Sharp-tailed grouse (*Tympanuchus phasianellus caurus*) reproductive success, and habitat use, at the northern edge of the species range, in a resource development area of western Yukon

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1. Project summary

In past and current placer mining project reviews, mostly located along the Indian River and tributaries, Environment Yukon and TR'ONDËK HWËCH'IN have raised concerns with potential impacts to sharp-tailed grouse (STGR) where proposed activities overlap suspected key STGR habitats. Of the seven species of grouse in Yukon, only STGR is of immediate management concern. STGR have a limited distribution in the Yukon, unique habitat requirements, restricted movements, and intense social behaviour. Of the Yukon grouse, only STGR uses a communal breeding strategy (a lek). This sets this grouse species apart from the others in that the selection of specific point locations increases the population's vulnerability to disturbances, compared with a more widespread breeding strategy that other grouse species utilize. The distribution of STGR is dependent on the availability of suitable habitat. It is not currently known how much suitable habitat exists in the region and which areas are occupied by STGR.

While large bank of data detailing the ecology of Sharp tailed grouse in agricultural habitats exists, there are limited studies on this grouse species inhabiting Yukon's boreal forest amidst unique mining activities. Based on limited information from Alaska and studies in southern Canada, it is believed STGR hens will nest and brood within two kilometers of lek locations. Habitats associated with leks are likely as important as the lek features themselves, as without effective habitats adjacent to leks, hens will be unsuccessful at raising young and local populations will be impacted, pending the magnitude and extent of change these habitats undergo. If traditional STGR management strategies are applied to the Yukon context, the recommended 'no development zone' around the breeding complex would be in direct conflict with mining activity in what is the most productive gold producing area of the territory.

1.2 Project Objectives

This project is investigating the specific STGR habitat requirements for lekking, nesting and brood rearing (the breeding complex) in the Dawson Goldfields. By studying reproductive success, we can identify factors affecting the population's viability in the Goldfields. The specific objectives of this research are: (1) to quantify nesting success of female STGR, and examine the patterns and sources of variation in observed success; (2) to measure STGR brood rearing success, and examine the patterns and sources of variation in observed success; (3) to examine multi-scale habitat selection patterns of female during the nesting and brood-rearing periods, and (4) identify some of the effects of local land use practices on this population of STGR.

2 Summary of Project Activities

I am currently in my second year of research on sharp-tailed grouse in the Dawson City Goldfields. 2015 was a pilot year for sharp-tailed grouse research in the Dawson Goldfields. In spring of that year, we located a number of new leks (communal display and breeding sites), confirmed all previously documented lek sites, and captured 50 birds at 5 different leks. We radio collared status, success, and movements during the spring and summer months. The success of this preliminary study encouraged us to move into a more rigorous program of study for 2016, focused nesting and brood rearing habitat use and selection. Funding from the Yukon Fish and Wildlife Management Board (YFWET) was critical in making the 2016 field season a reality and success.

Figure 1. Male sharp-tailed grouse displaying on lek in Dawson Goldfields.

Objective 1. Determine location of STGR leks in the Klondike Goldfields, and estimate number of males at each lek;

Due to the increased work load in 2016, two full time field assistants were hired for the summer months. Lek searches are conducted in early April, when males begin displaying on the leks. Leks located in the 2015 field season were confirmed as active leks by returning to the identified sites while males were displaying in early April. A lek was considered active if birds were seen displaying for two consecutive seasons. In addition to confirming previously

Figure 2. Volunteers handling sharp-tailed grouse.

