YUKON FISH AND WILDLIFE MANAGEMENT BOARD

Decline and recovery: returning arctic ground squirrels to their traditional range

Final Report

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Project objectives

The arctic ground squirrel is considered to be keystone species that influences many ecological processes over large geographic scales in northern North America. They serve as an important prey item, herbivore and ecological engineer, and their distribution drives the abundance and spatial arrangement of many other Yukon species, ranging from top carnivores to plant communities. A decade and a half ago populations of Arctic ground squirrels began to decline precipitously in the boreal forest of the SW Yukon. By 2000 ground squirrel populations in this region collapsed to nearly zero and have remained there to date. These animals were used by First Nation peoples as an important source of food, clothing and tools. Today they are seasonal source of food, and traditional hunting continues to be a culturally important activity.

The objective of this project is to establish new populations of ground squirrels within First Nation traditional hunting areas. These efforts are part of a larger program aimed at recovering populations of this important herbivore while determining why numbers have declined in recent decades. The substance of this report is limited to the wildlife enhancement activities that were supported by the Yukon Fish & Wildlife Enhancement Trust. A broader report detailing a range of conservation oriented projects on this species is available upon request. Photographs pertaining to this enhancement project are provided in the final section of this document.

Project activities

Reintroductions were used to repopulate meadow habitats known to have supported healthy populations in the recent past [source populations: Destruction Bay post office (61°15'4.60"N 138°48'7.55"W) and Burwash Landing airport (61°22'5.85"N 139° 1'43.10"W); translocation site: Duke River meadows (61°23'21.35"N 139° 6'13.86"W)]. The reintroduction site has a long history of traditional harvest but currently enjoys a voluntary moratorium on hunting; nearly 100 traditional cooking pits can be found throughout the Duke meadow system. Project activities were carried out in three sequential phases described below (for illustrations see photo section).

Site Preparation

Site preparation and release methods were designed using an experimental framework in order to maximise the learning potential of these 'population recovery' efforts. Arctic ground squirrels were placed into a variety of manipulated and un-manipulated meadow habitats, which included the provision all possible combinations of short/tall grass and high/low burrow availability in a 500 x 250 m (~13 ha) area. Vegetation height in 50x50m blocks was reduced to 10 cm using gas powered grass trimmers and mowers. To combat recent tree encroachment within the release area, we cut approximately 400 poplar, aspen, and spruce trees (ranging from saplings to ~10m in height). We boosted burrow density from a natural baseline density of ~30/ha to over 200/ha to provide adequate refuges from predators. Artificial burrows were drilled at a 45º angle using a Dutch hand auger to a depth of 50 cm. In total, we build over 2,000 artificial burrows. All site preparation activities were conducted between May 10 and June 30, 2014.

Soft-Release methods

In response to some challenges met during our initial reintroduction efforts (2013) we initiated a more intensive translocation program. This second attempt differed from the initial attempt in several ways. First we moved over 250 squirrels (rather than 60) into Duke Meadows. Second, we employed a series of increasingly complex treatments designed to promote site fidelity while simultaneously testing their efficacy (Table 1).

Release Type	***Summary***	***Approx. number***
Hard	Morning capture; immediate transport (~1hr); release from cages at reintroduction site.	*120*
Firm	Morning capture; immediate transport as family groups (~1hr); released into separate artificial burrows with supplemental food (apple, sunflower seeds); burrow entrance plugged temporarily (~2hr); all individuals released into one of 16 50x50m grids, each containing either short (cut) or tall (natural) grass, and 200 (augmented) or 50 (natural) burrows per ha.	*130*
Soft	Morning capture; immediate transport (~1hr); housed in separate cages (1.8 x 1.2 x 0.75m) for 2 week acclimatization period; cages were situated within the release meadow, arranged in a 5x5 pattern 20m apart; food (rabbit chow, apple, natural forage) and water provided *ad libitum*; all cages protected from large mammalian predators with a single 5 strand electric fence.	*35*

Table 1: Release methods used during enhancement efforts.

