

BIG GAME INVENTORY FUND

Annual Report – 2014/15



Photo credit: Jerry MacDermott

BC Ministry of Forests, Lands and Natural Resource Operations
Fish and Wildlife Branch

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BC Ministry of Forests, Lands and Natural Resource Operations (MFLNRO)

INTRODUCTION

Big game populations in British Columbia represent an extremely valuable resource. For many First Nations, resident and non-resident hunters, big game hunting is a very important cultural and traditional activity that provides a source of high quality meat and other animal products. In addition to hunting-related values, sustainable big game populations are an integral part of healthy ecosystems and provide significant wildlife viewing opportunities. The purpose of inventories carried out under the Big Game Inventory Fund (BGIF) is to ensure sustainable use of big game, and provide support to key Ministry initiatives related to resource development, stewardship, and First Nation consultation.

The goals and priorities of the BGIF are to:

1. Provide inventory information that optimizes sustainable use of big game to support First Nation harvesting interests, licenced hunting opportunities and the guiding industry in BC.
2. Ensure coordinated management of regional and provincial priorities for big game inventories to improve the quality and integrity of resource data available for science-based decision making.
3. Conduct priority big game inventory projects which have been reviewed for technical soundness, and that are both robust and comparable over time and between areas.
4. Conduct big game inventories that incorporate the goals and objectives of provincial harvest management procedures and regional species/inventory plans.
5. Conduct “repeated surveys” on representative big game populations throughout the province.
6. Ensure inventory data results and reports are properly documented and accessible in a corporate database.

2014/15 REGIONAL PROJECT SUMMARIES

This document (compiled by K. Brunt Wildlife Consulting Services) provides summary reports for 24 regionally-led projects funded under the BGIF program in fiscal year 2014/15. A list of all BGIF activities (including both Regional- and Branch-based projects) is summarized in Table 1.

Table 1. Summary of 2014/15 Big Game Inventory Fund project allocations and expenditures by Area and Region.

Area	Region	Reg.#	Project Title	BGIF Allocation	BGIF \$s Spent ¹	Comments	Regional Allocation	Regional Expenditure ¹	Area Allocation	Area Expenditure ¹		
Coast	West Coast	1	West Coast Roosevelt Elk Inventory	\$60,000	\$69,200	\$9,200 reallocated from 2 projects below	\$74,000	\$74,000	\$154,000	\$154,000		
Coast	West Coast	1	Estimating Cougar Populations	\$10,000	\$ 2,500	\$7,500 reallocated to elk inventory						
Coast	West Coast	1	West Coast Black Bear Tooth Aging	\$4,000	\$ 2,300	\$1,700 reallocated to elk inventory						
Coast	South Coast	2	South Coast Predator Monitoring	\$30,000	\$30,000	Reallocated from: <i>South Coast Moose Inventory</i>	\$80,000	\$80,000				
Coast	South Coast	2	South Coast Roosevelt Elk Inventory	\$30,000	\$30,000							
Coast	South Coast	2	South Coast Mountain Goat Population Inventory	\$20,000	\$20,000							
South	Thompson/Okanagan	3	Assessing Population Connectivity of Bighorn Sheep	\$50,000	\$31,700	Reallocated from: <i>Moose Thompson Plateau SRB Survey</i>	\$105,000	\$86,700	\$385,000	\$272,700		
South	Thompson/Okanagan	3	West Fraser Mountain Goat Survey	\$30,000	\$23,300	\$6.7k reallocated to project below						
South	Thompson/Okanagan	3	Wells Gray/N Thompson Goat Survey	\$25,000	\$31,700	Includes \$6.7k reallocated from above project						
South	Kootenay/Boundary	4	Kootenay Mountain Goat Inventory	\$35,000	\$35,000		\$57,000	\$57,000				
South	Kootenay/Boundary	4	Mule Deer Composition Surveys	\$22,000	\$22,000							
South	Cariboo	5	1. Moose Recruitment Surveys in 5-04B 2. Bighorn Sheep Survey in 5-03 and 5-02	\$98,000	\$47,000	Reallocated from: <i>MU 501 SRB Moose Inventory and Moose Surveys with High FN Harvest</i>	\$128,000	\$77,000				
South	Cariboo	5	Itcha-Ilgachuz Caribou Survey	\$30,000	\$30,000							
South	Thompson/Okanagan	8	1. Boundary Moose Composition (incomplete SRB) 2. Grand Forks Bighorn Sheep Census 3. Westside/Shorts Bighorn Sheep Census 4. Okanagan Mountain Park Mountain Goat & Bighorn Sheep Census 5. Similkameen Mountain Goat Census	\$95,000	\$52,000	Reallocated from: <i>Boundary GMZ Moose SRB Survey and Similkameen GMZ Moose SRB Survey</i>	\$95,000	\$52,000				
North	Skeena	6	First Nation Harvest Surveys	\$20,000	\$20,000		\$42,200	\$42,200			\$194,000	\$169,700
North	Skeena	6	Skeena Southern Mountain Goat Inventory	\$22,200	\$22,200							
North	Omineca	7A	Moose Composition Survey GMZ 7B	\$40,000	\$30,700		\$52,000	\$42,700				
North	Omineca	7A	Robson Valley Elk Inventory	\$12,000	\$12,000							
North	Northeast	7B	MU 742 Moose Survey	\$84,800	\$84,800		\$99,800	\$84,800				
North	Northeast	7B	Agriculture Zone Winter Ungulate Replicate Count	\$15,000	-	No info. available						
Branch	-	-	Big Game Inventory Plan	\$5,000	\$5,000		\$17,000	\$13,500	\$17,000	\$13,500		
Branch	-	-	Wildlife Species Population Inventory DataBase	\$2,000	\$2,000							
Branch	-	-	Wildlife Specialist Inventory Travel	\$10,000	\$6,500							
Totals				\$750,000	\$609,900		\$750,000	\$609,900	\$750,000	\$609,900		

¹Rounded to nearest \$100

Project Name: West Coast Roosevelt Elk Inventory

Region: West Coast (Region 1)

Species: Roosevelt elk

Survey Area/Extent (include size of Survey and Project Areas): This project included aerial surveys of portions of 37 elk population units (EPU) and 31 elk hunt zones in wildlife management units 1-03 to 1-13 on Vancouver Island.

Funding Source(s): BGIF, LBIS, regional operating budget, Wildfire Management Branch

Total Project Budget: \$78,000

Amount Allocated from BGIF: \$60,000

Amount Spent from BGIF: \$69,200 (*\$9,200 reallocated from other Region 1 BGIF projects*)

Rationale for the Survey:

- **What was the regional priority of this survey? 1**
- **Were there First Nations issues that led to this survey? If so, briefly describe.**
First Nations are increasingly identifying elk conservation as a concern when in discussion with FLNR during consultation on a variety of topics. Demand for ceremonial, cultural and subsistence use exceeds current opportunities in parts of the range which is raised as a concern. FNs are concerned that their access to this resource be maximized within the confines of conservation. There are also concerns that the non-FN hunters may be over harvesting and that overharvest would go undetected resulting in present and future impacts to FN ability to harvest.
- **What is the level of hunter interest and participation for this population?**
Very High, resident hunters submit more than 15,000 LEH applications annually for an opportunity to hunt Roosevelt Elk on Vancouver Island (<300 opportunities).
- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**
Yes, variable impacts.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**
Yes
- **Is this a repeated survey? If so, when was the last survey?**
Yes. A portion of the range is surveyed annually depending on funding and staff availability. Some level of inventory has been performed annually since 1993. Large populations with relatively high hunting pressure are surveyed every 1-2 years depending on funding. Smaller populations with lower hunting pressure are surveyed less frequently.
- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**
Population management objectives vary by EPU with the majority of the 37 units having objectives of maintaining the current population size. Where population maintenance is the objective, management objective are:
 - minimum of 20 bulls : 100 cows; and
 - minimum of 20 calves : 100 cows.

Methods (state RISC standards followed):

Aerial-based Inventory Methods for Selected Ungulates (No.32, v.2)

Results:

This table shows the results of all 23 aerial elk composition surveys conducted on Vancouver Island (by Wildlife Management Unit) in March 2015. Elk were observed in 11 MUs that were surveyed and one MU during transit (MU 1-02).

Wildlife Management Unit (MU)	Bulls					Cows / Calves			Unclass.	TOTAL Count
	SPIKES	RAGHORNS	5 PT+	Bull: 100COWS	% Branched Antlers	CALVES	CALVES: 100COWS	COWS		
SOUTH ISLAND										
SUB-TOTAL: M.U. 1-02	1	0	2	0.0	0%	0	0.0	0	0	3
SUB-TOTAL: M.U. 1-03	5	3	5	16.0	62%	22	27.2	81	25	141
SUB-TOTAL: M.U. 1-04	23	11	23	25.8	60%	46	20.8	221	18	342
SUB-TOTAL: M.U. 1-05	10	12	13	25.4	71%	58	42.0	138	0	231
SUB-TOTAL: M.U. 1-06, 1-07	5	4	8	34.0	71%	13	26.0	50	0	80
SUB-TOTAL: SOUTH ISLAND	44	30	51	25.5	65%	139	28.4	490	43	797
NORTH ISLAND										
SUB-TOTAL: M.U. 1-08	1	1	3	50.0	0%	1	10.0	10	0	16
SUB-TOTAL: M.U. 1-09	11	13	26	34.7	78%	35	24.3	144	44	273
SUB-TOTAL: M.U. 1-10	73	46	104	31.4	67%	226	31.8	710	119	1278
SUB-TOTAL: M.U. 1-11	29	17	26	33.8	60%	47	22.1	213	13	345
SUB-TOTAL: M.U. 1-12, 1-13	2	5	23	93.8	93%	13	40.6	32	15	90
SUB-TOTAL: NORTH ISLAND	116	82	182	34.3	69%	322	29.0	1109	191	2002
ISLAND TOTAL	160	112	233	31.6	68%	461	28.8	1599	234	2799

Management Implications/Recommendations as a Result of this Survey:

Composition survey results show that bull: 100 cow and calf: 100 cow indices are slightly elevated in many EPU's relative to typical years and are above minimum management objectives thresholds for nearly all EPU's. Exceptionally mild winter conditions for 2014/15 likely account for relatively high bull and calf survival in many areas. EPU's with calf survival indices below management objectives correlate with areas of relatively high predator observations/reports (particularly wolf).

Confirmation of status quo was the result for the majority of the 31 elk hunt zones. A declining trend was confirmed in the Nahmint EPU (1-07A) which resulted in recommendation from region to remove this area from the LEH regulation and the subsequent Ministerial Order (No. M148) in May 2015. Surveys in the Chemainus, Klanawa, Nitinat and North Shore Cowichan EPU's will potential result in increasing the licenced hunter opportunities starting in the 2016 fall hunting season pending changes to the LEH regulation. Consultation with First Nations and stakeholders is underway regarding regulation change proposals for these areas and are anticipated to be submitted to headquarters in October 2015.

Project Name: Estimating Cougar (*Puma concolor vancouverensis*) Populations on Northern Vancouver Island using DNA mark-recapture techniques

Region: West Coast (Region 1)

Species: Cougar (*Puma concolor vancouverensis*)

Survey Area/Extent (include size of Survey and Project Areas): The area encompasses 3 Wildlife Management Units (MUs 1-09, 1-10, and 1-11) totaling roughly 6,000 km².

