SITE C | CLEAN ENERGY PROJECT

RESPONSE TO WORKING GROUP AND PUBLIC COMMENTS ON THE SITE C CLEAN ENERGY PROJECT ENVIRONMENTAL IMPACT STATEMENT

Technical Memo

MOVEMENT OF GRIZZLY BEARS AND LARGE CARNIVORES

MAY 8, 2013

REVISION 1 – JULY 19, 2013

Subject: Movement of Grizzly Bears and Large Carnovires

Purpose

A number of comments received during the Comment Period raise the question of whether the Project has the potential to affect wide ranging species that occur at low densities and/or are unevenly distributed across the landscape. Specifically, concern has been raised over the potential for the Project to interrupt north-south and east-west movement of grizzly bear, fisher, wolverine and lynx. BC Hydro is aware of the interest expressed by the Yellowstone-to-Yukon group with respect to the movement of large mammals.

The purpose of this Technical Memorandum is to: 1) summarize the general rationale for why patterns of migration of wide ranging wildlife will not be affected by the Project, and 2) to provide excerpts Environmental Impact Statement (EIS) that demonstrate consideration for the potential effect of the Project on movements of wide-ranging wildlife.

Effects of the Project on Migration of Large Mammals

The effects of the Project on wide ranging movements of wildlife species were considered in the EIS. Grizzly bears large carnivores and fisher were considered explicitly in Volume 2 Section 14 and Appendix R. Two species identified during the Comment Period as being potentially affected by the Project, wolverine and lynx, were not considered in the EIS. The rationale for their exclusion was provided in the EIS[1]:

Wolverine	Individuals may be found in areas associated with specific Project components, but given their home ranges are very large these activities are not expected to have a measureable effect.
Canada lynx	A species whose population and density is strongly linked to cyclical fluctuations in prey (especially snowshoe hare). Since effects to snowshoe hare are not expected to be measureable the same is assumed for Canada lynx.

The EIS concludes that the Project will not effect the wide ranging movements of grizzly bear and other large carnivores. This conclusion was reached for three reasons. First, conversion of the Peace River to a reservoir will not create a barrier to movement of large mammals in the LAA. Large mammal species, including grizzly, bear have been documented crossing large water bodies. As discussed in the EIS, the proposed reservoir will be 2-3 times the existing width of the Peace River and does not represent a barrier or constraint to movement. The predicted changes in downstream flows with the Project will not prevent animals downstream of the project from continuing to cross the Peace River. As confirmed though DNA studies on grizzly bear in northeastern B.C., no physical barriers currently exist to the movement of grizzly bears throughout northeast BC, including Williston Reservoir, which is a much larger reservoir than the Site C reservoir will be.

[1] EIS Volume 2, Section 14, Table 14.2.

Second, baseline data on grizzly bear, collected by the B.C. Ministry of Environment, indicate that the Peace River valley does not support a resident grizzly bear population. Province wide population estimates are conducted by the British Columbia Minisitry of Forest Lands and Natural Resource Operations on approximately a 4 year interval and are derived from a predictive population density model that uses provincial grizzly bear inventories (based on a DNA mark--recapture methodology), expert knowledge of local areas, local knowledge of bear distribution, availability of food sources, sex and age of past harvests, and the frequency of problem bear occurences (see Attachment 1 British Columbia Grizzly Bear Population Estimate, Ministry of Forest Lands and Natural Resources 2012). As stated in the EIS:

> "GBPU [Grizzly Bear Protection Units] boundaries in northern BC are drawn along natural and ecological boundaries or transition areas (mainly heights of land between watersheds) as bear movements in this region are largely unimpeded (BC Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO) 2012). The north bank of the Peace River valley between Bear Flat and Hudson's Hope is along the southern boundary of the Rocky GBPU population (BC Ministry of Forests, Lands and Natural Resource Operations (BCMFLNRO) 2012), which has a viable population estimated at 538 bears (Table 1.5.1). MU 7-35 is located on the north bank of the Peace between Hudson's Hope and Bear Flat and extends north to the Graham and Halfway Rivers, forming the southern portion of the Rocky GBPU. According to BC Ministry of Environment data, no resident grizzly bears were thought to be present in 2011 within that management unit. The Moberly GBPU lies south and west of Hudson's Hope, on the south bank of the river. The remainder of the Peace River valley is not included in a GBPU but is classified as an area where grizzly bears are extirpated. The 'extirpated' area is bordered by the Hart GBPU to the south, the Moberly to the west, and the Taiga and Alta units to the north (Map 1.6.44). The Taiga and Moberly GPBUs were closed to hunting in 2012 due to low numbers of bears."[2]

