Grizzly Bear Habitat Assessment and Candidate WHA Submission:

Western Portions of the Kitimat River Area of TFL #41

Contract: GS-Mcelhanney-08-01

Prepared for:
Lance Loggin, R.P.F.
West Fraser Mills Ltd.
5330 Highway 16 West,
Terrace, BC
V8G 4A3

April 2009

Prepared By:
Brad T. Pollard, R.P.Bio. and
Tosha Casper, B.Sc.
McElhanney Consulting Services Ltd.
Suite # 1 – 5008 Pohle Ave.
Terrace BC

Executive Summary

McElhanney Consulting Services Ltd. was contracted by British Colombia Timber Sales (BCTS) and West Fraser Mills Ltd. (Skeena Sawmills) to identify high value habitat for grizzly bear in several watersheds flowing into Kitimat Arm and the Douglas Channel (Western Kitimat River study area). The purpose of the project was to enable Wildlife Habitat Area (WHA) establishment under the provincial Identified Wildlife Management Strategy (IWMS) and the Forest and Range Practices Act (FRPA) and to implement strategies outlined for grizzly bear management in the Kalum Land and Resource Management Plan (Kalum LRMP). This project was completed concurrently with a moose winter range identification, results of which are provided in a separate report.

The approach used to identify high value grizzly bear habitat within the Western Kitimat River study area follows a method that has been progressively improved over the last few years to comply with existing Resource Inventory Committee (RIC) standards. No RIC methodology for identifying candidate WHA currently exists, but discussions with Provincial wildlife staff and other grizzly bear experts suggest that the final RIC methodology will likely follow the general approach used for this project.

Initially, the area was assessed using ground, aerial and remote survey methods. The method involved first identifying all potentially high value areas by orthophotographs and then field verifying a subset of those polygons. Those polygons not seen in the field were examined in detail on orthophotographs, in the context of those seen in the field, and characteristics and ratings were assigned. High value core sites were then enclosed within forest buffers, where possible, to provide candidate WHA.

During planning stages a total of 3207 potential grizzly bear core areas were identified, leading to the identification of 1704 core areas with moderate, high or very high values during field and remote surveys. Core areas identified are distributed among general categories of avalanche (32.7%), floodplain (26%), wetlands (21.2%), rich forests (16.9%), mesic forests (2.8%) and other (0.4%) habitats. The highest number of core areas are located in avalanche ecosystems of the moist maritime subzone of the Mountain Hemlock biogeoclimatic zone and floodplain ecosystems of the very wet maritime subzone of the Coastal Western Hemlock biogeoclimatic zone (18.1 and 16.4%, respectively).

A total of 391 candidate WHA were designed to capture all moderate to high value core areas. Due to the variation of ecosystems represented in the core areas, core areas are distributed throughout the landscape. There is a tendency, however, to concentrations at the valley bottoms adjacent to fish bearing rivers and on low elevation south and south west-facing steep slopes where avalanches predominate.

In order for core areas to retain their ecological integrity and value to grizzly bears, the maintenance of adjacent forest as security cover is essential. A goal of this project was to ensure that security habitats (buffers) for core areas were applied appropriately and according to site specific habitat protection requirements. The maintenance of full retention buffers around core areas is critical to ensure the long term value and use of these sites by grizzly bears.

The submission package for the Western Kitimat River study area includes this report, and a CD that includes digital map coverage of candidate security WHA, a complete photo log, field data in a Resource Inventory Committee (RIC) format and VENUS, and an accompanying attributes database.

Acknowledgements

Establishing suitable wildlife habitat areas for grizzly bear in their most valuable foraging area was the goal of this project. Because this is a consistent objective among government staff and stakeholders, we were able to solicit valuable input, feedback and participation from a variety of individuals.