Funding Source(s): HCTF and LBIS

Total Project Budget: \$55,604

Amount Allocated from BGIF: \$10,000

Amount Spent from BGIF: \$2,500 (2 Pseudart projectors/guns, 2 dehumidifiers for DNA samples, and 1 laptop for data entry; \$7,500 reallocated to Region 1 West Coast Roosevelt Elk Inventory BGIF project)

Rationale for the Survey:

- **What was the regional priority of this survey?**
Very high, ranked 2nd, only behind ungulate inventory
- **Were there First Nations issues that led to this survey? If so, briefly describe.**
N/A
- **What is the level of hunter interest and participation for this population?**
Interest is extremely high for resident and non-resident hunters, guide outfitters, public, and media. MUs 1-09, 1-10, and 1-11 are premier cougar hunting and guiding locations. In most fiscal years MU 1-10 accounts for cougar harvest numbers equivalent to the rest of the region. Region 1 annual net revenue generated from cougar licenses has averaged \$12,000 dollars for resident and non-residents with \$3,000 going to HCTF through surcharges.
- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**
N/A – the project has been postponed for one year until the winter of 2015/16, due to lack of snowfall.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**
No, this not a Category A species.
- **Is this a repeated survey? If so, when was the last survey?**
This has never been done before in B.C. or Canada for cougars. U.S. studies utilizing DNA-based mark-recapture inventories are providing scientific population estimates for cougars.
- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**
The harvest of females in Region 1 was approximately 16% last season and has fluctuated between 20% and 30% since the regulation change. Literature from the U.S. indicates that hunting can begin to negatively affect the cougar population when adult female component of the harvest exceeds 35-40% annually.
By utilizing modern, science based population estimates, such as through DNA mark recapture, findings from previous radio-telemetry studies will likely be supported, indicating that the cougar population on northern Vancouver Island is one of the largest in North America (3.5-5+/100km²).

Methods (state RISC standards followed):

This project follows protocols found under RISC Bear Inventory, specifically 3.6.1 DNA mark-recapture. The project utilizes DNA-based mark-recapture inventories and closed spatial mark-recapture modelling to provide science based cougar population estimates.

Results:

The project has been postponed for one year until the winter of 2015/16, due to lack of snowfall.

Management Implications/Recommendations as a Result of this Survey:

Once the northern study area is completed, representative study areas for central and southern portions of Vancouver Island will be identified and surveyed.

This inventory will:

- provide modern science-based population estimates to ensure long-term conservation and sustainability of cougar populations;
- have an effect on how region 1 and provincial big game managers effectively estimate cougar populations;
- provide modernized data to scientifically assess cougar populations;
- support current cougar seasons and bag limits; and
- assist managers in responding to media and the public regarding populations, and how estimates were/are obtained.

Project Name: West Coast Black Bear Tooth Aging

Region: West Coast (Region 1)

Species: Black Bear

Survey Area/Extent (include size of Survey and Project Areas): MUs 1-1 through 1-15

Funding Source(s): BGIF/LBIS

Total Project Budget: \$4,000

Amount Allocated from BGIF: \$4,000

Amount Spent from BGIF: \$2,267 (*\$1,700 reallocated to Region 1 West Coast Roosevelt Elk Inventory BGIF project*)

Rationale for the Survey:

- **What was the regional priority of this survey?**
This ranked 3rd. In terms of acquiring age data for predators (bears and cougars), it is a very high priority.
- **Were there First Nations issues that led to this survey? If so, briefly describe.**
Black bears are important for food, social and ceremonial purposes for many First Nations. However, there are divergent views among Nations, as some do not hunt black bears. First Nations in many coastal areas are also involved in economic opportunities utilizing bears for commercial viewing/tourism ventures as well.
- **What is the level of hunter interest and participation for this population?**
Vancouver Island is considered to contribute some of the best black bear hunting opportunities in the world. Nearly 1,000 licensed hunters dedicate more than 5,000 hunter days per year in Region 1 in efforts to harvest black bears (Average 1981-2008). Guided hunters over the same time period averaged 580 hunter days per year. These opportunities are considered vital to the guide outfitting industry in the West Coast region. Black bears are the most guided for species in the Region. Trappers are also extremely interested in the possibility of harvesting black bears on traplines in the Region as well.
- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**
This survey provides defensible scientific information for wildlife managers and decision makers when liaising with First Nations, stakeholders and the media.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**
No, this is not a category A species
- **Is this a repeated survey? If so, when was the last survey?**
Between 1989 and 2004 tooth aging of black bears harvested by guide outfitters and miscellaneous harvest by COS and resident hunters showed an average of 9 years with a slightly increasing trend. This harvest data suggests a conservative management strategy over the time frame.
- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**
The current management strategy is to target predominantly male bears to maintain the breeding population of females and to avoid orphaning of cubs. Hunters are requested to not harvest young bears and as well as females in the presence of cubs. The objective is also to maintain a healthy population with a stable age class structure.

Methods (state RISC standards followed): N/A

Results:

203 black bear tooth samples were submitted to a third party lab for aging. The minimum age was 3, the maximum age was 24 and the overall average age was 10.

Management Implications/Recommendations as a Result of this Survey:

Given that the overall average age has slightly increased since the 2004 age data summary, the harvest data suggests a conservative/sustainable management strategy. The population is stable considering there are large numbers of older/mature boars on the landscape as seen in the long-term and short-term harvest data (2013/14). In the future, DNA mark-recapture modelling projects will provide science based population estimates for black bears as well. In the interim, Region is maintaining the age data sets and continuing to acquire tooth samples. Also, staff are counting bears and looking at trends in their population while conducting annual ungulate inventories.

Project Name: Wolf (Predator) Monitoring in South Coast (reallocated from: South Coast Moose Inventory)

South Coast Region BGIF dollars were allocated towards a stratified random block (SRB) moose surveys in the Upper Lillooet River valley, Soo River, and the Elaho River valley of MU's 2-11 and 2-6 respectively. Much effort was dedicated to refining a GIS model (Heard et al. 2008) for the survey area. Due to circumstances out of our control, (i.e., lack of winter conditions such as snow and cold temperatures), funds were reallocated to a South Coast predator monitoring study. The following includes a summary of that work.

Region: South Coast (Region 2)

Species: Focus on predators, namely wolf (*Canis lupus*)

Survey Area/Extent (include size of Survey and Project Areas): Management Units 2-9 and 2-10

Funding Source(s): BGIF

Total Project Budget: \$30,000

Amount Allocated from BGIF: \$30,000

Amount Spent from BGIF: \$30,000

Rationale for the Survey:

- **What was the regional priority of this survey?**

A knowledge gap exists regarding the presence and distribution of wolves, and other predator populations, in South Coast. Estimates of wolf populations in BC are tied closely to ungulate distribution and estimates of prey biomass on the landscape. Localized trends in wolf populations are indexed primarily by hunter harvest statistics and observational reports from Ministry Staff and other stakeholders. Currently, there is no wolf harvest in several MUs in Region 2 and thus population status and trends are difficult to ascertain. Meanwhile, Roosevelt elk populations (i.e., distribution and prey biomass) in this region are expected to continue increasing due to natural recruitment and ongoing translocation efforts. If wolf populations also increase, this could create opportunities for a harvest in order to meet “use” objectives under the Wildlife Program Plan and to minimize predation pressure on recovering elk populations. Baseline data on wolf presence and distribution are required to evaluate these management objectives.

- **Were there First Nations issues that led to this survey? If so, briefly describe.**

First Nations did not initiate this survey.

- **What is the level of hunter interest and participation for this population?**

There is always interest from hunters to have expanded opportunities throughout the Province, and especially in South Coast as a large proportion of BC resident hunters reside within the boundary of the Lower Mainland.

- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**

As there is currently no harvest for wolves in MUs 2-9 and 2-10, there will be no decrease. Cameras were installed in various locations throughout the MUs in April 2015 and as of yet, there is not enough information to determine if a harvest will be realized.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**
No.
- **Is this a repeated survey? If so, when was the last survey?**
This survey has not been performed in the past.

Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).

No specific population management objective other than presence/absence. Remote camera data can provide information on occupancy, minimum number of individuals and breeding status (e.g., pups or juveniles observed, prey deliveries, etc). Over an adequate sampling period it is possible that detection rates (photos per camera trap effort) could also serve as an index of relative abundance.

Methods (state RISC standards followed):

Inventory Methods for Wolf and Cougar (1998). Although not explicitly outlined in the RISC standards, use of cameras is mentioned for determining presence/absence and relative abundance.

Initial analysis of the area resulted in an average sampling density of 1 station / 200 km², when the entire study area (~4,000 km²) is considered. However, this included habitats that are not suitable for wolves such as rock, ice and water. Accounting for habitat suitability, the study area is considerably smaller which effectively increases the density of sampling stations (e.g., area below 1000 m is ~1500 km²; or 1 station / 75 km²). In either case, wolves occupy large territories, often several hundred square kilometers, so this sampling intensity is sufficient to ensure all wolves in the study area are available to be sampled (i.e., no gaps exist in the camera array that are larger than the home range of a wolf). A sampling grid of 10 x 10 km, with a restriction of 1 camera location per cell, has been used to ensure cameras are well-distributed throughout the study area.

Cameras will be in place for 1 calendar year, at such time all data will be compiled, analyzed, entered in SPI and a report written.

Results:

To date, cameras have been visited twice (June and July) to check operational status, replace batteries where required, clear any vegetative obstructions that have appeared since deployment, and download images. Throughout this time, 1 wolf has been identified. However, multiple black bears, coyotes, bobcats and cougars have been detected throughout the study area. More time is required with these cameras in their current position to collect enough data to present our findings. Noteworthy is the confirmation of range expansion, from initial release sites, of Roosevelt elk. Bull elk have been detected in areas not observed previously, thereby increasing the distribution of the species throughout South Coast and increasing the available prey biomass on the landscape.

Management Implications/Recommendations as a Result of this Survey:

Recommendations at this time include maintaining the camera locations in their current location until April 2016, at which time all data will be compiled and analyzed. We also recommend moving cameras after this time to new locations in other MUs where no wolf harvest exists (most notably MU's 2-17, 2-18, and 2-19).

Project Name: South Coast Roosevelt Elk Inventory

Region: South Coast (Region 2)

Species: Roosevelt Elk

Survey Area/Extent (include size of Survey and Project Areas): 18 of 27 elk population management units in South Coast (Region 2) were surveyed.

Funding Source(s): BGI / HCTF / Regional Operations

Total Project Budget: \$80,000

Amount Allocated from BGIF: \$30,000

Amount Spent from BGIF: \$30,000

Survey Rationale:

South Coast Roosevelt elk recovery efforts during the last decade have resulted in several new elk herds and new hunting opportunities. Elk management and performance has become a focal point for wildlife management in the region. First Nations, stakeholders and industry have all provided input and support to the recent creation of a Roosevelt elk Management Plan for BC. Herd sizes, compositions and recruitment data, is required in order to adjust and rationalise conservation strategies and harvest opportunities and to support the creation of new hunt zones and seasons at several locations in the region. Conservation and harvest agreements with First Nations are routinely sought throughout the region. Detailed inventory data is required to support our discussions in order to reach and maintain agreements. An increase of Roosevelt elk hunting opportunities by up to 20% is expected as result of our surveys and 3 new hunt zones/ seasons are anticipated to be proposed.

Goals/Management Objectives:

Roosevelt Elk are designated Category A and harvest opportunities are managed by consultation with First Nations, Limited Entry Hunting and allocation to Guide Outfitters.

Surveys are repeated annually or every 2nd to 3rd year, in order to estimate population size, composition and status in each population management unit. Where population objectives (>50 elk, >20 bulls / 100cows, and > 30% of bulls are branch antlered) are achieved, hunting opportunities are considered, consulted and most often proposed. In those areas where hunting is already occurring, harvest is adjusted accordingly and is consistent with the direction set forth in the BC Roosevelt Elk Management Plan.

Where possible elk are fitted with GPS tracking collars in order to evaluate; survival, causes of mortality, habitat use and correct survey data for sightability.

Methods (state RISC standards followed):

Aerial surveys are the principal method for monitoring population size, sex composition and age structure. Also, the use of satellite-telemetry collars collect detailed information on survival, mortality, seasonal ranges and habitat use. These data will provide valuable information for wildlife managers to evaluate management objectives for elk and sightability correction.

Aerial surveys were conducted during late winter, over preferred habitat locations where elk concentrate and where sightability is greatest. Elk were counted, classified, and then corrected for sightability for each population management unit. Where possible elk were immobilized and fitted with satellite-telemetry collars.

