Individual Variation in the Ruffed Grouse (*Bonasa umbellus*) Drumming Display

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BACKGROUND

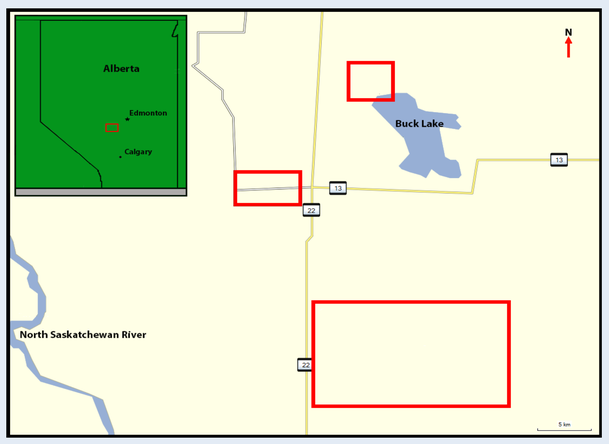
Male ruffed grouse produce a unique non-vocal wing beat display called 'drumming' during the breeding season in early spring. The drumming display consists of a series of rapid, downward wing strokes by a stationary male in a perpendicular position to a drumming structure, typically a log, producing a series of pulses resembling a drumming sound (Hjorth 1970). While counting drumming males is commonly used as a censusing technique, little is understood of how the drumming varies among and within individuals and how drumming is used to attract females and/or defend territories.

STUDY AIMS

1) How consistent are individual drumming patterns?
2) Do individual differences in the drumming display vary throughout the day and the breeding season?
3) How do males respond to playbacks of drumming?

METHODS

- drumming ruffed grouse were located in the spring near Buck Lake, Alberta (see below)
- Songmeters were used to collect long term audio recordings of their drumming behaviour
- pulse train analyses were performed using Avisoft bioacoustic software to measure the number of drum beats and speed (# drumbeats per second)
- each drumming display was also tallied and hourly and weekly averages calculated to determine how often males were drumming throughout the day and season
- playback experiments were performed to determine if male grouse would respond to the sound of an unfamiliar male drumming



On the left is a male ruffed grouse drumming on the root of a spruce tree. **On the right** is map showing field site locations within Alberta. Field sites were located between Drayton Valley and Rocky Mountain House along highway 22.

RESULTS

In 2012 and 2013 playbacks were performed on 33 birds, some birds were given two trials for a total of 46 playbacks. 22/46 playbacks performed resulted in the focal male moving off of his drumming log and in the direction of the speaker (an approach). On rare occasions, a male would fan out its tail feathers and ruff and rush towards the speaker in what Hjorth (1970) described as an agonistic display (see below).The number of males responding to a playback by approaching was not significantly different from chance (x^2= 0.09, p = 3.84). Some males 'cluster' in exploded leks, which could potentially influence how a male responds. However, whether a bird was within a lek or not did not affect whether they approached the speaker (Table 1, Fisher's exact test, p = 0.45). To test if drumming speed influenced males approaching the speaker, two stimuli were presented to birds in 2014 and 2015: fast and slow. Males did not differ in whether they approach regardless of playback speed (p's > 0.20).

Shown above is an example of a red phase male performing an agonistic display towards the speaker.

Table 1. The number of males that approached (yes) and did not approach (no) a drumming playback divided into males found in exploded leks and males drumming by themselves. Lekking did not have a significant effect on the probability of a male approaching the speaker.

	Yes	No	Totals
Lek	13	14	27
No Lek	23	15	38
Totals	38	29	65

Table 2. The number of males that approached (yes) and and did not approach (no) to playbacks of two stimuli: fast drumming and slow drumming. There was an equal probability of an approach as no approach slow and fast drumming rates

	Yes	No	Totals
Slow	16	16	32
Fast	14	18	32
Totals	30	34	64

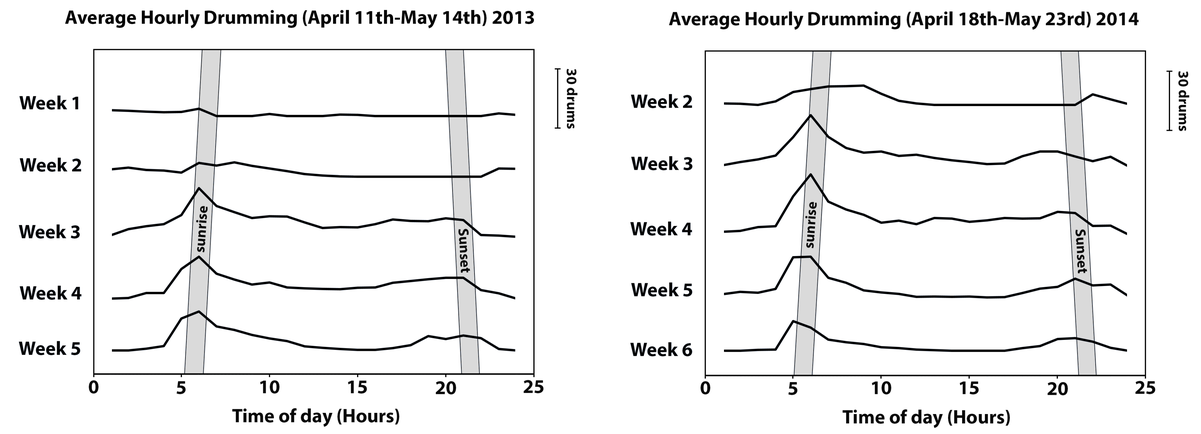


Figure 1. The number of drumming displays per hour averaged across 5 males throughout the 2013 breeding season and **B.)** 2014 breeding season. Grey bands designating sunrise and sunset show a time frame of 30 minutes before and after the event. Daily drumming activity increases leading up to sunrise throughout each week. A second peak in daily activity can be observed during sunset. This indicates drumming is related to day length, as sunrise becomes progressively earlier during the spring so does the peak period of drumming activity during the day.