We am grateful to Ministry of Environment staff Tony Hamilton, Anne Hetherington, and Troy Larden for their input and advice. A special thanks to Chris Broster, Ecosystem Specialist. He acted as the contract monitor on behalf of the Ministry of Environment, assisted with field work, and provided positive support and feedback throughout the project.

Thanks are also in order to a variety of participants and stakeholders who provided invaluable information on local grizzly bear use including Fred Seiler, a local ecotourism guide with a strong interest in the grizzlies of this area. William Renwick from the Haisla First Nation provided valuable local knowledge as well as participating in field work. Grant MacHutchon was a great sounding board for methodology discussions and was kind enough to provide his coastal grizzly bear life history (Appendix I) as support for the methodology and habitat valuation.

Finally, this project would not have been possible without the dedicated support of the McElhanney project team including Patty Burt and Kate Dillon. These people boldly treaded through grizzly bear habitat armed with notebooks and pencils. I would also like to thank Quantum Helicopters for safely transporting us in and out of bear country.

This project was funded by the forest licencee Forest Investment Account (FIA) through the coordination of Gail Campbell of BCTS, with Lance Loggin of Skeena Sawmills (a Division of West Fraser Mills Ltd.) overseeing contract administration.

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Photographs (Appendix II)

List of Attachments

Introduction

McElhanney Consulting Services Ltd. (MCSL) was retained by the West Fraser Mills Ltd. to identify, stratify and rank high value grizzly bear (*Ursus arctos*) habitat within 14 partial 1:20,000 mapsheets covering several watersheds draining into the Kitimat River and Douglas Channel (Western Kitimat River study area). The project is also a key component of the implementation of the Kalum Land Resources Management Plan (Kalum LRMP) (BC Ministry of Sustainable Resource Management 2002), a higher level plan that provides a framework for grizzly bear management. Ministry of Environment (MoE) biologists, field staff and in-kind resources assisted in the completion of the project.

The purpose of this project was to use existing biophysical information, supplemented with field surveys, to locate and map high value grizzly bear habitat within the Western Kitimat River study area. The project set out to:

- review and record local grizzly bear use and habitat information,
- identify and select priority areas for evaluation of high value habitat,
- conduct field assessments to verify habitat values and use,
- map and rank candidate core areas according to their importance to grizzly bears within the context of appropriate Resource Inventory Committee (RIC) standards, and,
- provide information required for future establishment of Wildlife Habitat Areas (WHA).

The resulting product is to be used to assist with forest development planning and facilitate the delineation of Wildlife Habitat Areas (WHA) for grizzly bears as described in the Forest and Range Practices Act (FRPA). During the Kalum LRMP development process, discussions focused on balancing grizzly bear management objectives with impacts to the timber supply. The outcome was a 2.6 to 4% impact to the timber harvesting landbase for grizzly bear management exclusively. A preliminary Timber Harvest Land Base (THLB) assessment is provided to provide resource managers with enough information to determine the impacts of their decisions on forest harvesting levels.

Study Area

This report provides results for grizzly bear habitat assessments for 14 partial 1:20,000 mapsheets covering portions of an area, until recently, known as Tree Farm Licence #41. The study area encompasses an ‘F’ shape of land, reaching from the west side of Douglas Channel north, to Coldwater Creek and east to the Chist Creek drainage. The central branch of the ‘F’ reaches from the Upper Little Wedeene River to the lower reaches of the Hirsch Creek watershed. See Figure 1 for the boundaries of the study area.

The study area is located within the Coast and Mountain Ecoregion and is contained exclusively within the Kitimat Range Ecosection (KIR). Mountains in the KIR are characteristically monolithic granite, nearly devoid of small-scale jointing, round-topped and dome-like with cirques on their north and north eastern sides. Matterhorns protrude above the mostly uniform summit elevations. The heart of the range has been penetrated by fjords and there are fewer glaciers than mountain ranges north and south of the project area. Additionally, no extensive ice fields remain. Long straight valleys or channels, the alignment of short valleys in a straight line comprise north-easterly trending lineament (Holland 1976).