Results:

South Coast Roosevelt elk inventory project objectives were fulfilled during February to March of 2015. A total of 838 elk were classified (Table 1) in more than 18 Population Management Units. Additionally, 20 elk were fitted with GPS collars.

Table 1. 2015 aerial survey results

	Total Elk	Cows >2yrs	Calves	Yearlings	Bulls > 2yrs (branched)
Classified	838	446	160	128	98
Sightability Corrected	1575	743	267	320	245
Ratio		100	36	43	33

Management Implications/Recommendations as a Result of this Survey:

Results of this project have been positively received by all stakeholders and leaders of 3 first nations were able to directly participate in our surveys. This involvement furthers our working relationships and aids consultation and reconciliation beyond those First Nations who were directly involved. The total number of Roosevelt elk estimated for South Coast (Region 2) exceeds 1600 and hunting in many elk population management units is occurring or is planned. The results of this inventory will inform Resource managers, First nations and stakeholders regarding the status of Roosevelt elk populations in South Coast. Furthermore, new hunt zones and seasons will be pursued for Southgate River, Homathko River and Stave River.

Project Name: South Coast Mountain Goat Population Inventory

Region: South Coast (Region 2)

Species: Mountain Goat

Survey Area/Extent (include size of Survey and Project Areas): Management Units 2-10, 2-17, 2-18, 3-14, 3-15. The survey units delineated for this survey had an area of 5,647.95 km². Approximately 1,583 km², or 28%, consisted of suitable goat habitat that was surveyed (i.e., the survey area).

Funding Source(s): BGIF and HCTF

Total Project Budget: \$46,470

Amount Allocated from BGIF: \$20,000

Amount Spent from BGIF: \$20,000

Rationale for the Survey:

- **What was the regional priority of this survey?**

The regional priority was to establish a population estimate for mountain goats within the aforementioned MU's. Apart from survey work in the Upper Lillooet River valley, there has not been much recent comprehensive inventory of mountain goats throughout the South Coast region. There is currently no harvest of goats throughout the survey area.

- **Were there First Nations issues that led to this survey? If so, briefly describe.**

Local First Nations did not initiate this survey.

- **What is the level of hunter interest and participation for this population?**

There is always interest from hunters to have expanded opportunities throughout the Province, and especially in South Coast as a large proportion of BC resident hunters reside within the boundary of the Lower Mainland. To that end, to have expanded opportunities for mountain goats within South Coast is highly desirable.

- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**

As there is currently no harvest for mountain goats in the survey area, there will be no decrease. We observed a population of goats that could withstand a harvest; and we have been in dialogue with BC Parks regarding this, as much of the area is within a Provincial Park. However, the status quo may be maintained during this regulation cycle while we continue to work with BC Parks.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**

Mountain goats are not currently designated as Category A in South Coast as there is no guide outfitter on a quota where goat harvest exists. However, if a harvest was to occur within this survey area, that designation would change as there is a guide outfitter within the survey area that would receive an allocation.

- **Is this a repeated survey? If so, when was the last survey?**

No.

- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**

No. We were simply conducting a survey to determine a population estimate for discrete population units within the survey area and to determine if harvest opportunities existed.

Methods (state RISC standards followed):

Followed RISC 2002: Aerial-based Inventory Techniques for Selected Ungulates. Prior to the survey, survey areas were delineated on a 1:50,000 topographic map based on elevation of mountain complexes (i.e., apparent suitable habitat), and anecdotal knowledge. All areas delineated on the map were surveyed in the field, in addition to areas identified as suitable in the field that were not previously delineated, as time and budget allowed.

Aerial surveys were conducted from July 21 – July 28, 2014, between the hours of 05:00 and 13:00 hours. One evening flight was conducted between the hours of 17:00 and 20:45. Timing of surveys was selected to avoid daily high temperatures and increased likelihood of observing goats during peak periods of activity as nursery groups frequent open alpine meadows and are most observable in July (RISC 2002 and Glasgow et al. 2003). Surveys began at treeline in a Bell 206B JetRanger and followed contours of mountain complexes increasing in elevation by approximately 220 – 312 meter intervals until the entire mountain complex was intensively surveyed. Survey effort ranged from 1.5-2.0 min/km² (Poole 2007). The helicopter, pilot and observers remained consistent throughout the survey period. The primary navigator sat in the front next to the pilot. The observer/recorder behind the pilot operated an iPad2 (IOS 6.1.3) using the application GPS Kit HD to collect flight lines, and GIS Kit to mark all observations. For both applications, *GoogleEarth* high resolution satellite imagery was used. Collection of flight lines using the iPad ensured that all delineated areas were surveyed, and that no area was surveyed twice (avoiding double counting).

Mountain goats were classified as either adult or kid. Classification of yearlings was not done in order to avoid misclassification of yearlings as kids, thus inflating the kid to adult ratio (Gonzalez-Voyer et al. 2001 and Festa-Bianchet and Côté 2008). In some instances, adults could be further classified as either a billy or nanny based on moulting pattern and size (RISC 2002); however, this was not consistent and classifications were recorded as either adult or kid. A sightability correction factor (SCF) was applied to each survey area.

Results:

A total of 254 mountain goats in 80 groups, including 187 adults, 66 kids (26% of total goats), and 1 unclassified was observed (Table 3). Group size ranged from 1 to 20 and averaged 3.18 ± 0.196 ($\bar{x} \pm SE$). Total observed kid to adult ratio across the study area was 35.3 kids to 100 adults; however, this ratio ranged from 32.6 in Nahatlatch to 44.4 in North Joffre (Table 1).

Table 1. Mountain goat survey observations in North Joffre, Breckenridge, Scuzzy, Old Settler, Ogilvie, Tulameen and Nahatlatch during July 2014 inventory.

Survey Unit	Adults	Kids	Unclassified	Total Goats Observed	Kid:100 Adult	% Juvenile
North Joffre	9	4	0	13	44.4	30.77
Breckenridge	34	14	0	48	41.2	29.17
Scuzzy	0	0	0	0	0.0	0.00
Old Settler	6	2	0	8	33.3	25.00
Ogilvie	20	7	0	27	35.0	25.93
Tulameen	26	9	0	35	34.6	25.71
Nahatlatch	92	30	1	123	32.6	24.39

Estimated survey unit density of goats ranged from 0.01 goats/km² in Old Settler, to 0.28 goats/km² in the Nahatlatch unit (Table 2). The population estimate across all survey units is 384.2 with the greatest number and density of goats being in the Nahatlatch unit, 175.9 and 0.28 goats/km² respectively (Table 2).

Table 2. Survey statistics and population estimates for goats in North Joffre, Breakenridge, Scuzzy, Old Settler, Ogilvie, Tulameen and Nahatlatch during July 2014 inventory.

Survey Units	Area Searched (km ²)	Survey Unit Area (km ²)	Total Goats Observed	Population Estimate*	Est. Unit Density (goats/km ² in unit)	Obs./Est. Density (goats/km ² searched)
North Joffre	284.12	680.13	13	20.7	0.03	0.05/0.07
Breakenridge	408.66	1322.24	48	76.3	0.06	0.12/0.19
Scuzzy	132	766.11	0	0.0	0.00	0.00/0.00
Old Settler	125	1055.22	8	12.7	0.01	0.06/0.10
Ogilvie	99.49	627.66	27	42.9	0.07	0.27/0.43
Tulameen	238	565.33	35	55.7	0.10	0.15/0.23
Nahatlatch	295.76	631.26	123	175.9	0.28	0.42/0.59

*Population estimates are the observed goats with the appropriate SCF applied.

Management Implications/Recommendations as a Result of this Survey:

The Nahatlatch unit held the majority of goats with 45.8% of the population estimate. When assessing a mountain goat population for a proposed harvest, it is important that there be a minimum of an estimated 50 adults in the population before a harvest is considered (MFLNRO 2014). The Nahatlatch had an observed minimum of 92 adults (131.6 after applying the SCF). We have initiated dialogue with BC Parks with respect to initiating a harvest for goats in the Nahatlatch unit, much of which is a provincial park; however, we are not having success as the management direction for the park is to remove hunting from its recreational opportunities.

Recommendations:

1. Continue dialogue with BC Parks regarding possible harvest opportunities;
2. Repeat surveys within 3-5 years to assess population trend.

Project Name: Assessing population connectivity of bighorn sheep (reallocated from: Moose Thompson Plateau SRB Survey)

A portion of Thompson Region BGIF dollars (\$50K) was allocated to SRB moose surveys on the Thompson Plateau south of Kamloops in Management Units 3-18 & 3-19. Unfortunately, persistent poor weather and inclement survey conditions forced cancellation of the surveys. Funds were reallocated to another priority project in the region for use in future monitoring of bighorn sheep in the Thompson metapopulation.

Region: Thompson (Region 3)

Species: California Bighorn Sheep

Survey Area/Extent (include size of Survey and Project Areas): MUs 3-18, 3-29, 3-30

Funding Source(s): Big Game Inventory Fund

Total Project Budget: \$50,000

Amount Allocated from BGIF: \$50,000

Amount Spent from BGIF: \$31,742

- ATS collar purchase (10 ATS G2110E) - \$30,000
- Radio-collar duties & brokerage - \$1,742

Rationale for the Survey:

- **What was the regional priority of this survey?**
No surveys were conducted as part of this project.
- **Were there First Nations issues that led to this survey? If so, briefly describe.** n/a
- **What is the level of hunter interest and participation for this population?** n/a
- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?** n/a

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?** n/a
- **Is this a repeated survey? If so, when was the last survey?** n/a
- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).** n/a

Methods (state RISC standards followed): n/a

Results: n/a

Management Implications/Recommendations as a Result of this Survey: n/a

Project Name: West Fraser Mountain Goat Survey

Region: Thompson (Region 3)

Species: Mountain Goat

Survey Area/Extent (include size of Survey and Project Areas): MUs 3-16 B, 3-16 C, 3-33 B and 3-33 E

Funding Source(s): BGIF

Total Project Budget: \$30,000

Amount Allocated from BGIF: \$30,000

Amount Spent from BGIF: \$23,323 (*the remaining \$6,677 was reallocated to the Wells Gray/North Thompson Mountain Goat Survey*)

Rationale for the Survey:

- **What was the regional priority of this survey?**

Of the four proposals submitted by the Thompson Region for funding consideration to the BGIF in 2014, this project was ranked #1.

- **Were there First Nations issues that led to this survey? If so, briefly describe.**

Local First Nations with traditional areas overlapping the survey zones have expressed strong concerns over the management of ungulate resources within their territories, and over licensed hunting within their territories. The survey of these zones were to help provide the foundation for addressing concerns in this matter (e.g. understanding current population levels will help ensure harvest by both First Nations and licensed hunters is sustainable).

- **What is the level of hunter interest and participation for this population?**

Populations in these zones (using pre-survey values) support approximately 32% of the regional AAH. In 2007-11, 18% of the regional resident harvest and 50% of the regional guide harvest occurred in the survey zones. Goat hunts are in high demand in the Thompson by resident hunters as indicated by numbers of applicants for LEH hunts. The 2013 average odds for LEH goat hunts in the Thompson Region were 6.7:1, which was higher than Region 4 (3.6:1), Region 5 (5.6:1), Region 6 (2.2:1) and Region 7 (6.1:1). For zones 3-16 B, 3-16 C, 3-33 B and 3-33 E, the 2013 odds were 13:1, 4.9:1, 5.3:1 and 1.7:1, respectively. All of the zones are covered by guide territories, and guides in the area have a strong interest in maintaining all hunting opportunities, including goats.

- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**

It was anticipated that the survey would impact hunter opportunity, however it was unknown if that impact would be an increase, decrease, or confirmation of the status quo. Harvest success in the LEH zones in question has been low relative to the AAH; for example in 2007-11 only about 45% of the 5-year allowable harvest was harvested (residents harvested 7 and guides harvested 22). This could be due in part to the difficulty of the hunts, but may also indicate a decline in the population in some areas, as has occurred in portions of the survey area and in other locations near the survey area in the past. Results of the 2014 surveys showed that populations have increased in 3-16 B and 3-33 E over previous estimates, and these increases should provide additional harvest opportunities. Estimates in 3-33 B remained relatively unchanged, and those in 3-16 C have decreased, which will result in reduced hunter opportunities.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**
Yes.
- **Is this a repeated survey? If so, when was the last survey?**
Surveys in portions of 3-16 were completed in 1977, 1979, 1982, 1992, 1998 and 2008. The last survey in 3-16 B and 3-16 C was completed in 2008. Surveys in portions of 3-33 occurred in 2005, 2009 and 2011. The last survey in 3-33 B and 3-33 E occurred in 2005.
- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**
The Thompson Region tries to maintain a minimum of 50 adult mountain goats in hunted populations, and to keep female harvest levels below 30% (as per the provincial Mountain Goat Harvest Management Procedure). The Thompson Region also works to achieve the overarching management goals for mountain goats, as described in the 2010 *“Management Plan for the Mountain Goat (Oreamnos americanus) in British Columbia”*¹. Those goals are to maintain viable, healthy and productive populations of mountain goats throughout their native range in BC.

Methods (state RISC standards followed):

Resources Information Standards Committee (RISC). 2002. Aerial-based inventory methods for selected ungulates: bison, mountain goat, mountain sheep, moose, elk, deer and caribou. Standards for components of British Columbia’s biodiversity No. 32. Version 2.0. B.C. Min. Sustainable Resour. Manag., Victoria, BC.

Results: Surveys were conducted between August 27, 2014 and September 9, 2014. The following table details the results of those surveys.

Area	Total Goats Observed	Kid:100 Adult Ratio	% Juveniles	Sightability	Population Estimate
3-16 B	129	29:100	22.5	80%	160
3-16 C	37	19:100	16.2	70%	50
3-33 B	110	39:100	28.2	80%	138
3-33 E	74	25:100	20.3	80%	93

Management Implications/Recommendations as a Result of this Survey:

The following are the primary recommendations resulting from these surveys:

1. With respect to harvest management, update the population estimate and annual allowable harvest values for surveyed units to manage future harvest opportunities.
2. Goat populations in surveyed units should be periodically monitored (3-5 years) to assess future population trends and inform harvest management.
3. In consideration of habitat connectivity, re-survey 3-16 C and adjacent LEH zones to confirm population estimates.

¹ Mountain Goat Management Team. 2010. *Management Plan for the Mountain Goat (Oreamnos americanus) in British Columbia*. Prepared for the B.C. Ministry of Environment, Victoria, BC. 87 pp.

Project Name: Wells Gray/North Thompson Mountain Goat Survey

Region: Thompson (Region 3)

Species: Mountain Goat

Survey Area/Extent (include size of Survey and Project Areas): MU 3-46 A, and adjacent areas of 3-46

Funding Source(s): BGIF, FLNR base funding

Total Project Budget: \$33,264

Amount Allocated from BGIF: \$25,000

Amount Spent from BGIF: \$31,677 *(includes \$6,677 reallocated from the West Fraser Mountain Goat Survey)*

Rationale for the Survey:

- **What was the regional priority of this survey?**

Of the four proposals submitted by the Thompson Region for funding consideration to the BGIF in 2014, this project was ranked #3.

- **Were there First Nations issues that led to this survey? If so, briefly describe.**

First Nation groups with traditional territories overlapping the survey areas have raised strong concerns over goat populations in the area; this concern is so great that one First Nation group has decided to voluntarily cease hunting within their territory until the issues can be addressed.

- **What is the level of hunter interest and participation for this population?**

Prior to the survey, it was estimated that 3-46 A encompassed approximately 10% of the region's hunted goat populations. Goat hunts continue to be in high demand in the Thompson by resident hunters as indicated by numbers of applicants for LEH hunts. For example, the 2013 odds for LEH goat hunts in the Thompson Region were 6.7:1, which was higher than Region 4 (3.6:1), Region 5 (5.6:1), Region 6 (2.2:1) and Region 7 (6.1:1). For the hunt in 3-46 A, the 2013 LEH odds were 4.4:1 which is lower than the regional average, likely due to the extreme remoteness of this LEH zone.

- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**

It was anticipated that the survey would impact hunter opportunity, however given the length of time since the previous survey (see below), it was unknown if that impact would be an increase, decrease, or confirmation of the status quo. There was some concern that population levels in 3-46 A had declined in recent years, and that decline had not been accounted for in regional management actions. Recent population surveys had indicated that mountain goat populations had declined by 50-85% in the last decade or more in other northern areas of the Thompson Region. Given this, it was anticipated that there could be some declines to the populations in the surveyed areas.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**

Yes.

- **Is this a repeated survey? If so, when was the last survey?**

The last mountain goat survey in Wells Gray Park and in portions of 3-46 A occurred in 1989.

- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**

The Thompson Region tries to maintain a minimum of 50 adult mountain goats in hunted populations, and to keep female harvest levels below 30% (as per the provincial Mountain Goat Harvest Management Procedure). The Thompson Region also works to achieve the overarching management goals for mountain goats, as described in the 2010 "*Management Plan for the Mountain Goat (*Oreamnos americanus*) in British Columbia*"². Those goals are to maintain viable, healthy and productive populations of mountain goats throughout their native range in British Columbia.

Methods (state RISC standards followed):

Resources Information Standards Committee (RISC). 2002. Aerial-based inventory methods for selected ungulates: bison, mountain goat, mountain sheep, moose, elk, deer and caribou. Standards for components of British Columbia's biodiversity No. 32. Version 2.0. B.C. Min. Sustainable Resour. Manag., Victoria, BC.

Results:

Surveys were conducted between July 11, 2014 and July 14, 2014. In all, 33 groups of goats were observed, with a total count of 98 goats, of which 80 were adults and 18 were kids. The overall observed kid:100 adult ratio was 23:100, and the total percent juveniles was 18.4%. In 3-46 A specifically, 19 groups of goats were observed, with a total count of 70 goats, of which 58 were adults and 12 were kids (a kid:100 adult ratio of 21:100). It is estimated that the mountain goat population within 3-46 A is approximately 100 goats (i.e. a sightability correction factor of 1.43; sightability = 70%).

Management Implications/Recommendations as a Result of this Survey:

The following are the primary recommendations resulting from these surveys:

1. With respect to harvest management, update the population estimate and annual allowable harvest values for 3-46 A to manage future harvest opportunities.
2. Goat populations in 3-46 A and the rest of Wells Gray Provincial Park should be periodically monitored (3-5 years) to assess future population trends and inform harvest management.
3. Work with BC Parks staff and representatives of industries/companies using helicopters within the park to ensure helicopter disturbance on goat groups is kept to a minimum.
4. Develop a winter severity index for goats in the Thompson Region.
5. Use data collected from this inventory to inform a weight-of-evidence approach, or other appropriate design, to assist in determining the causes of goat declines in other areas of the region.

² Mountain Goat Management Team. 2010. Management Plan for the Mountain Goat (*Oreamnos americanus*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 87 pp.

Project Name: Kootenay Mountain Goat Inventory

Region: Kootenay/Boundary (Region 4)

Species: Mountain Goat

Survey Area/Extent (include size of Survey and Project Areas): East Kootenay. Portions of MU 4-06, 4-20, 4-22, 4-23, 4-25, 4-34, 4-35.

Funding Source(s): Habitat Conservation Trust Foundation, Big Game Inventory Fund

Total Project Budget: \$126,000

Amount Allocated from BGIF: \$35,000

Amount Spent from BGIF: \$35,000

Rationale for the Survey:

Most mountain goat populations have not been inventoried in the East Kootenay for at least 8 years (15 years in some areas). Surveys in 2013 suggest populations have declined. It is unknown whether declines are widespread across the region.

The Management Plan for Mountain Goat in BC (Mountain Goat Management Team 2010) goal is to “*maintain viable, healthy and productive populations of mountain goats throughout their native range in British Columbia*” and one objective is to “*ensure opportunities for non-consumptive and consumptive use of mountain goats are sustainable*”. This project will contribute to these objectives by updating population estimates and assessing factors affecting East Kootenay populations in the, including sustainable harvest rates.

Goals/Management Objectives:

Mountain goats are a Category A species in most of Region 4. Many mountain goat populations in the East Kootenay were inventoried in the early to mid-2000s. However, some areas have not been inventoried since 1998. The Ministry of Forests, Lands and Natural Resource Operations (FLNRO) issues approximately 1000 Limited Entry Hunt (LEH) permits and 80 guide quotas for goats annually. The average harvest rate in the East Kootenay over the past 5 years was 2.7% (range 1 – 6% across all Limited Entry Hunt zones), with an average annual harvest of 173 goats. Over the past 5 years, 16 % of the total harvest was females.

Objectives were to: create goat Population Management Units (PMUs); identify representative goat survey areas within each PMU; inventory a minimum of 8 goat survey areas each year for 2 years; analyze and synthesize the survey data; conduct a retrospective analysis of population trends, and; prepare a report. The retrospective analysis will attempt to assess the effect of goat harvest (particularly female harvest) and other potential limiting factors (e.g. weather/snow accumulation, predation) on population trends, to determine whether these factors may explain population increases or decreases.

Methods (state RISC standards followed):

- Using previous goat inventory locations, Compulsory Inspection kill locations and GPS radio-telemetry data (Poole et al. 2006), create goat Population Management Units (PMUs) for the East Kootenay.
- Using previous goat inventory data identify goat survey areas (GSUs) within each PMU; once created, these survey areas, which will be smaller than Management Units and PMUs, could be inventoried regularly to assess population trends at a relatively lower cost.

- Rank and select a minimum of 3 survey areas to inventory each year; select areas that were inventoried in the past 10 years, have harvest rates 3% or higher and have a range of female harvest rates.
- Inventory goat inventory zones in late summer to provide best estimates for hunting season.
- Use methods outlined in Standards for Components of British Columbia's Biodiversity No. 32 (RISC Standards 2002) for total count with sightability correction factor.
- Divide inventory zones into discrete mountain blocks; conduct survey in early morning hours to take advantage of cooler survey conditions (<10°C) when goats may be more active and visible; use a Bell 206B Jet Ranger helicopter with pilot, navigator, and 2 experienced observers; record GPS location, broad habitat type, elevation, canopy closure, terrain obstruction, and behaviour of goat groups when first spotted; classify goats according to kids and non-kids;
- Record incidental wildlife sightings especially bighorn sheep and mule deer.
- Apply a sightability model (Rice et al. 2008) or sightability factor to survey data to estimate goat populations within survey areas, LEH zones and guide outfitter territories (as per Poole and Klafki 2005).
- Prepare an annual inventory report, annual HCTF report, and final HCTF report.
- Update LEH permits and guide outfitter quotas accordingly.

Results:

Compared to the last surveys conducted, which occurred from 2000 to 2006, higher numbers were estimated in 2014 in 2 of the 11 GSUs, with 82% more goats in the unit surrounding Dutch Creek in the Purcells compared with 2004, and 20% more goats in the Connor Lakes area compared with 2005. No change was detected in 2 GSUs. Lower numbers were observed in 7 of the units, with all but two in the 41-65% decline range. Two of the 3 GSUs surveyed in the southern Purcells exhibited significant declines, but severe declines were also observed in the Rockies, including the Beaverfoot Range southeast of Golden, the Stanford Range east of Invermere, and the Van Nostrand-Towers unit west of the upper Bull River. Kid:adult ratios were similar to ratios observed during surveys of many of the same areas conducted in 2002-06. Using the 2014 estimates, harvest rates from 2009-13 were greater than the recommended 2-3% in 2 of the 7 GSUs with lower estimates compared to previous surveys.