Finally, the existing level of habitat changes (alteration and fragmentation), disturbance and displacement, and potential for mortality in the LAA exceeds accepted thresholds for the sustained presence of a resident population and create conditions that currently interrupt or discourage migrations (e.g., roads, habitat changes, livestock protection measures undertaken by agriculture interests) through the LAA. Non-resident grizzly bears infrequently move through the Peace River valley, and movements are limited by conflicts with people and the associated presence of high road densities. As stated in the EIS:

> "The frequency of grizzly bear dispersal through the Peace River valley has not been well documented, but is infrequent based on the province's population and habitat data. Data from DNA studies do not indicate fragmentation within northern grizzly bear populations (Proctor et al. 2012). Patterns of recorded mortalities suggest that there are currently no physical barriers to grizzly bear movements in northeastern B.C., and that movement is instead limited by conflicts with people and associated grizzly bear mortalities (B.C. Ministry of Environment, Large Carnivore Specialist, 2012, pers. comm.). Habitat suitability around the eastern portion of the Peace River

[2] EIS, Volume 2, Appendix R, Part 7: Mammals, Section 1.5.1.2, page 172.

> valley is relatively low and therefore less likely to attract or support dispersing bears (A. Hamilton, B.C. Ministry of Environment, pers. comm. September 2012)."[3]

Road density classes were used to assess the ability of habitats within the LAA to support a population of grizzly bears. Road density analysis is used to determine the suitability of the area for sustaining large carnivore populations as the metric represents the level of risk to the population for conflicts and mortality associated with interactions with humans. The classes used were provided to BC Hydro by the Ministry of Environment and are presented in the EIS[4]. Areas with a road density of >1.2 km/km^2 are considered to be unlikely to be occupied by grizzly bear. Two road density calculations were completed. The first represents the existing road density without the Project, the second represents road density after Project construction. Road densities in both calculations exceed the 1.2 km/km^2. The EIS states:

> "Grizzly bear mortality risk is often assessed using an analysis of road density (Mattson 1993; Mace et al. 1996; Wakkinen and Kasworm 1997). A road density analysis was completed to evaluate changes in the LAA in road density due to the Project. Permanent roads are generally placed in areas where road density already exceeds a 1.2 km/km^2 threshold, and thus these areas are unlikely to be used by grizzly bears. The large unroaded areas south of the Peace River will remain virtually the same once temporary construction roads are removed."[5]

Conclusion

The EIS concludes that construction and operation of the Project will not have a negative effect on grizzly bear populations and other large carnivores or movement in the LAA should it proceed. Nor is it expected to affect other large carnivore species that currently reside or travel through the LAA.

Related Comments / Information Requests:

This technical memo provides information related to the following Information Requests:

gov_0016_010	gov_0005-014	gov_0010-571	gov_0010-574	gov_0010-754
pub_0064-003	pub_0001-001	pub_0049-001	pub_0054-001	pub_0237-001
pub_0243-003	pub_0088-001	pub_0191-001	pub_0194-001	pub_0241-002
pub_0376-001	pub_0244-001	pub_0246-003	pub_0249-001	pub_0293-001
pub_0508-001	pub_0457-006	pub_0474-001	pub_0478-008	pub_0478-011
pub_0603-001	pub_0535-009	pub_0596-001	pub_0597-001	pub_0597-004
pub_0795-001	pub_0641-001	pub_0739-001	pub_0742-001	pub_0783-001
pub_0980-001	pub_0796-001	pub_0910-001	pub_0935-001	pub_0952-001
ab_0007-005	pub_1018-001	pub_1020-001	ab_0001-342	ab_0001-351
Response to Sierra Club and Yellowstone to Yukon Conservation Initiative (Y2Y) Standard Letters				

[3] Volume 2, Section 14 Wildlife Resources, Section 14.2.9 Large Carnivores, page 14-22 lines 39-46 and page 14-23 line 1.

[4] EIS Volume 2, Appendix R, Part 7, Table 1.5.2, page 174.

[5] EIS Volume 2, Section 14 Wildlife Resources, Section 14.2.9 Large Carnivores, page 14-23 lines 3-10.