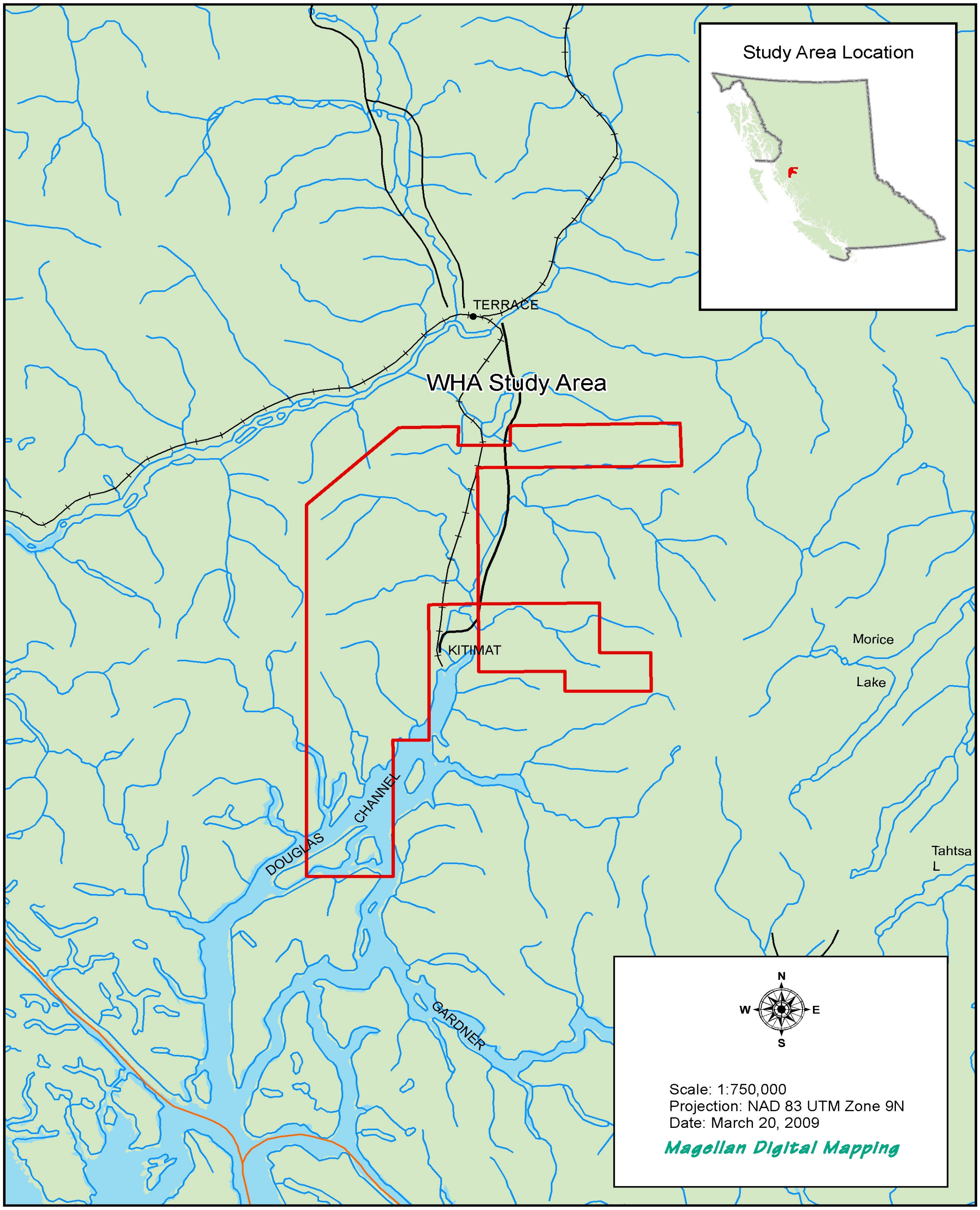

Figure 1: Study area map showing the approximate boundaries of the Western Kitimat River study area investigated as part of this assessment.