Surveys for mountain goats in 2014 were the first major counts conducted since 2006 and, coupled with 2 surveys conducted in 2013, showed lower populations in almost 70% of units, with many declines >30%. The consistency of trends among areas suggest that some factors are affecting goat numbers on a regional scale, but the long intervals between sequential surveys – several had not been surveyed since the early 2000s – make interpretation of results difficult.

Management Implications/Recommendations as a Result of this Survey:

Given the data from 2014, the inventory should be expanded in 2015 to verify and further determine the extent and magnitude of these population changes. A resurvey of 2 to 3 of the areas surveyed in 2013 and 2014 would help to verify trends in populations.

Project Name: East Kootenay Spring and Fall Mule Deer Composition Surveys

Region: Kootenay/Boundary (Region 4)

Species: Mule Deer

Survey Area/Extent (include size of Survey and Project Areas): MUs 4-02, 4-03, 4-26 and 4-35 (7,091 km²)

Funding Source(s): LBIS – Big Game Inventory Funds

Total Project Budget: \$85,878 (2014-15)

Amount Allocated from BGIF: \$22,000

Amount Spent from BGIF: \$22,000

Rationale for the Survey:

The Kootenay Region initiated a mule deer monitoring project to investigate causes of population declines and factors limiting recovery. Fourty GPS collars were deployed on adult female mule deer in MUs 4-02 and 4-03 in winter 2014/15 and an additional 40 collars will be deployed in winter 2015/16 in the West Kootenay and North Trench. Composition data were needed in these MUs so population growth rate (λ) could be calculated using a survival-recruitment model (DeCesare et al. 2012). Fawn recruitment data and adult female survival estimates will be used to assess whether population growth is being limited by recruitment or doe survival (or both). Surveys will occur annually in monitored populations to measure population change.

This was the Kootenay Region's second highest priority survey for 2014-15. Mule deer hunter numbers averaged 1600 (19% of regional total) from 2008-14 in the study area, while hunters days averaged 12,472 (19% of regional total). MU 4-03 has the highest number of mule deer hunter days in the region (2009-2014 average = 5,116 days). There are 10 guide-outfitters operating in the study area and over 1,600 resident mule deer hunters per year. Guide-outfitters, resident hunters and local First Nations have expressed concern with declining mule deer populations for the past 10 years. These surveys will not result in immediate changes to hunting seasons; however research findings will support management actions to increase populations and enhance hunting opportunity.

Goals/Management Objectives:

These surveys provided data to contribute to the Kootenay Mule Deer Monitoring Project. Specifically, fawn recruitment data were needed to estimate λ , while buck ratios were needed to estimate proportion of bucks in the population. Regional management objectives in the Kootenay-Boundary Mule Deer Management Plan (FLNR 2014) are to "improve inventory and monitoring methods to track mule deer population trends". Survey-specific objectives were to classify at least 100 mule deer per MU.

We used buck ratios to assess whether provincial targets outlined in the Southern Interior Mule Deer Harvest Procedure were being met (at least 20 bucks:100 does post-hunting season). Results were compared to past surveys conducted in the Southern East Kootenay between 2008 and 2012.

Methods (state RISC standards followed):

We followed RISC standards for mule deer composition surveys:

https://www.for.gov.bc.ca/hts/risc/pubs/tebiodiv/ungulatesv2/UNGA%20MI20_ODHE_Addendum.pdf

Surveys were conducted in a Bell 206B helicopter with 3 observers. All observers had substantial experience with mule deer composition surveys. Bucks, does and fawns were classified in fall surveys. Bucks had shed antlers before the spring surveys and all adult deer (yearlings and older) were recorded as "adults". We used the proportion of bucks from the fall

surveys to predict the number of bucks and does in the spring sample. We estimated λ using ratios of fawns:100 does from the spring surveys.

Results:

Fall Surveys

We completed 6 hours and 24 minutes of surveys between November 30th and December 4th, 2014. Surveys were carried out in MUs 4-02, 4-03 and 4-35. Snow conditions were good for the MU 4-02 and 4-03 surveys but marginal for the MU 4-35 survey. We observed 517 mule deer and calculated buck ratios of 18-27 bucks:100 does and fawn ratios of 36-41 fawns:100 does (Table 1). Target sample size of >100 classified deer per MU were achieved in all areas. Observations from composition surveys were used to identify areas to deploy collars. Buck ratios were above management targets in MUs 4-02 and 4-03 but slightly below targets in MU 4-35, which could be attributed to later survey timing (i.e., surveying after bucks had separated from does).

Table 1: Mule deer composition data for November and December surveys completed in MUs 4-02, 4-03 and 4-35.

MU	Fawns:100 Does	Bucks:100 Does	Total Observed
4-02	41	27	274
4-03	36	27	114
4-35	40	18	125

Spring Carryover Surveys

We completed 7 hours and 42 minutes of surveys on March 5th and 6th, 2015. Snow cover was non-existent during the surveys, making it difficult to detect deer in forested habitats. We observed 664 mule deer and calculated fawn ratios of 41-51 fawns:100 adults. We did not achieve the target sample of >100 classified deer in MU 4-35 so additional deer were classified in the North Trench (MU 4-26). Survey results suggest relatively good fawn recruitment, which could be attributed to the mild 2014/15 winter.

In all survey areas, fawn ratios were higher in the spring than fall. Because survey crews were consistent between surveys, we expect the discrepancy is due to underrepresentation of does with fawns in the fall survey. In fall 2016 we will assess habitat use of collared deer to predict whether animals with fawns select habitats where they are less likely to be detected with aerial surveys than does without fawns.

Table 2: Mule deer composition data for March surveys completed in MUs 4-02, 4-03, 4-35 and 4-26.

MU	Fawns:100 Adults	Total Observed
4-02	50	291
4-03	48	236
4-35 & 4-26	41	137

Population Growth Rate

We used the survival-recruitment model developed by DeCesare et al (2012) to estimate preliminary growth rate for the first 6 months of the project:

$$\lambda = \frac{(1-M)}{(1-R)} = \frac{S}{(1-R)}$$

λ = Growth Rate

M = Mortality (from collared deer)

S = Annual adult female survival (from collared deer)

R= Proportion of females recruited (from March aerial surveys)

We used March aerial survey data to calculate the proportion of female fawns recruited, assuming 50% of classified fawns were female. We estimated a preliminary survival estimate of **0.84** and a population growth rate of **1.08** for both study areas combined.

Management Implications/Recommendations as a Result of this Survey:

This survey contributed to a larger monitoring project that is in the early stages. Survey results suggested relatively high fawn recruitment in Year 1; however an additional 4 years of survey data are needed to evaluate whether fawn recruitment is limiting population growth (or whether population growth is being limited by adult female survival).

We will likely use buck proportion estimates measured in 2014/15 for future λ calculations rather than repeating fall surveys each year. However, additional fall surveys are needed to measure the proportion of bucks in the North Trench, where bucks were likely underrepresented in the 2014/15 surveys.

Project Names: (reallocated from: MU 5-01 SRB Moose Inventory and Moose Surveys With High FN Harvest)

- 1. Moose Recruitment Surveys in 5-04B**
- 2. Big Horn Sheep Survey in 5-03 and 5-02**

Cariboo Region BGIF dollars were allocated to SRB moose surveys in 5-01 and Moose Composition Surveys in Areas of High First Nations Harvest. Unfortunately, due to consistently poor weather conditions throughout the survey areas of interest, both the SRB and Composition surveys had to be cancelled. BGIF Funds that were unspent on the proposed projects [small portions of the funding were used on pre-stratification of 5-01 (\$9,000) and incomplete composition survey attempts (\$3,500)] were reallocated to other priority inventories in the region, including 1) a recruitment survey for collared cow moose in the Big Creek (5-04B) area, and 2) a Big Horn Sheep (BHS) total count survey in 5-03 and 5-02. The following includes recruitment data from the 5-04B moose recruitment survey and population and composition results from the BHS survey.

Region: Cariboo (Region 5)

Species:

1. Moose
2. California Big Horn Sheep (BHS)

Survey Area/Extent (include size of Survey and Project Areas):

1. 5-04B –Big Creek (5,152 km²)
2. 5-03, 5-02 and 5-14– Junction, Churn Creek-Fraser River west and Alkali-Dog creek BHS Populations

Funding Source(s): BGIF

Total Project Budget: \$98,000

Amount Allocated from BGIF: \$98,000

Amount Spent from BGIF: \$47,005

Rationale for the Survey:

- **What was the regional priority of this survey?**
The surveys undertaken were not previously ranked for BGIF submission. The 2nd ranked option funds (Itcha Ilgachuz caribou post-calving population survey 2014), was completed using BGIF funds, and the 4th ranked option (Mt. Goat Surveys) could not be undertaken due to the unsuitable survey timing.
- **Were there First Nations issues that led to this survey? If so, briefly describe.**
 1. First Nations are highly concerned about declining moose populations in 5-04 and surrounding MUs; recruitment survey will assist in better understanding the reasons for the declines and appropriate management actions.
 2. Canoe Creek and Alkali FN communities harvest BHS in 5-02 and are interested in seeing recovery of BHS populations.
- **What is the level of hunter interest and participation for this population?**
 1. Moose harvest in 5-04B is of high interest to FN, and currently moderate interest to resident and non-resident hunters (avg. odds ratio of 5:1). Interest in this hunt was previously higher, but has declined

due to the recent population decline as well as highly publicized land claims disputes/threats of hunting blockades with local First Nations within the area.

2. Big Horn Sheep harvest in 5-02 is under full-curl restricted GOS with closed areas where populations are of conservation concern (including surveyed areas in 5-04 and 5-14). Resident and Non-resident hunter interest in these areas is considered moderate to high.
- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**
 1. No impact to hunter opportunity.
 2. No Impact to hunter opportunity.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**
 1. Moose – Yes
 2. BHS – No
- **Is this a repeated survey? If so, when was the last survey?**
 1. Yes, recruitment has been assessed in 5-04B most recently in 2012, 2014 and 2015 (current year survey). Calf to Cow ratios were 27, 27.5, and 35 respectively.
 2. Yes, Big Horn Sheep surveys in these areas were last undertaken in 2010 (Alkali-Dog Creek); 2012 (Junction) and 2013 (Churn Creek-Fraser River).
- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**
 1. No target in terms of calf: cow ratios, but knowledge of recruitment rate used to make inferences about the productivity of the moose population as well as predation levels.
 2. Objective of the surveys was to determine population trend to ensure hunted areas could still be sustainably harvested and closed areas had not increased to a level where a hunt could be initiated.

Methods (state RISC standards followed):

1. On February 24th and 25th 2015, a Bell 206 Jet Ranger Helicopter was used to locate radio-collared Cow Moose in 5-04B using radio-telemetry. The survey crew consisted of a navigator/radio-telemetry operator in the front and two observers in the rear of the helicopter. Once a collared animal was located, it was observed for a sufficient time to determine presence of a calf or calves. The animal's location was marked with a handheld GPS unit by the rear observer who also recorded the data. Non-collared moose observed during the survey were also opportunistically counted and classified as either bulls, cows or calves. Because the survey was biased toward looking for cows, data was not suitable to use for making inferences regarding bull to cow ratios.
2. Survey methodology for the Big Horn Sheep survey was informed from Aerial-based Inventory Techniques for Selected Ungulates (RISC, 2002). Bighorn Sheep were surveyed using encounter transects spaced at approximately 400 m in open habitats and 200 m in more closed forested habitats. Transects typically followed contours from low to high elevation. Speeds of 50-80 km/hour were targeted while maintaining a distance of 50-300 m above the ground. The survey crew consisted of one navigator in the front seat and two observers in the rear. The navigator used the track log function on a handheld GPS unit to monitor survey coverage and mark

waypoints of animal locations. When animals were located the group was circled to allow observers to count and classify the sheep. Post-classification the navigator took photographs of the groups to confirm classifications.