TECHNICAL MEMO – ATTACHMENT 1

MOVEMENT OF GRIZZLY BEARS AND LARGE CARNIVORES

British Columbia Grizzly Bear Population Estimate for 2012

Ministry of Forests, Lands and Natural Resource Operations
April, 2012

Introduction

This report summarizes the current (2012) Grizzly bear population estimate for British Columbia. The previous population estimate was made in 2004 (Hamilton et al. 2004), and updated in 2008 (Hamilton 2008). The 2012 population estimate is primarily derived from a predictive population density model that uses all of the provincial Grizzly bear inventories (mark-recapture DNA estimates) and other inventories across North America to predict densities in areas without mark-recapture inventories on the basis of several environmental and human independent factors that are thought to influence bear numbers. Where they existed, inventory results were directly applied. Expert knowledge of local areas was used in addition to the information provided by the model to determine population estimates for each Grizzly bear Population Unit (GBPU) in the province.

The population estimate is one portion of the information used in managing harvest opportunities for Grizzly bears in BC. *The Grizzly Bear Hunting - Frequently Asked Questions* document (available at www.env.gov.bc.ca/fw/wildlife/management-issues/#grizzly) explains in detail the harvest managment process.

Grizzly Bear Population Units

The current range of Grizzly bears in British Columbia has been divided into 56 GBPUs that delineate individual bear populations for conservation and management. In the south, GBPU boundaries follow natural (e.g. large rivers) and human-caused (e.g. settled valleys) fractures in Grizzly bear distribution. In the case of many southern GBPUs, the boundaries also reflect a degree of genetic isolation from other populations (Proctor et al. 2012). In northern and coastal British Columbia, GBPU boundaries follow natural and ecological boundaries or transition areas (primarily heights of land between watersheds) as there are few actual barriers to Grizzly bear movement.

GBPU boundaries at the edges of Grizzly bear distribution in the province represent the "occupied/unoccupied" line. This line was drawn to reflect the known and predicted distribution of resident adult females. Transient males, particularly subadults, are occasionally sighted in unoccupied areas. However, these lines are the expected limits of areas regularly inhabited by Grizzly bears. GBPUs serve as the key units for setting population objectives. They are also used for setting land-use priorities during strategic land-use planning. Each GBPU has been assigned a

conservation status of either Threatened or Viable. The objective for the 9 Threatened GBPUs in B.C. is population recovery to prevent range contraction and ensure long-term population viability. The objectives for the remaining 47 viable GBPUs includes maintaining current population abundance and distribution, and providing sustainable harvest and viewing opportunities where appropriate.

Population Estimation

Population estimates for Grizzly bears in BC have changed over the years, as new and more sophisticated methods for estimating populations have become available. In the 1970's the estimate was 6,600 bears. That changed to 13,000 (a minimum estimate) in 1990 and 17,000 in 2004. The last estimate from 2008 was 16,000. The 2012 estimate is 15,000. Because the methods used to estimate the population have evolved and improved over time, the variation in estimates from year to year do not reflect a trend in Grizzly bear numbers in the province. The current estimate uses all available inventories and incorporates the most rigorous statistical modelling approach used to date.

Direct inventories used DNA mark-recapture methods to determine bear density (the number of bears per 1000 km^2) in a particular area. This type of inventory, that was first developed in British Columbia (Woods et al. 1999) has been carried out here since 1996 and provides the most reliable population estimates with a measure of confidence for the various studies areas (see summary in Proctor et al. 2010). In several areas, direct application of inventory was used to derive the 2012 population estimate.

In the majority of the province, a predictive population density model (using multiple regression analysis) was used to estimate the number of Grizzly bears. This model used 89 estimates of Grizzly bear density from study areas across western North America to predict Grizzly bear densities in areas of the province using independent variables such as precipitation, vegetation type and human and livestock densities. These variables were found to be significant as general landscape scale predictors of Grizzly bear density. The regression model did not find hunting (harvest/1000km^2) to be a significant factor predicting density. The above model was derived for areas where grizzly bears ate little or no salmon (interior). Another model was built to predict density for coastal areas where salmon was a large part of the diet. The coastal model had 18 records of density and included 4 variables. A similar type of multiple regression model was used to obtain the 2008 Grizzly bear population estimate (Mowat et al. 2004). However, the current models incorporate additional data from recent inventories and employ more sophisticated statistical analysis. The new models were also applied at a finer scale (Wildlife Management Units) to better reflect density differences across GBPUs (GBPUs incorporate several Management Units).