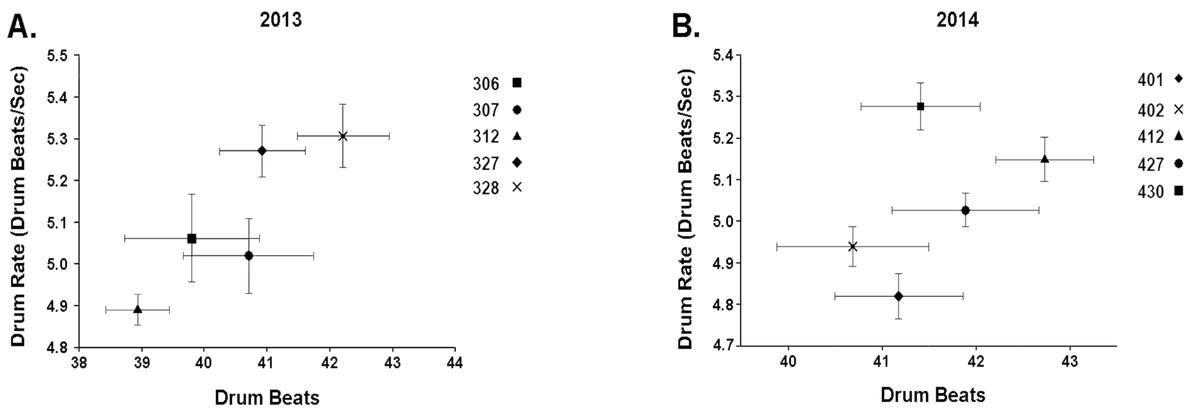


Figure 2. The average drumming rate plotted against drum beats of five grouse monitored over the **A.** 2013 season and **B.** 2014 season. Error bars represent standard deviations of the drum rate and drum beats produced by each male during the given season. Males tend to show more individual variation amongst one another in drumming rate than drum beats. In cases where males show overlap in drumming rate, they are separated by significant distances (i.e. 306 and 307 are 24 km apart).

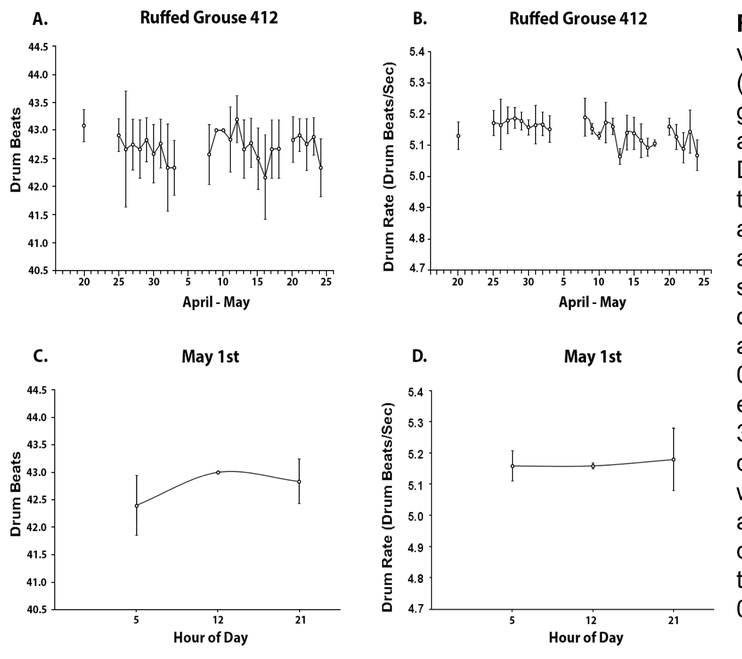


Figure 3. The top two graphs show seasonal variation in in the drum beat (**A**) and drum rate (**B**) of a single male (#412). The bottom graphs show daily variation in drum beat (**C**) and drum rate (**D**) of the same individual. Drumming rate and drumbeats were analyzed three times each day (5:00-6:00, 12:00-13:00, and 21:00-22:00), six drummings were analyzed during each hour. Throughout the season, there is a significant effect of day on drum beats ($F = 2.24$, $df = 25, 208$, $p < 0.01$) and drum rate ($F = 4.36$, $df = 25, 208$, $p < 0.01$). Based on effect size calculations, date explained 21% of variation in drum beats and 34% of the variation in drum rate. Within a day, there no significant variation in the rate at which a male drums ($F_{2,16} = 0.19$, $p = 0.83$) across the three times sampled and although drum beats appeared to vary within a day, this trend was not significant ($F_{2,16} = 3.53$, $p = 0.06$).

Conclusions

- responses of males to playbacks is independent of the drumming speed of the stimulus or whether the male was in an exploded lek
- drumming activity increases in the morning hours just prior to sunrise with a second smaller increase in activity around sunset
- the number of drumbeats or drum rate did not vary significantly within an individual day, but both drumbeats and drum rate change throughout the season

REFERENCES

Archibold, H. L. (1976). Spring Drumming Patterns of Ruffed Grouse. The Auk 93: 808-828.
Garcia, M., I. Charrier, et al. (2012). "Temporal and spectral analyses reveal individual variation in a non-vocal acoustic display: the drumming display of the ruffed grouse." Ethology **118**: 292-301.
Hjorth, I. (1970). "Reproductive behaviour in tetraonidae, with special reference to males." Viltrevy **7**(4): 184-596.

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