Results:

1. Calf: Cow ratio for collared cow moose in 5-04B was 35: 100, with all 43 collared cows located during the survey.
2. Alkali-Dog Creek = 123 sheep observed, 71 ewes, 22 lambs, and 30 rams. Slight decline.
Churn Ck Fraser West = 108 sheep observed, 59 ewes, 20 lambs & 29 rams. Stable to increasing trend.
Junction = 154 sheep observed, 84 ewes, 27 lambs, and 43 rams. Stable to increasing trend.

Lamb recruitment on all three surveys was above 30 lambs: 100 ewes.

Management Implications/Recommendations as a Result of this Survey:

1. Recruitment rate information will be used to inform the provincial moose mortality project as well as future population models used for harvest allocation. Results are also important to inform management discussion with stakeholders and First Nations regarding the recent moose population decline and potential causative factors.
2. Big Horn Sheep Population counts will be used to guide future harvest decisions and First Nations engagement.

Project Name: Itcha Ilgachuz Caribou Post-calving Population Survey 2014

Region: Cariboo (Region 5)

Species: Northern Caribou

Survey Area/Extent (include size of Survey and Project Areas): MU 5-12

Funding Source(s): BGIF- \$30,000; FLNR \$6,605

Total Project Budget: \$45,000 budgeted, actual spend was \$36,605

Amount Allocated from BGIF: \$30,000

Amount Spent from BGIF: \$30,000

Rationale for the Survey:

- **What was the regional priority of this survey?**
Ranked as priority #2
- **Were there First Nations issues that led to this survey? If so, briefly describe.**
Yes, there is FN concern with wolf predation, declining caribou numbers and low calf recruitment over the past 10 years. The post-calving caribou survey provides a sightability index for both collared cows and collared bulls, a current population estimate, neo-natal calf recruitment rates, and population trend.
- **What is the level of hunter interest and participation for this population?**
Moderate interest by local resident hunters. Local guides express interest, but do not generally use all quota.
- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**
The current AAH of 40 bulls (RH and NRH) has been under-utilized over the past 5 years (avg. harvest 20 bulls, 2010-2014). First Nation harvest is estimated between 20-30 caribou. Consequently, hunter opportunity will likely be maintained under the current GOS in 2015; however, options for LEH or reduced GOS will be investigated given that the caribou population has declined 52% since 2003.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**
Yes
- **Is this a repeated survey? If so, when was the last survey?**
Yes. The Itcha-Ilgachuz caribou herd has been part of a continuous monitoring program since the 1980s. Recent surveys undertaken in 2014, 2012, 2009, and 2007 observed a decrease in caribou numbers from the high counts of observed caribou in 2003.
- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**
 - Obtain a population estimate and assess trend.
 - Sustainable harvest target is 2-3% as per Hatter and Young (2004)¹.
 - Provincial management target of 35 bulls:100 cows post-harvest season.

Methods (state RISC standards followed):

Below is an excerpt from the Itcha Ilgachuz Population Report (draft 2015).

In 2014 a portion of the adult females and adult males in the Itcha-Ilgachuz caribou herd had GPS or VHF collars, thereby enabling surveyors to utilize mark-resight methods to generate survey estimates. The post-calving caribou survey was

conducted in two stages: a pre-survey telemetry fixed-wing flight followed by rotary-wing survey using total count for absolute abundance methods (Resource Information Standards Committee, 2002). The purpose of the telemetry flight was to locate all collared caribou, determine the number of radio-collars within the defined survey area, and identify any collars on mortality signal. For the rotary-wing survey, mountain complexes were flown in a counter clockwise manner to allow observers on the left side of the helicopter to scan the open habitat for caribou; several of the wider ridges and meadows required more than one pass for complete visual coverage. The observer in the back right-hand seat provided additional coverage when necessary, particularly in the flatter and forested terrain. Caribou group locations and flight lines were recorded in UTM coordinates using a handheld GPS unit to ensure complete survey area coverage and allow comparison over survey years.

Caribou were classified into the following categories: adult cow, adult bull, yearling cow, yearling bull, calf, unsexed adult, unsexed yearling and unclassified. Unclassified animals were caribou whose age and sex could not be determined; thus, the unclassified category may include adults, yearlings or calves. When a collared caribou was visually detected within a group of caribou, surveyors classified as cow or bull, identified the individual animal by ear tag color combination, and then verified the collar radio-frequency. If the collared caribou was a cow, presence of a calf was recorded: a calf in close proximity and following a collared cow's movements closely was recorded as a cow-calf pair. All collared caribou not observed during the defined survey period, including those outside the defined survey area, were relocated post-survey using radio-telemetry to assess calf presence and confirm herd affiliation to specific mountain ranges. Mountain goats were also inventoried using total count for absolute abundance methods.

Survey estimates with 95% confidence intervals for adult females and adult males were derived using the Joint Hypergeometric Estimator (JHE) Mark-Resight Population Estimation for Closed Population from the NoREMARK software (White & Garrot 1996). Population trend analysis included assessment of long-term and short-term trends based on definitions adapted from Thomas and Gray (2002).

Results:

Below is an excerpt from the Itcha Ilgachuz Population Report (draft 2015).

- The 2014 population estimate is 1,350 caribou. Total number of caribou has been decreasing since the peak population estimate of 2,800 caribou in 2003 and although early calf production rates remain stable, calf survival is poor with inadequate annual recruitment to offset adult mortality. Currently, the herd is similar in size to that of the early 1990s.
- Long-term population trend of the Itcha-Ilgachuz caribou herd is *stable* with change in population size of -3.6% (1994-2014), however the short term trend is *decreasing* with change in population size of -51.8% (2003-2014). Current trend of caribou survey counts is *down* 15.6% (2012-2014).
- The 2014 survey count was 685 caribou. An additional 266 caribou were observed post-survey, resulting in a minimum count of 951 caribou. Survey estimate for adult cows was 753 (535-1319) and adult males was 137 (66-696) using mark-resight methods. Combined the adult cows and bulls were estimated at 890 (601-2015).
- Early calf production of 33.0% calves and calf ratios of 56.6 calves:100 cows were comparable to those observed when the Itcha-Ilgachuz herd was increasing from 1996 to 2003. However, annual calf recruitment averaged 9.3% calves between 2004 and 2014 (n=4), much lower than the average 17% calves (1996-2003, n=8) observed during herd growth.
- The June bull ratio using minimum count data was 28.7 bulls:100 cows. Additional survey in October resulted in a bull ratio of 29.7 bulls: 100 cows. Interpretation of bull:cow ratios should consider potential bias associated with classification error. During the rut survey, similar body size and antler development in yearling bulls and young adult cows may result in some yearling bulls being misclassified and counted as cows thereby underestimating the bull: cow ratio. However, the presence of collared bulls in the caribou herd provided insight into bull sightability (33% in June 2014), increased confidence in bull counts, and knowledge of bull distribution on the landscape. The observed bull ratio is below the provincial management target of 35 bulls:100 cows post-harvest season.

- Caribou have modified their use of the landscape possibly in response to habitat changes associated with the mountain pine beetle epidemic and/or dispersed to reduce predation risk. Expansion of the survey area may be required in future inventories if caribou distribution continues to shift in the low elevation forested landscape. Targeting high suitability low elevation habitat that favours sightability will increase survey efficiency and effectiveness; habitat suitability mapping based on current telemetry data may assist in identifying these areas.

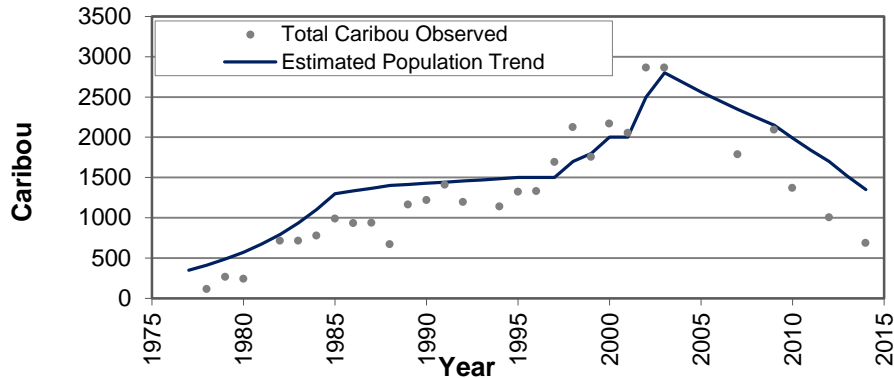


Figure 1. Summary of caribou post calving surveys for the Itcha-Ilgachuz Mountains caribou herd, 1977-2014.

Management Implications/Recommendations as a Result of this Survey:

Summary

- The caribou population has declined 52% between 2003 (pop. est. 2800) and 2014 (pop. est. 1350).
- The 2014 observed bull ratio of 29.7 bulls:100 cows is below the provincial management target of 35 bulls:100 cows post-harvest season.
- Harvest rates of 2 to 3% have been recommended as a sustainable limit to maintain woodland caribou populations (Hayes et al. 2003). For the Itcha-Ilgachuz herd a harvest rate of 2-3% based on a pre-hunt population estimate of 1132 would yield an annual sustainable harvest of 23-34 caribou (pop estimate of 1350 – [1350 * 0.51 calf survival June-Oct, 1996-2000] = 1132 pre-hunt pop. estimate).
- The current AAH exceeds the recommended sustainable harvest yield. The AAH is 40 bulls (RH and NRH), not accounting for First Nation harvest estimate of 20-30 caribou. Combined, the RH-NRH & FN harvest take is 60-70 caribou. However, the reported hunt has been under-utilized over the past 5 years, with average harvest of 20 bulls per season (RH & NRH 2010-2014)
- A potential harvest of 60-70 caribou (AAH + FN) represents 5.3-6.2% of the population.

Recommendations

- Current harvest management is GOS for 5 point bull between September 1 and October 15.
- Consider regulation change: options for LEH or reduced GOS.
- Consider reducing the AAH, while taking into account FN harvest, to be within the recommended 2-3% harvest.

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Project Names: (reallocated from: *Boundary GMZ Moose SRB Survey* and *Similkameen GMZ Moose SRB Survey*)

- 1. Boundary Moose Composition (incomplete SRB)**
- 2. Grand Forks Bighorn Sheep Census**
- 3. Westside/Shorts Bighorn Sheep Census**
- 4. Okanagan Mountain Park Mountain Goat & Bighorn Sheep Census**
- 5. Similkameen Mountain Goat Census**

Okanagan Region BGIF dollars were allocated to SRB moose surveys in the Boundary and Similkameen GMZs. Unfortunately, persistent, inclement weather forced cancellation of the surveys in both locations. Funds were reallocated to 2nd priority inventories in the region. The following includes composition data from the incomplete SRB moose survey plus the additional 2nd priority surveys.

Region: Thompson/Okanagan (Region 8)

Species: Moose, California bighorn sheep, Mountain goat

Survey Area/Extent (include size of Survey and Project Areas):

1. Moose composition (MU 8-15) – north of Grand Forks along the Granby and Burrell Rivers to Hwy 6 in the north.
2. Grand Forks bighorn (MU 8-15) – south aspects from Sand Creek to Christina Lake north of Hwy 3 and Grand Forks
3. Westside/Shorts bighorn (MU 8-11) – Shorts Creek canyon and east aspects above Westside Road from Bear Creek to Shorts Creek.
4. Okanagan Mountain Park bighorn sheep and goats (MU 8-09) – Okanagan Mountain Park.
5. Similkameen goats (MU 8-02/8-07) – North of Hwy 3 from Princeton to Keremeos and from Keremeos to north of Olalla.