Figure 3. Female sharp-tailed grouse with radio collar.

located leks, we simultaneously searched for new lek. Leks were located by driving and walking transects; the observer would walk 1 km, then pause for 10 minutes and listen for displaying sounds, such as tail rattling or cooing. On calm, clear days these sounds can be heard at distances up to 1 km. In addition to only searching for leks on calm, clear days, efforts were further limited by the fact that males only display for approximately 3-4 hours at dawn. When these sounds were heard the observer would walk towards them until the birds were flushed and counted. A lek was considered its own entity, and not a satellite lek, if there was greater than 1 km between sites. Since this study began, we have identified 8 active leks, and 3 satellite leks. All previously identified leks from 2015 were found to be active in 2016. Although we only located one new lek in 2016, we were able to identify relatively large areas where there appears to be little STGR activity at this time. 2-3 camera traps were deployed at all known leks which enabled us determine the arrival dates and commencement of displaying activities at a particular lek, as well as monitor the number of males utilizing the dancing grounds. Males begin displaying on lek at the tail end of March or early April. Females, on the other hand, come in a single 4-day pulse to reproduce with the dominant cocks. Further counts were conducted during the capture period, which coincides with the arrival of the females at the leks, females and males were counted every 30 minutes from a blind with a spotting scope. To date, the average number of males displaying at a given lek is 9.

Objective 2. Quantify nesting success of female STGR, and examine the patterns and sources of variation in observed success

The mild temperatures in April and early snow-off in 2016, resulted in reproductive activities commencing 4 days earlier than the 2015 season. Capturing STGR safely at several research station required the help of a large team of support staff and volunteers. We found assistance from Fish & Wildlife staff, Conservation Officers, Tr'ondëk Hwëch'in, YESAB staff, experienced bird bander, private sector ecologists, as well as interested community volunteers.

Figure 4. Male sharp-tailed grouse displaying in front of a trap with containing two females.

In the 2016 field season, a total of 82 sharp-tailed grouse were captured between the three study areas: Indian River, Dominion Creek and North Fork Road. Of the captured individuals 33 females were equipped with VHF necklace style radio transmitters (approximately 2-years); However, one collar was dropped (inappropriately attached) shortly after deployment. In addition to collaring females, all captured grouse (females and males) are sexed, aged, weighed and wing cords measured. During nesting and brooding, we located the remaining 32 radio-collared hens bi-weekly using the VHF signal to determine their status (e.g., active nest, predation, broods present), reproductive success, and conduct vegetation and habitat selection surveys. Daily field observations by field crew suggest a large increase in raptor activity (particularly goshawks) in the study areas. Raptors were the cause of 6 hen mortalities during the pre-nesting period, compared to zero in the previous field season. Camera traps were deployed on the 24 located nests, to monitor for predation events, nest attendance patterns, hatch success and timing of hatch. (Apparent nesting success (successful/unsuccessful nest), where >1 chick hatched, was 83% (n=24); 2 hens were killed by raptors away from the nests leaving the nests unattended, and a different 2 nests were predated by large carnivores. Perhaps because the nest predation events occurred in the final week of incubation, the hens involved did not renest. In 2016, clutches averaged 8 eggs, 3 more than in 2015. Nest locations average 1.2 km (max 4.1km, mins 0.3km) away from lek of capture.

Objective 3. Examine multi-scale habitat selection patterns of female during the nesting and brood-rearing periods

Once the nests were abandoned field crews sampled and described vegetation and habitat characteristics at all 2015 and 2016 nest locations. To investigate habitat selection patterns of breeding sharp-tailed grouse, we measured habitat characteristics at the landscape scale (4-km), the patch scale (<250-m), and the nest- and brood-site scale (1-m). Measurements recorded included vertical (Higgins et al. 1994) and horizontal concealment (Robel et al. 1970), along with 11 other vegetation and habitat descriptors (structure, elevation, moisture, slope, etc.). Every STGR flush location was paired with a random site located within 4km of the lek, where we also conducted a vegetation survey.

Objective 4. Measure STGR brood rearing success, and examine the patterns and sources of variation in observed success

Figure 5. Graduate student, Joël Potié, relocating sharp-tailed grouse.