Model estimates were carefully considered by ministry regional biologists. They took into

account the precision of the model estimate, local knowledge on bear distribution and movements, availability of major food sources such as salmon, as well as the age and sex of past hunter harvests and the frequency of problem bear occurrences. The model estimate was accepted or modified based on the above considerations. For example, the model for the interior areas of the province was better at predicting densities than the model for the coastal areas. For the coastal populations, information from inventories and local knowledge about the abundance of bears was used to estimate the population, rather than a strict reliance on the model.

In some areas the model estimate was modified to be lower or higher through expert opinion. In 17 of 184 Management Units (MUs), the opinion of experts differed greatly from model estimates. In six of these MUs, the model predicted no bears but, because bears do exist in these areas the model estimate was changed. Of the remaining 11 MUs, three were adjusted down and eight were adjusted up. In the majority of these cases (9), the MUs were on the coast or heavily influenced by the presence of spawning salmon. The authors of the model cautioned that the "coastal" version of the model was less reliable than the "interior" version, largely because of the limited number of reliable mark-recapture density estimates available for the coast and the high influence of rainfall as a model input parameter. In the final two MUs, regional biologists applied densities from adjacent Management Units and inventories that were done in nearby areas to adjust the estimate.

The revised Grizzly bear population estimate for British Columbia in 2012 is 15,075 bears. A quantitative measure of precision at the provincial level is not possible because the expert-based approach does not provide a statistical estimate of uncertainty.

The 2012 estimate of approximately 15,000 bears should not be interpreted as a decline in Grizzly bear numbers since 2008 but rather a more accurate estimate of the total population size in the Province. Differences between the 2008 and 2012 estimates are due to the updated model, the application of the model at the Management Unit scale, and the availability of new information, such as recent inventory and monitoring work which informed the revised estimates. Population estimates by GBPU are summarized in Table 1. Grizzly bear densities by GBPU in increments of 10 bears/1000km^2 are shown in Figure 1.

Grizzly Bear Hunting

There is no Grizzly bear hunting in extirpated areas or Threatened GBPUs (Figure 2). Other areas closed to Grizzly bear hunting include Grizzly Bear Management Areas and National Parks. Some GBPUs may be temporarily closed where known mortality has met or exceeded allowable limits, as established through the Ministry's Grizzly bear harvest management procedure. Two GBPUs, the Francois and Moberly, were closed in 2012 as a result of their new, lower, population estimates. In other areas open to hunting the allowable harvest has been adjusted up or down reflecting the new population estimates. While population estimates are

used to set allowable harvest limits, other information collected from harvested bears (e.g. sex and age) is also used to ensure a sustainable harvest. For more information on the management of Grizzly bear hunting in British Columbia please refer to the *Grizzly Bear Hunting – Frequently Asked Questions* document on the Fish, Wildlife and Habitat Management Branch website (www.env.gov.bc.ca/fw/wildlife/management-issues/#grizzly).

Figures

Figure 1. Grizzly bear density by Grizzly Bear Population Unit.