On July 1 through July 5, 2014 over 200 squirrels were captured from various locations in the vicinity of the Burwash Landing Airport, marked with individual ear tags, radio collared, and translocated (~8 km north) into Duke meadows. "Firm" release methods were most commonly

used. These animals were released during the time of peak activity (between 7 and 9 a.m.) into burrows outfitted with retention caps and supplemental food. The retention caps were designed to force individuals to invest energy into their novel home by digging a second entrance. Sliced apple and 1 cup of black sunflower seeds were placed within each release burrow to promote site fidelity and reduce stress associated with foraging in a novel environment.

Hard release techniques were used as an efficient means of increasing initial population density, and involved opening individual cages in several portions of the meadow and allowing individuals to roam freely.

Finally, a smaller number of animals were transported into temporary cages, where they were protected from predators and acclimatised to their new environment (Table 1). After two weeks cage doors were wired open, allowing each squirrel to come and go as it pleased. Caged animals were fed high protein rodent food, apple, carrot, and native forbs collected from the surround meadow. These animals habituated to humans and so interested members of the community of Burwash Landing were allowed to visit them freely, provided the electric fencing was turned off.

Monitoring

The survival, movements and habitat choice of released individuals were studied by locating ground squirrels daily during the first three months post-release. Kluane First Nation were directly involved in these release and monitoring activities. Approximately 30 squirrels were also captured, collared, and moved a meadow near the town of Burwash as an experimental control to evaluate the influence of artificial movement on squirrel behaviour and survival. Causes of deaths were identified using a predator kill-key developed for the kluane region.

Preliminary results

Intensive monitoring will be required during the spring of 2015 to gauge the ultimate success of these experiments. However, several patterns did emerge during the summer of 2014: At least 73 individuals were trapped and/or confirmed alive (visually) at the end of the monitoring period. We see these patterns in survival of reintroduced animals as tentative evidence that some minimum release size (or some minimum population density) is required to achieve short-term reintroduction success. A second key result was that most of the animals that survived the first few weeks were individuals that stayed near the release site. Additionally, site fidelity was

greatest in the soft release group, with firm release methods resulting in intermediate success. These data are presently being analysed.

The provision of supplemental food was an important factor in keeping ground squirrels near the release site during the first several weeks. Those that moved large distances or settled in the adjacent forest did not survive to hibernation. Hard release methods were largely unsuccessful and should be avoided.

Overall we view our enhancement efforts as a success. We were able to found a new population in a region where arctic ground squirrels are locally extinct. A voluntary moratorium on harvest should ensure that surviving squirrels successfully reproduce and that the Duke meadow population continues to grow. We intend to census the population during May and July, 2015 to determine overwinter survival and reproductive success. A detailed report will be provided to Geraldine Pope (Resource manager, Kluane First Nation government) post-monitoring during 2015.

Communications

This project is intended to result in three publications during 2015-16, in addition to those listed below. The following has been accepted and will be published in the coming months:

Werner, J.R., Donker, S.A., Krebs, C.J., Sheriff, M.J., and Boonstra, R. 2015. Arctic Ground Squirrel Population Collapse in the Boreal Forests of the Southern Yukon. Wildlife Research, *In Press*.

The following has been submitted:

Werner, J.R., Donker, S.A., Sheriff, M.J., and Krebs, C.J. The Forest Squirrel versus the Meadow Squirrel: the impacts of habitat on Female Reproductive condition of Arctic ground squirrels. Canadian Journal of Zoology, *Submitted*.

An invited paper was presented in August 2014, at the 5th International Conference on Rodent Biology and Management, 25-29 August 2014, Zhengzhou, Henan Province, China. Three conference posters were presented in 2014. A yearly progress report that is distributed to Yukon government, First Nation governments, funding agencies, Parks Canada, BC Parks, is submitted yearly.