Sharp-tailed grouse chicks are precocial, and are led by the hen to brood rearing locations immediately after hatch. Because the newly hatched chicks are particularly vulnerable in their first 10 days of life, due to their inability to thermoregulation, and the increased risk of predation, hens and broods were not flushed during this period; However, their movement was monitored from > 50 m during this period. Once the chicks were estimated to be 10 days old, field crews resumed bi-weekly flushes to determine brood status. Because it was the hens that were radio-collared and not each individual chick, flush counts represent a minimum estimate of the proportion of chicks surviving because not all chicks may be observed. If chicks did not flush, but the female behaved as though chicks were present (broken wing displays), we considered some chicks were alive. If hen behaviour and movement patterns became erratic and exhibited large-scale movements, we assumed that the brood had been lost. Vegetation surveys and paired random sites were again conducted for every brood flush location. 16 (80%) hens successfully raised > 1 chick to 40 days. In one instance a hen lost her entire brood, and in three other cases collars were retrieved at raptor kills sites. Because all three of these predation events occurred early in the brood rearing period, chick survival is doubtful without the hen to help them thermoregulate. The broods were followed until brood-break up (40 days' post hatch), at which point brood status is no longer deemed reliable.

Objective 5. Identify some of the effects of local land use practices on this population of STGR

Figure 6. Field assistant, Alex Whitelaw, with vegetation sampling equipment.

Two (Dominion and Indian River) of our research sites are located in the Klondike Goldfields, the third (North Fork Road) is a control site, where there is no industrial disturbance within 6 km of the lek. By comparing the reproductive success, movement patterns, and habitat selection we will attempt to deduce any effects placer mining may have on this population of Sharp-tailed grouse. Unfortunately, we only collared 4 hens at the control site this year, which is too low a number to generate conclusive

results. In 2017 we will focus our lek search efforts in this region, as we currently only have one active lek identified.

We will be continuing the research for one more field season in 2017, due to the large number of recovered radio-collars, and because the collars are scheduled to transmit for another 17 months. One more year of data collection will increase the sample size to a scientifically valuable level, and will permit us to collect some lacking data.

My focus at this time is to continue data analyses and advancing thesis chapters. Currently, my approach involves resource selection function modeling based on the vegetation data collected and collar locations. I will also be investigating the reproductive success of this population when compared to other research results, to understand recruitment and the factors limiting population growth.

3 Project Contribution to the Protection, Enhancement or Restoration of Fish and Wildlife or their Habitat

Figure 7. A volunteer handling a collared sharp-tailed grouse.

The existing conflict of sharp-tailed grouse and placer mining activities in the Dawson Goldfields are the result of an ecological knowledge gap. Habitat loss, fragmentation and predation are known to be the leading causes of sharp-tailed grouse populations across their range. To ensure the species' persistence depends on understanding the impacts of resource development on sharp-tailed grouse. When completed, this study will contribute to the protection and enhancement of wildlife and habitat by providing the foundation for the development of sharp-tailed grouse management guidelines, and will serve as a model for grouse conservation in northern environments. By understanding this sup-species' reproductive success and habitat selection, efforts can be made to maintain existing populations of sharp-tailed grouse, protect and restore existing habitats, expand populations into secure habitat, and understand allowable threshold levels of development without risk to the species. There will also be opportunities to work with miners to develop remediation strategies directed at creating STGR habitat. This project also opens doors for future collaborations between academia and the Environment Yukon.

4 Communications

This research forms the core of my M.Sc. thesis with McGill University. After the review process is completed, the thesis chapters will form the basis for one or more peer-reviewed papers, to be published in pertinent journals. In addition, the results will be shared with Environment Yukon.

Figure 8. Male sharp-tailed grouse displaying on a reclaimed tailing pile.

Since receiving YFWET funding this research has been presented to the board members of the Trust, YESAA assessment officers, and at Weekend on the Wing in Tombstone Territorial Park. In early April 2017, I will be presenting at the Brown Bag Lunch Series at the Yukon College, Whitehorse campus. Other possible communications include the Biodiversity Working Group, and the Yukon Gold Show in Dawson City in Spring 2017. I am not limited to the above presentations, and hope to attend other conferences to share the results of the research. The Yukon Fish and Wildlife Management Board will be acknowledged as a key contributor in these, and any other reports or presentations.

5 Financial statements

The following is a summary of expenses from the 2016 field season. Trust funding was requested to cover daily travel between study sites, camp food, and camp fuel to run a generator and propane stove. Variance in expenditures were due to lower than forecasted costs for meals and camp fuel which we relocated to higher than forecasted expenses for travel, and with permission from the trust purchase expendable field equipment. Original receipts are attached.

