush (>10 m)	Ef
calm cluck	Cc	white shoulder spot visible	As		
		full display	Ad		
		head bobbing	Ahb		
		aggressively move at observer	Am		
		flap wings	Afw		
		"attack" observer	Az		
		aggressive cluck	Ac		
		cackling (laughing) call	Al		
		hiss	Ah		
		whinny	Aw		
		tweet	At		

Table 2. Tameness scale for blue grouse hens from central Idaho, summer 2001 (adapted from McNicholl 1983).

SCALE 1: REACTION TO OBSERVER

1 = resumed feeding after displaying alert posture

2 = behavior pattern did not include crouch posture, entering cover, or flushing

3 = behavior pattern included short flush

4 = behavior pattern included crouch posture or entering cover

5 = behavior pattern included full flush

SCALE 2: NUMBER OF AGGRESSIVE BEHAVIORS (excluding alert posture)

1 = zero

2 = 1-2 aggressive behaviors

3 = 3-4 aggressive behaviors

4 = 5-6 aggressive behaviors

5 = > 6 aggressive behaviors

SCALE 3: TIME TO RETURN TO CALM BEHAVIOR

1 = immediate

2 = within 2 minutes

3 = did not return to calm behavior in view of observers

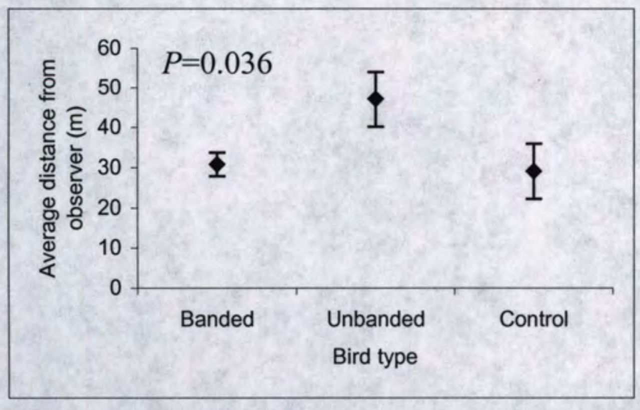

Figure 1. Distance from observer at which hen blue grouse assumed an alert by bird types on lower Big Creek, summer 2001.

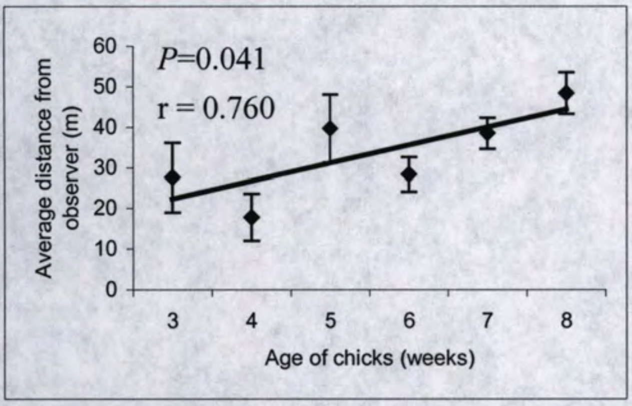

Figure 2. Distance from observer at which hen blue grouse assumed an alert posture versus age of their chicks on lower Big Creek, summer 2001.

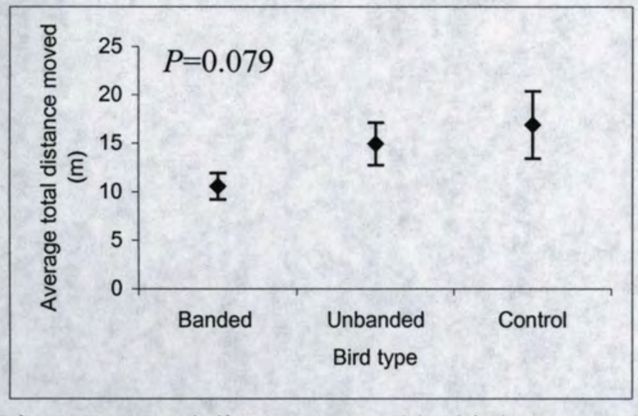

Figure 3. Total distance moved by bird types on lower Big Creek, summer 2001.