All of these communications gratefully acknowledge financial support from the Yukon Fish & Wildlife Enhancement Trust

The Yukon News featured one article on these arctic ground squirrel reintroduction, and may be accessed here: http://yukon-news.com/letters-opinions/tiny-tasty-ecosystem-engineers-hit-tough-times/

Conclusion

By approaching wildlife enhancement experimentally we are now in a position to answer several questions that would not have been possible without site preparation and intensive monitoring. Spatial patterns in survival and movement will be analysed during the spring of 2015 and recommended strategies for future reintroduction will be provided to Kluane First Nation. Future recovery efforts will focus on the translocation of female biased groups into short grass habitats. This was a successful second step (in a three part process) towards building up a population that will soon support sustainable traditional harvest. We are grateful for direct community involvement at all stages of this enhancement project.

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Financial Statements

Below is a summary of our anticipated budget and actual costs. Receipts for the "actual claim" column have been submitted to the Enhancement Trust. Overall, we came slightly over budget due to unanticipated expense associated with building and transporting soft-release cages. These extra costs were covered using money that came from a grant issued by the Arctic Institute of North America and by the Grant holder, Jeff Werner. Travel charges (mostly gas) are in lieu of AINA, which was billed directly to UBC and paid through another account. Materials & Supplies are in lieu of Radio collars with were billed to UBC and paid through a general account.

Requested Funds from Enhancement Trust

Item	Anticipated	Actual Claim	Description
AINA	4,050	0	3 people x 3.5 months x $45/day
Materials & Supplies	1,725	5,000	reintroduction equipment & supplies
Travel (gas etc.)	900	4,015	gas, airplane tix, accommodation, food
Radio Collars (new)	2,340	0	12 x $195
Total Requested	**9,015**	**9,015**	

Total Project Costs

Item	Anticipated	Actual	Description
AINA	10,800	14,175	3 people x 3.5 months accommodation x $45/day
Travel	1,200	1,200	2 x $800 airplane return tickets Vancouver-Whitehorse
Truck costs	2,925	3,332	6500 km x 49¢/km
Salary field assistant	8,800	9,800	4 x $2,200/mo (May-Aug. 2013) + $1000 vol. stipend.
Salary graduate student	8,000	8,000	5 months x $1,600/month (May-Sep 2014)
Radio Collars	9,750	9,880	50 x $195 holohil PD2-C units[1]
Telemetry receiver	1,390	1,390	2 x $695 (model R-1000 comm. spec.)[2]
Telemetry Antenna	250	250	2 x $125 (RA-XX directional yagi antenna)
GPS	690	690	2 x $345 (Garmin GPS Map 62S)
Bear Spray	100	100	4 x $25 (225g canister)
Total Costs	**47,030**	**48,820**	

[1] http://www.holohil.com/bd2.htm [2] http://www.com-spec.com/r1000/r1000.htm

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Photographs

To receive higher resolution files or other images contact werner@zoology.ubc.ca

Photo 1-2: South west boundary of the Duke meadows system. August 20, 2014.

Photo 3: Shelby Harkless and Keenan Peddie erect a notice prohibiting hunting. Six signs were installed at key access points throughout the reintroduction site. June 10, 2014.

Photo 4: Malkolm Boothroyd uses a gas powered trimer to create a 50x50m "short grass" treatment in Bear Creek meadows. Site preparation involved cutting grass and excavating artificial burrows. June 24, 2014.

Photo 5: Cage and nest box construction, Kluane Lake Research Station. June 15, 2014.

Photos 6-7: Acclimatisation cages and protective electric fencing were used to promote site fidelity during the critical first two weeks. Duke meadows, July 2, 2014.

Photo 8: An adult female forages on natural vegetation several days after being firm-released into Bear Creek meadows.

Photos 9-10: Approximately 80 ground squirrels were monitored, post-release, using radio telemetry. Predator visitations were recorded using camera traps. July 26, 2014.

Photo 11-12: A juvenile male within its protective cage. July 10, 2014.

Photo 13: Adult female arctic ground squirrel in alert posture after having had its radio collar removed. Duke meadows, August 23, 2014.