Expenditure Categories	Items	Projected Cost	Actual Cost	Anticipated from Trust	Actual from Trust
Capital Expenses	VHF collars, trap materials, trail cameras, receivers and antennae	39,000	36,618.02	0	0
Wages	2 x field assistants	25,000	25,000	0	0
Office & Admin. Expenses	In kind support from Environment Yukon	0	0	0	0
Gas and Mileage	100km/day @ $0.57/km*2 vehicles	6,000	7007.16	6,000	6,746.7
Camp food	Per diem @ 54$/day for 92 days for 3 people	5,000	5,000	3,000	2,538.37
Camp fuel	Fuel for generators & propane stove	1,000	1001.01	1,000	0
Materials & Supplies	Batteries, veg sampling equipment, SD cards, STGR handling materials	3,000	3,714.93	0	714.93
Total		79,000	78,341.12	10,000	10,000

Gas Receipts

Item	Date	Invoice #	Vendor	Expense type	Total
1	March 5, 2016	702623	Northern Superior	Fuel	47.88
2	March 19, 2016	704365	Northern Superior	Fuel	40.00
3	March 31, 2016		Dawson City Gas & Tire	Fuel	104.24
4	April 7, 2016		Dawson City Gas & Tire	Fuel	71.19
5	April 10, 2016		Dawson City Gas & Tire	Fuel	54.89
6	April 27, 2016	720658	Northern Superior	Fuel	49.48
7	May 1, 2016		Bonanza Klondike	Fuel	54.5
8	May 11, 2016		Bonanza Klondike	Fuel	62.35
9	May 12, 2016	9081096	North 60 Petro	Fuel	64.40
10	May 13, 2016	9265210	North 60 Petro	Fuel	68.47
11	May 14, 2016	729111	Northern Superior	Fuel	59.99
12	May 17, 2016	9090002	Dawson City Petro Express	Fuel	68.75
13	May 18, 2016	465223	Bonanza Klondike	Fuel	22.11
14	May 20, 2016		Dawson City gas & Tire	Fuel	44.98
15	May 23, 2016	316179	BONanza Klondike	Fuel	90.65
16	June 12, 2016		Bonanza Klondike	Fuel	36.76
17	June 13, 2016		Bonanza Klondike	Fuel	37.80
18	June 18, 2016		Bonanza Klondike	Fuel	42.21
19	June 19, 2016		Bonanza Klondike	Fuel	46.25
20	June 21, 2016		Bonanza Klondike	Fuel	54.15
21	June 29, 2016	53	Dawson City Gas and Tire	Fuel	130.07
22	July 1, 2016		Bonanza Klondike	Fuel	68.05
23	July 5, 2016		Bonanza Klondike	Fuel	120.95
24	July 8, 2016		Bonanza Klondike	Fuel	31.91
25	July 10, 2016		Bonanza Klondike	Fuel	46.83
26	July 13, 2016		Bonanza Klondike	Fuel	97.21
27	July 14, 2016		Northern Superior	Fuel	44.20
28	July 18, 2016		Dawson City Gas and Tire	Fuel	54.62
29	July 20, 2016	7409	Goodys Gas Whitehorse	Fuel	69.58
30	July 20, 2016		Selkirk Gas Bar	Fuel	57.84
31	July 21, 2016		Bonanza Klondike	Fuel	54.15
32	July 22, 2016		Bonanza Klondike	Fuel	62.15
				Total	1958.61