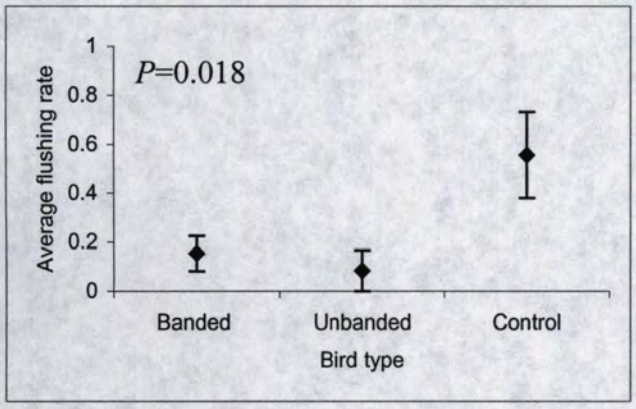

Figure 4. Flushing rate for by bird types on lower Big Creek, summer 2001.

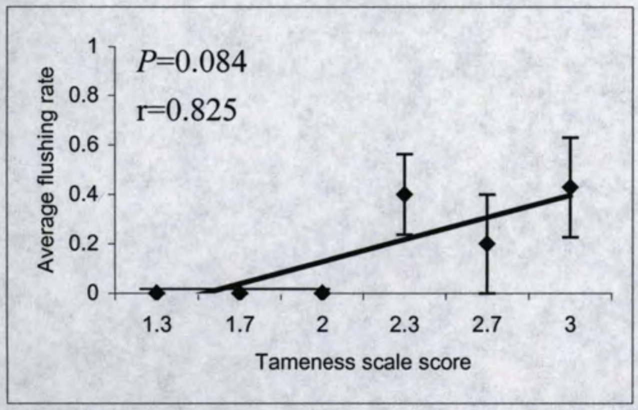

Figure 5. Flushing rate versus tameness scale score for hen blue grouse on lower Big Creek, summer 2001.

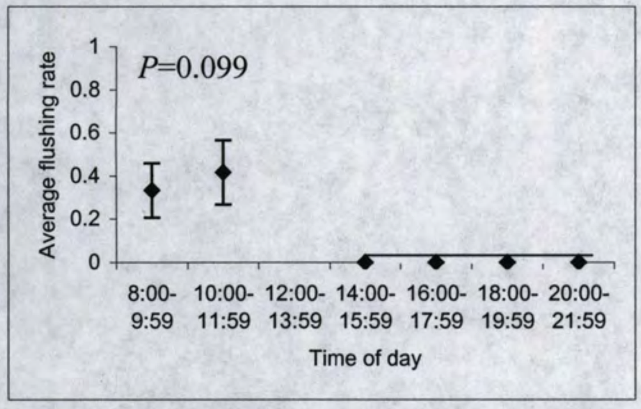

Figure 6. Flushing rate versus time of day for hen blue grouse on lower Big Creek, summer 2001.

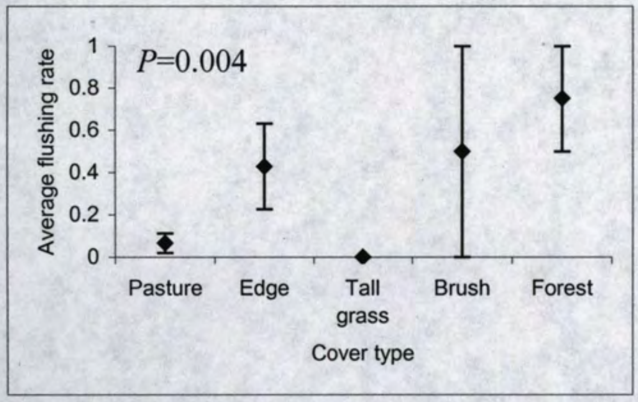

Figure 7. Flushing rate versus cover type for hen blue grouse on lower Big Creek, summer 2001.