Funding Source(s): BGIF

Total Project Budget:

Amount Allocated from BGIF: \$95,000

Amount Spent from BGIF: \$52,000

Rationale for the Survey:

- **What was the regional priority of this survey?**
In 2014/15 the regional priority was 1 for moose and 2 for goat and sheep.
- **Were there First Nations issues that led to this survey? If so, briefly describe.**
Local First Nations did not initiate these surveys, although a strong interest in the Similkameen goat and bighorn populations exists from the Upper and Lower Similkameen Bands.
- **What is the level of hunter interest and participation for this population?**
The hunted bighorn sheep populations surveyed in Okanagan Mountain Park (MU 8-09) and Granby (MU 8-15) see the most demand of any draws issued in the Okanagan populations. This year there were 2 LEH authorizations issued for Okanagan Park and 4 LEH authorizations for the Granby. Both are tenured guide-outfitter territories, which collectively have a 5 year quota of 26 sheep (5.2 per year). The survey in MU 8-11 was used to determine the status and location of transplanted bighorns that were introduced into Shorts Creek in January of 2015.

In regards to the Mountain goats, there are currently 5 LEH authorizations issued regionally a year and a cumulative 5 year GO quota of 8 Mountain goats between 2 outfitters resulting in an average licenced harvest of 6-7 goats per year. Mountain Goat LEH in the Okanagan are the most highly subscribed in the province (i.e. 187:1 odds for MU 8-09 and 95:1 odds for MU 8-07 in 2015) and GO hunts are listed at \$30,000 because of the trophy quality and ease of access.

- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**

Surveys resulted in an increase in quota and LEH authorizations for the Grand Forks bighorn population and status quo for other populations.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**

All species surveyed are Category A.

- **Is this a repeated survey? If so, when was the last survey?**

All surveys were repeat surveys for sheep and goat:

- Grand Forks bighorn (2012)
- Westside bighorn (2012)
- Okanagan Park bighorn and goats (2013)
- Similkameen Goats (2010)

- **Was there a specific population management objective for this population that led to this survey?**

No population specific objectives.

Methods (state RISC standards followed):

General survey standards were adopted from Aerial-based Inventory Techniques for Selected Ungulates (RISC, 2002). Surveys were conducted with a Bell 206 Jet Ranger equipped with rear bubble observation windows. Encounter transects were used to locate bighorn with transects spaced at approximately 400 m in open habitats and 200 m in more closed forested habitats. Transects typically followed contours from low to high elevation. Speeds of 50-80 km/hour were targeted while maintaining a distance of 50-300 m above the ground.

We used three people on surveys at all times: one navigator in the front seat and two observers in the rear. The navigator used the track log function and real time navigation feature on a Garmin 60Cx handheld GPS to maintain transect width, monitor survey coverage, mark waypoints of animal locations, and record data. In addition, the navigator photographed observed bighorn whenever possible. Observers located, counted and classified from the rear seats.

Results:

1. Boundary moose composition (incomplete SRB)
 - total of 43 moose counted with observed calf: 100 cow and bull: 100 cow ratios of 19 and 13, respectively.
2. Grand Forks bighorn sheep census
 - total of 228 sheep counted with observed lamb: 100 ewe and ram: 100 ewe ratios of 18 and 54, respectively.
 - previous survey in December 2012 counted 129 bighorn.
3. Westside/Shorts bighorn sheep census
 - total of 74 bighorn observed, including the recently translocated bighorn, which are residing within the Shorts Ck. Park or immediate area.
 - herd augmented with 36 bighorn in Jan 2015, previous estimate was 40-50 bighorn.
4. Okanagan Mountain Park mountain goat & bighorn sheep census
 - total of 85 mountain goats counted with observed kid: 100 adult ratios of 27.
 - increase in mountain goat observations from 63 and 59 in 2011 and 2012, respectively.

- total of 65 bighorn counted with observed lamb: 100 ewe and ram: 100 ewe ratios of 16 and 14, respectively.
5. Similkameen mountain goat census
- total of 88 mountain goats counted with observed kid: 100 adult ratio of 28.
 - previous inventory (2010) counted 95 mountain goats with a observed kid: 100 adult ratio of 14.

Management Implications/Recommendations as a Result of this Survey:

Harvest allocation will continue to track the updated population estimates from these surveys with everything remaining status quo except for the Granby Bighorn population MU 8-15 which will see an increase in quota and LEH authorizations.

Project Name: First Nation Harvest Surveys

Region: Skeena (Region 6)

Species: Moose

Survey Area/Extent (include size of Survey and Project Areas): Kitsumkalum First Nation Traditional Territory, Gitanyow traditional territory, Ulkatcho First Nation traditional territory

Funding Source(s): BGIF

Total Project Budget: \$20,000

Amount Allocated from BGIF: \$20,000

Amount Spent from BGIF: \$20,000

Rationale for the Survey:

- **What was the regional priority of this survey?**

1

- **Were there First Nations issues that led to this survey? If so, briefly describe.**

FN harvest information is critical to ensure optimized, sustainable use of wildlife in support of FN needs (Activity 1), and to address FN concerns with wildlife populations (Activity 2), especially in regard to the ability of a wildlife population to meet sustenance needs. Skeena provided funding for FN harvest surveys for the Tahltan, Gitanyow, Ulkatcho and Kitsumkalum FN's over 2010-2014. We wish to continue to support the Gitanyow, Ulkatcho, and Kitsumkalum studies. Without these surveys, the ministry is forced to "guess" at FN harvest levels and is vulnerable to legal challenges by FN's of harvest management procedures. The Gitanyow and Nisga'a FN's recognize that their unregulated harvest, particularly of cow moose, may be largely responsible for the decline and lack of recovery of the Nass moose population. The Ulkatcho FN feels strongly that licensed harvest is causing the Tweedsmuir/Entiako moose population to decline.

- **What is the level of hunter interest and participation for this population?**

These populations are all LEH hunts with high subscription rates.

- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**

The data will likely not result in any changes to hunter opportunity.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**

Yes

- **Is this a repeated survey? If so, when was the last survey?**

Yes, similar surveys took place in 2014 for all FN's.

- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**

Data was to inform harvest management allocation.

Methods (state RISC standards followed):

Surveys were community based interviews of hunters from the First Nation. No RISC standards exist for this type of data collection.

Results:

Two of the three First Nations have provided reports on harvest from within their community.

Management Implications/Recommendations as a Result of this Survey:

The value of these surveys is in the data they produce, but also the engagement with First Nations regarding their harvest of moose. We are building a relationship which will lead to more communication and collaboration with local First Nations on moose harvest.

Project Name: Skeena Southern Mountain Goat Inventory

Region: Skeena (Region 6)

Species: Mountain Goat

Survey Area/Extent (include size of Survey and Project Areas): MU 6-09 (bluffs south of Houston, Morice Mountain, LEH Zones of 6-09E Sibolas, 6-09D Nanika Mountain, 6-09G Nadina Mountain, 6-04A Kasalka Range, and 6-09R Atna River).

Funding Source(s): BGIF

Total Project Budget: \$22,200

Amount Allocated from BGIF: \$22,200

Amount Spent from BGIF: \$22,200

Rationale for the Survey:

- **What was the regional priority of this survey?**

Based on the four regional priorities submitted last year for LBIS, this was priority 2, so it did have a high regional priority. Past inventory data from the 1990's indicates that all three LEH Zones (6-09D, 6-09E and 6-09G) and Morice Mountain are near or below the threshold of 50 adult goats. LEH area 6-09R had not previously been surveyed and the population for management purposes was estimated. LEH Zone 6-04A was surveyed in 2004, where the population was estimated with a SCF of 1.2 at 48. Since this is below the recommended level for harvesting, a repeat survey was suggested. The bluffs south of Houston are not currently open to harvesting; however an inventory had not been done in the area previously. Based on all this information, a survey of these areas was undertaken. Implementation of the direction identified in the Provincial Goat Management Plan necessitates an inventory for each of these zones. Currently, there is no harvesting in Morice Mountain due to conservation concerns, but the Skeena Hunter Advisory Committee has been requesting an inventory be undertaken to explore possible implementation of a hunt.

- **Were there First Nations issues that led to this survey? If so, briefly describe.**

No, it was not First Nation issues that led to this survey. However, First Nations are interested in all of the goat areas listed and their respective populations, some in terms of conservation and others for possible harvest. For example, if Morice Mountain were to be opened for harvesting, there would be interest from Wet'suwet'en hunters to harvest the allowable harvest.

- **What is the level of hunter interest and participation for this population?**

For all of these populations, excluding Morice Mountain and the bluffs south of Houston, there is a current licenced goat harvest occurring, for both resident and non-resident hunters.

- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**

Yes, 4 of the survey areas are being recommended for closure on the basis of conservation concerns. The 4 zones recommended for closure include LEH Zones: 6-09D Naninka Mountain, 6-09G Nadina Mountain, 6-04A Kasalka Range, and 6-09R Atna River.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**

Yes, the areas that are open to goat harvesting are Category A (6-09D, 6-09E, 6-09G and 6-04A).

- **Is this a repeated survey? If so, when was the last survey?**

Some of the areas that were surveyed had previously been surveyed (see table below) while other have not previously been surveyed (6-09R, Atna River) and the bluffs south of Houston.

Area	Population Estimate from last survey before recent one (with SCF)	Previous Surveys
6-09D Nanika Mountain	51	1991, 1996, 2012
6-09E - Sibolas	40	1995
6-09 - Morice Mountain	62	1990, 2004
6-09G - Nadina Mountain	63	1982, 1991, 1996, 2000, 2004, 2012
6-04A	48	2004

- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**

Yes, there were management objectives for the populations surveyed. The areas were surveyed for either of 2 reasons. First, for conservation as some goat populations were at or near a level that could support a sustainable harvest. Second, to determine if the goat closed areas could be suitable for future harvest opportunities. The surveys were conducted to maintain and either recommend the open or closure of an area for harvesting.

Methods (state RISC standards followed):

A Bell 206B Jet Ranger helicopter (Highland Helicopters, Smithers, BC) equipped with rear bubble windows was used to survey goats using RISC standards for aerial-based inventory methods for selected ungulates. During July 29-31, 2014 ~18 hours of flying took place to complete surveys for LEH zones 6-09E Sibola Mountain, 6-09D Nanika Mountain, Morice Mountain, 6-04A Kasalka Range, and 6-09R Atna River. On October 14, 2015 ~ 3 hours of surveying occurred along the bluffs south of Houston.

The crew consisted of 1 pilot and 3 observers. The helicopter pilot was Ryan Madley of Highland Helicopters, and the survey crew consisted of Krystal Dixon, Bill Jex and Conrad Thiessen. Suitable goat habitats were surveyed, and all goats observed were recorded. Any additional incidental wildlife species or important features observed were also recorded. At the beginning of each survey we recorded the start time, end time, temperature, wind and cloud cover. With each goat observation we recorded the number of adults (unclassified adults), number of kids (based on body size and close proximity to a nanny), activity (standing, walking, running or lying down), habitat (alpine, sub-alpine, rock/talus, conifer, deciduous, or wetland/meadow), elevation, and UTM coordinates.

A population estimate for the areas surveyed was determined by applying a standardized sightability correction factor (SCF) of 1.25. A SCF of 1.25 means that we feel we observed 80% of the animals in the zone, which we feel is appropriate given the relatively good visibility and survey conditions.

Results:**Minimum counts for the areas surveyed**

Area	Total	Adults	Kids	% Kids	Kids/100 adults
6-09E Sibolas	75	57	18	24%	32
6-09D Nanika	39	32	7	18%	22
6-09G Nadina	45	36	9	20%	25
Morice Mountain	54	43	11	20%	26
6-04A Kasalka Range	24	18	6	25%	33
South Houston Bluffs	124*	96	26	21%	27
6-09R Atna River	6	5	1	17%	20

*includes 2 unclassified

Population estimates for the areas surveyed using a SCF of 1.25

Area	SCF	Total	Adults	Kids	% Kids	Kids/100 adults
6-09E Sibolas	1.25	94	71	23	24%	32
6-09D Nanika	1.25	49	40	9	18%	22
6-09G Nadina	1.25	56	45	11	20%	25
Morice Mountain	1.25	68	54	14	20%	26
6-04A Kasalka Range	1.25	31	23	8	25%	33
South Houston Bluffs	1.25	155	120	33	27%	21
6-09R Atna River	1.25	7	6	1	17%	20

Management Implications/Recommendations as a Result of this Survey:

Area	Management Recommendations
6-09E Sibolas	None. Population okay to keep harvest at 3% status quo.
6-09D Nanika	Recommend harvest closure.
6-09G Nadina	Recommend harvest closure.
Morice Mountain	Do not recommend opening. Population is too close to minimum required to support a harvest and there are several other factors in this area that need to be considered (access, First Nations interest in harvesting this population).
6-04A Kasalka Range	Recommend harvest closure.
South Houston Bluffs	Do not recommend opening; many goats were seen, however, before a harvesting opportunity could be considered, there are several concerns to consider. Some of these concerns include access and landscape changes that need to be understood; habitat selection/use study needed to determine what would be considered the population.
6-09R Atna River	Recommend harvest closure.