Camp Food Receipts

Item	Date	Invoice #	Vendor	Expense type	Total
1	April 10, 2016	414286	Bigway Foods Dawson City	Camp Food	70.96
2	April 18, 2016	416694	Bigway Foods Dawson City	Camp Food	34.35
3	April 19, 2016	417221	Bigway Foods Dawson City	Camp Food	379.30
4	May 16, 2016	421605	Bigway Foods Dawson City	Camp Food	57.33
5	May 17, 2016		Bigway Foods Dawson City	Camp Food	226.96
6	May 14, 2016	290001009	Superstore	Camp Food	122.16
7	May 20, 2016	306395	Bigway Foods Dawson City	Camp Food	45.48
8	May 24, 2016	430101	Dawson City General Store	Camp Food	42.03
9	May 29, 2016	432206	Bigway Foods Dawson City	Camp Food	72.25
10	May 31, 2016	433215	Bigway Foods Dawson City	Camp Food	97.63
11	June 5, 2016	309419	Bigway Foods Dawson City	Camp Food	75.76
12	June 5, 2016	435518	Bigway Foods	Camp Food	83.89
13	June 6, 2016		Bonanza Market	Camp Food	24.59
14	June 5, 2016	435254	Bigway Foods Dawson City	Camp Food	29.00
15	June 8, 2016	437030	Bigway Foods Dawson City	Camp Food	91.45
16	June 11, 2016	438448	Bigway Foods Dawson City	Camp Food	99.45
17	June 13, 2016		Bigway Foods	Camp Food	36.41
18	June 13, 2016		Bonanza Market	Camp Food	19.08
19	June 14, 2016	311800	Bigway Foods Dawson City	Camp Food	48.20
20	June 18, 2016	313221	Bigway Foods Dawson City	Camp Food	31.96
21	June 19, 2016	442624	Bigway Foods	Camp Food	34.34
22	June 21, 2016	443632	Bigway Foods Dawson City	Camp Food	47.02
23	June 22, 2016	314511	Bigway Foods Dawson City	Camp Food	55.50
24	June 25, 2016		Bonanza Market	Camp Food	30.79
25	June 25, 2016	765	Bigway Foods	Camp Food	50.6
26	June 25, 2016	779	Bigway Foods Dawson City	Camp Food	19.36
27	July 3, 2016	315732	Bigway Foods	Camp Food	51.72
28	July 3, 2016		Bonanza Market	Camp Food	28.38
29	July 9, 2016	452048	Bigway Foods	Camp Food	46.87
30	July 9, 2016		Bonanza Market	Camp Food	25.11
31	July 11, 2016	453057	Bigway Foods Dawson City	Camp Food	85.23
32	July 15, 2016		Bonanza Market	Camp Food	15.13
33	July 15, 2016	454961	Bigway Foods	Camp Food	37.74
34	July 20, 2016		Superstore Whitehorse	Camp Food	226.87
35	July 23, 2016	8385	Bigway Foods	Camp Food	58.45
36	July 30, 2016	462287	Bigway Foods	Camp Food	37.02
				Total	2538.37

Field Equipment Receipts

Item	Date	Invoice #	Vendor	Expense type	Total
1	April 11, 2016	5212	HH Dawson City	Field equipment	54.03
2	April 18, 2016		Dawson Hardware	Fiel Equipment	75.63
3	April 19, 2016		Walmart	Field Supplies	50.15
4	May 2, 2016		Dawson Hardware	Field Supplies	27.8
5	May 5, 2016	5469	HH Dawson City	Field equipment	45.09
6	May 9, 2016	12	Arctic Inland Resources	Field Supplies	33.18
7	May 13, 2016		Walmart	Field Supplies	34.07
8	May 13, 2016		Canadian Tire	Field Supplies	18.87
9	May 13, 2016	10	Mac's Fireweed Books	Field Supplies	72.15
10	May 14, 2016	350375	HH Whitehorse	Field equipment	15.74
11	May 25, 2016	3004	HH Dawson City	Field equipment	52.48
12	May 26, 2016		Dawson Home Hardware	Field Supplies	50.44
13	June 3, 2016		Arctic Inland Resources	Field Supplies	14.48
14	June 3, 2016		Dawson Home Hardware	Field Supplies	9.49
15	June 14, 2016	7446	Dawson Home Hardware	Field Supplies	45.32
16	June 14, 2016		Canada Post	Field Supplies	86.01
17	July 2, 2016		Canada Post	Field Supplies	16.36
18	July 7, 2016		Dawson Hardware	Field Supplies	13.64
					714.93