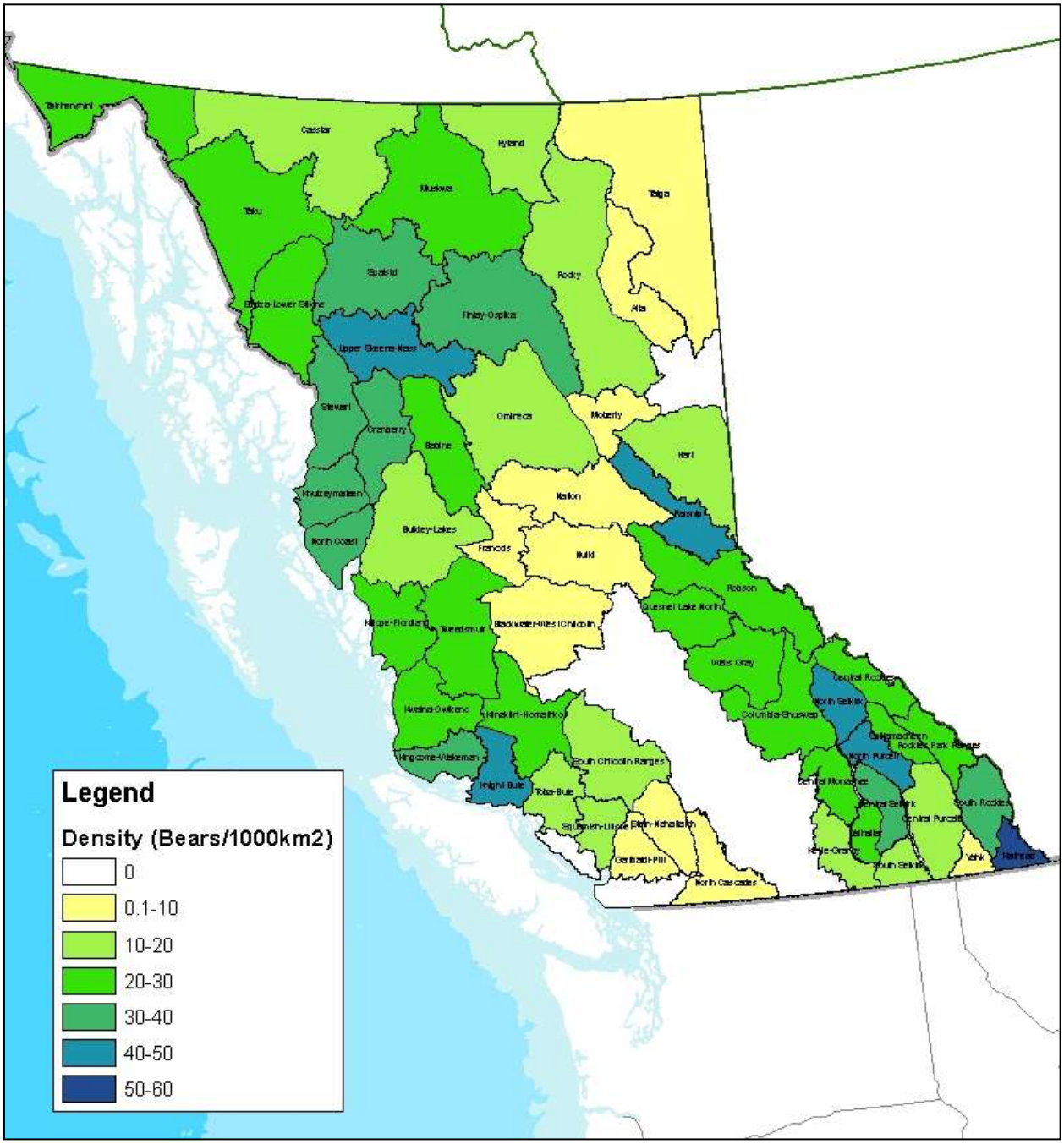
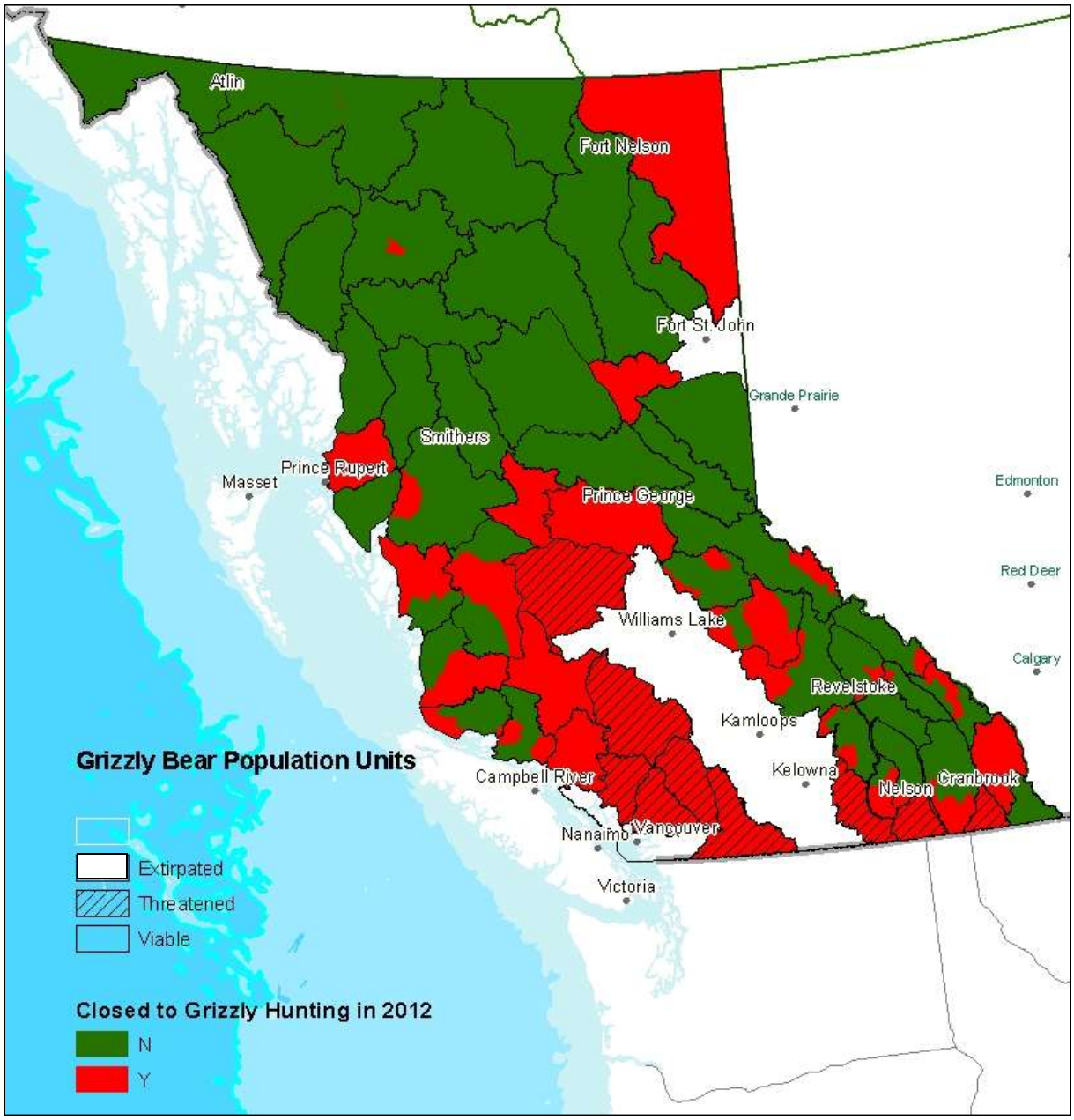