Project Name: Moose Composition Survey GMZ 7B

Region: Omineca (Region 7A)

Species: Moose

Survey Area/Extent (include size of Survey and Project Areas): Prince George East (PGE): 7200 km². Prince George West (PGW): 14800 km². Parnsip: 2500 km². Fort St. James (FSJ): 8700 km² (not surveyed in 2014/15 due to poor weather conditions)

Funding Source(s): BGIF

Total Project Budget: \$40,000

Amount Allocated from BGIF: \$40,000

Amount Spent from BGIF: \$30,678

Rationale for the Survey:

- **What was the regional priority of this survey?**

Stratified random block surveys in 2011/12 and 2012/13 showed that moose densities declined in PGE and PGW by 50%. Management actions aimed to increase the moose population focused on lowering the number of cow LEH permits issued to resident hunters and guide outfitters. The calf moose season was also shortened and restricted to youth and seniors. Ongoing monitoring of population demographics, particularly in light of these recent management actions is necessary to understand moose population dynamics.

- **Were there First Nations issues that led to this survey? If so, briefly describe.**

FLNRO wildlife staff has worked closely with First Nations to develop our regional moose management plan. In several regional meetings, First Nations have expressed serious concerns over declining moose densities across the southern Omineca. Results from composition surveys are shared at local meetings to help address concerns over low moose numbers.

- **What is the level of hunter interest and participation for this population?**

The southern Omineca (PGE, PGW, FSJ) reflect some of the highest moose densities in British Columbia and thus are very popular areas for both resident and non-resident hunters.

- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**

Hunter opportunity will remain at the status quo; there is no change in the number of LEH authorizations as a result of this survey.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**

Yes

- **Is this a repeated survey? If so, when was the last survey?**

Yes; composition surveys have been conducted annually since 1984, except for 2007 to 2010. The last composition survey was in 2013/14.

- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**

PGE, PGW, and FSJ study areas have hunted moose populations that are managed to provide a sustainable harvest. Specific population objectives are to ensure that the post-hunt bull:cow ratio remains above 30 bulls:100 cows and recruitment rates above 30 calves:100 cows.

The Parsnip unit is part of a long-term Caribou Recovery Strategy experiment (Gillingham et al. 2010). Moose harvest quotas were increased and hunting seasons lengthened with the objective to maintain moose populations at low densities. We included Parsnip composition to monitor trends in light of increased moose harvest regulations.

Methods (state RISC standards followed):

We calculated the population composition for each survey area in terms of the number of calves per 100 cows, and the number of bulls per 100 cows. Following aerial-based inventory methods for moose (RISC 2002) we circled and classified each moose recording its age and sex as a calf (~ 8 months old), cow, bull (including antler configuration) or unclassified, based on the presence of a white vulva patch, the bell length and shape and facial colouration and morphology (Heard et al. 1999). We conducted the composition counts from Bell 206B Jet Ranger Helicopters flown 30-50 m above the ground.

Results:

We counted a total of 310, 114, and 68 moose in PGE, PGW, and Parsnip study areas respectively. Poor weather conditions prevented us from surveying FSJ in 2014/15. Calf:cow ratios were similar between PGE and PGW averaging 29 ± 9.7 and 27 ± 7.8 calves per 100 cows in 2014 respectively. Recruitment rates in PGW were consistent with 2013 results, however, recruitment appeared to increase in PGE from 15 calves:100 cows in 2013. Calf recruitment in the Parsnip study area decreased from an average of 34 calves per 100 cows in 2013 to 9 ± 2.5 calves per 100 cows in 2014. Sex ratios were similar around Prince George with 37 ± 13.4 and 32 ± 10.2 bulls per 100 cows in PGE and PGW, respectively. These rates were similar to those observed in 2013. We observed a higher than expected sex ratio in the Parsnip where the ratio averaged 108 bulls per 100 cows.

Management Implications/Recommendations as a Result of this Survey:

The 90% decrease in cow LEH permits and restricted calf season in the southern Omineca is anticipated to increase moose numbers by 8% over 5 years. These actions, however, also reduced the number of resident hunters by ~3,000 per year and essentially eliminated cow moose hunting for the guiding industry. Our results suggest that population objectives for sex ratios are being achieved around Prince George (i.e. > 30 bulls:100 cows) however, calf recruitment appears to be low (< 30 calves:100 cows). While no new management recommendations resulted from the 2014/15 composition surveys, continued monitoring of the moose population within these study areas is essential to improve our understanding of moose population dynamics in relation to these ongoing management actions.

Project Name: Robson Valley Elk Inventory

Region: Omineca (Region 7A)

Species: Elk

Survey Area/Extent (include size of Survey and Project Areas):

Agricultural lands within:

- Robson Valley – Morkill River – Holmes River
- PG South – Hixon to Naver Ck.
- PG North – Salmon River/Fraser River Confluence & Willow River/Fraser River
- Vanderhoof/ Ft. St. James – Nechako River – Stuart River and between Tezzeron and Pinchi Lakes

Funding Source(s): BGIF

Total Project Budget: \$12,000

Amount Allocated from BGIF: \$12,000

Amount Spent from BGIF: \$12,000

Rationale for the Survey:

- **What was the regional priority of this survey?**
Elk are of a regional management interest due to both agricultural conflict as well as high resident hunter interest.
- **Were there First Nations issues that led to this survey? If so, briefly describe.**
None
- **What is the level of hunter interest and participation for this population?**
Very high for both interest and participation, given the relatively small number of elk.
- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**
Yes (though results mean we maintain status quo), revisited annually.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**
No
- **Is this a repeated survey? If so, when was the last survey?**
Yes, 2013.
- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**
 - To maintain a viable population of elk in Omineca Region.
 - To maintain sustainable elk harvest in Omineca Region.
 - To coordinate elk population and harvest objectives with agricultural conflicts such that harvest opportunities may be directed to areas experiencing elk-agriculture conflicts.

Methods (state RISC standards followed):

Aerial-based Inventory Methods for Selected Ungulates: Bison, Mountain Goat, Mountain Sheep, Moose, Elk, Deer and Caribou

Standards for Components of British Columbia's Biodiversity No. 32 [Forms] – Presence/Not Detected – Composition surveys

Results:

Despite the poor counting conditions (i.e. low snowpack, infrequent snowfall, poor flying and/or counting weather), relative abundance and distribution of elk appear to be similar to the previous survey (2013).

Area	Number Observed	
	2013	2015
Robson Valley	60	14*
PG South - Hixon	0	0
PG North - Salmon/Willow R.	4	47
Vanderhoof / Ft. St. James	108	201

* Total of 70 were observed using telemetry. Only 14 were observed spontaneously (without the use of telemetry).

Management Implications/Recommendations as a Result of this Survey:

The results from these composition counts are presented, in conjunction with harvest data, to inform a regional elk management stakeholders committee. Any decisions concerning management actions are presented to and made in cooperation with this group. As a result of the 2015 composition counts the harvest regime will remain the same as last year.

Project Name: MU 7-42 Moose Survey

Region: Northeast (Region 7B)

Species: Moose

Survey Area/Extent (include size of Survey and Project Areas): MU 7-42 (5905 km²)

Funding Source(s): BGIF

Total Project Budget: \$84,800

Amount Allocated from BGIF: \$84,800

Amount Spent from BGIF: \$84,800

Rationale for the Survey:

- **What was the regional priority of this survey?**

This survey was ranked as #1 priority for the region.

- **Were there First Nations issues that led to this survey? If so, briefly describe.**

Reports from local First Nations suggested declines in moose populations in MU 7-42 since the early 2000's. The local First Nations have demanded that FLNRO implement Limited Entry Hunting (LEH) and reduce moose harvest by resident and non-resident hunters by 50% in MU 7-42 and surrounding areas. First Nations concerns surrounding the management of moose in the area could be considered extreme.

- **What is the level of hunter interest and participation for this population?**

MU 7-42 supports approximately 2,700 resident hunter days and 295 non-resident hunter days annually (2000–2013 avg.). The average number moose harvested annually from 2000–2013 is 83 by resident hunters and 47 by non-resident hunters.

- **Was there – or is there expected to be – an impact (increase, decrease, or confirmation of status quo) in hunter opportunity as a result of this survey?**

The survey was required to maintain current opportunity for licensed hunters. Given that the observed bull to cow ratio observed during this study was above the provincial minimum, there is no mandate to reduce the current level of bull harvest in this area as a direct result of this survey.

Goals/Management Objectives:

- **Is the surveyed population designated as Category A?**

No. Moose are currently hunted under a general open season for residents and non-residents in the Peace Region.

- **Is this a repeated survey? If so, when was the last survey?**

Yes. MU 7-42 has been previously surveyed using a stratified random block methodology in 1989, 1993, and 2001.

- **Was there a specific population management objective for this population that led to this survey? If so, please indicate the objective(s).**

The priority for population management in this study area is to meet the subsistence needs of local First Nations; however, local First Nations suggested moose populations had declined to inadequate levels. The second priority is to maintain a post-hunt bull to cow ratio greater than 30 bulls per 100 cows in order to support a general open bull season for resident and non-resident hunters.

Methods (state RISC standards followed):

- MU 7-42 (area of 5905 km²) was divided into 5 km by 5 km sample units (SUs) following regional standards for stratified random block (SRB) surveys, for a total of 245 blocks. The SUs were divided into four strata (i.e., high, moderate, low and very low) based on moose and track observations made during pre-survey stratification flights. Stratification transects were flown using a Bell 206 Jet Ranger helicopter at approximately 200–400 m elevation. Transects were flown at 2.5 km intervals starting 1.25 km from the north or south SU edge.
- The survey utilized a SRB design following RISC standards. The SUs to be surveyed were randomly selected for each stratum. Survey flights were conducted at low altitude (40 – 100 m) and low airspeed (80 – 120 km/hr) using a Bell 206 Jet Ranger helicopter. Nine parallel transects were flown over each surveyed SU at 500 m intervals starting 250 m from the SU edge. Search distance for the three observers was 250 m out from both sides of the helicopter.
- Moose sighted were classified as calves (males and females <1 year old), adult cows (females >1 year old), or adult bulls (males >1 year old). Adult bulls were not classified by antler configuration because by mid-January many of the bulls had dropped their antlers. When moose were located, the helicopter was positioned to allow accurate determination of the number, sex, and age class of individuals. The program MOOSEPOP was used to analyze the survey data.

Results:

- A total of 515 moose were observed during the survey, composed of 126 bulls, 350 cows, and 39 calves. The corrected bull to cow ratio was 45 bulls per 100 cows and the corrected calf to cow ratio was 12 calves per 100 cows.
- The uncorrected (for sightability) density estimate for the study area was 0.20 moose per km².

Management Implications/Recommendations as a Result of this Survey:

- The bull to cow ratio observed during this survey has increased since previous surveys and is above the provincial minimum. Thus, there is little concern that the moose population in MU 7-42 is being overharvested by licensed hunters, and the survey results suggest that this population can continue to sustain a general open season for licensed hunters to harvest bulls.
- The calf to cow ratio has declined since previous surveys. This may suggest that suspected increases in predator populations, including wolves and bears, may be contributing to a population decrease in the area.
- The density of moose per km² has also decreased substantially since previous surveys.