Figure 2. Areas open (green) and closed (red) to Grizzly bear hunting in British Columbia. Threatened units are identified by cross-hatching. White areas within BC are extirpated or never occupied.



Tables

Table 1. Grizzly Bear Population Estimates for British Columbia by GBPU, 2012. Dark grey indicates threatened units, light grey highlights additional units that are currently not hunted.

Grizzly Bear Population Unit	2012 Estimate
Alta	132
Babine	313
Blackwater-West Chilcotin	53
Bulkley-Lakes	439
Cassiar	612
Central Monashee	147
Central Purcell (formerly South and Central Purcell)	176
Central Rockies	169
Central Selkirk	188
Columbia-Shuswap	346
Cranberry	349
Edziza-Lower Stikine	398
Finlay-Ospika	971
Flathead	175
Francois	58
Garibaldi-Pitt	2
Hart	244
Hyland	231
Kettle-Granby	86
Khutzeymateen	280
Kingcome-Wakeman	199
Kitlope-Fiordland	214
Klinaklini-Homathko	251
Knight-Bute	250
Kwatna-Owikeno	229
Moberly	71
Muskwa	840
Nation	170
North Cascades	6
North Coast	190
North Purcell	234
North Selkirk	265
Nulki	44
Omineca	402
Parsnip	455

Grizzly Bear Population Unit	2012 Estimate
Quesnel Lake North	187
Robson	534
Rockies Park Ranges	116
Rocky	538
South Chilcotin Ranges	203
South Rockies	305
South Selkirk	58
Spatsizi	666
Spillamacheen	98
Squamish-Lillooet	59
Stein-Nahatlatch	24
Stewart	358
Taiga	94
Taku	575
Tatshenshini	407
Toba-Bute	116
Tweedsmuir	368
Upper Skeena-Nass	755
Valhalla	88
Wells Gray	317
Yahk	20
Total	**15,075**

Threatened GBPUs	Dark grey
Additional un-hunted GBPUs	Light grey

References

Hamilton, A.N. 2008. 2008 Grizzly bear population estimate for British Columbia. B.C. Ministry of Environment. October, 2008. 3pp. Available at: http://www.env.gov.bc.ca/wld/documents/gbcs/2008_Grizzly_Population_Estimate_final.pdf

Hamilton, A.N., D.C. Heard, and M.A. Austin. 2004. British Columbia Grizzly Bear (*Ursus arctos*) population estimate 2004. B.C. Ministry of Water, Land and Air Protection. Victoria, BC. 7pp. Available at: http://www.env.gov.bc.ca/wld/documents/gb_bc_pop_est.pdf

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