The study area is dominated by the Coastal Western Hemlock biogeoclimatic zone. The very wet hypermaritime subzone (CWHvh) covers the outer coastal lowlands. At low elevations, the very wet maritime subzone (CWHvm) covers the valley bottoms. Further upslope this subzone feathers into the submontane variant (CWHws^1) between 10 and 400m and the montane variant (CWHws^2) between 600 and 1000m of the wet submaritime subzone. Ecological boundaries are associated with a reduction in precipitation and reduction in annual growing days at higher elevations. At higher elevations, several different variants occur including both the windward and leeward variants of the moist maritime subzone of the Mountain Hemlock zone (MHmm^1 and MHmm^2). Parkland (MHmmP) ecosystems are uncommon but they do occur in the upper Wedeene River watershed and in smaller areas across the study area. Alpine ecologies dominate the highest elevations.

Watersheds within the study area include Aveling Creek, Jesse Creek, Coldwater Creek, Chist Creek, Bish Creek, Hirsch Creek, and the Wedeene and Little Wedeene Rivers. All systems drain predominately south into the Kitimat Arm. Steep slopes along the Gardner canal provide partial limits on animal movement, while areas in the Douglas Channel area generally have more moderated terrain. Large open stretched of ocean, including Douglas Channel, are known to limit grizzly bear dispersal.

Background

The grizzly bear is one of 39 identified ‘Species at Risk’ in British Columbia. Policies for conservation of identified wildlife are outlined in the provincial Identified Wildlife Management Strategy (IWMS) (Ministry of Environment 2004) and are implemented through the FRPA. The Ministry of Forests (MoF) and MoE share responsibility for the IWMS initiative, in consultation with the other agencies, the public and stakeholders. The principle threats to grizzly bear populations in British Columbia, aside from human-caused mortality, are habitat loss, alienation, and fragmentation (Ministry of Environment Lands and Parks 1995; Kansas 2002).

The IWMS includes coarse filter mechanisms for managing identified wildlife, such as landscape level planning, Old Growth Management Areas (OGMA), and fine-filter mechanisms, such as the establishment of WHAs and General Wildlife Measures (GWM). This project provides the initial steps of locating and rating grizzly bear habitat, which will be used for establishing WHAs. There are two categories of WHAs for grizzly bears: foraging and security (MoE 2004). For the purpose of this report, critical patch habitats are synonymous with core areas or foraging WHAs.

Many core areas for grizzly bears include open habitats, inherently free of merchantable timber and not directly threatened by harvesting. However, in order for these sites to retain their ecological integrity and value to grizzly bears, the maintenance of adjacent forest (security cover) is essential. Adjacent forests contain important wildlife habitat features (WHF) for grizzly bears, such as bedding sites, trails, mark trees or wallows. These areas also provide important microclimatic conditions during the summer months, namely reduced localized temperature and shade. In the absence of security cover, the value of the core area for grizzly bears is reduced or negated. Grizzlies may not use an exposed core area despite the presence of high quality forage. As such, a major goal of WHA establishment in this project was to delineate forested buffers around identified core areas for retention. It was also important to ensure that future security habitats can develop in areas where harvesting adjacent to identified core areas has already occurred (recruitment buffers).

Protection of security cover associated with critical patch habitats is achieved by the delineation of WHA buffers and the application of GWM at the planning and operational levels. For the purpose of this project, a 'security WHA' is defined as a core area (high value forage site) and a buffer, as per the IWMS. The importance of maintaining full-retention security WHAs with GWMs for grizzly bears, as well as landscape-level connectivity between these habitats, cannot be understated.

Since critical grizzly bear habitat within the Western Kitimat River study area hasn't been identified, this project will fill that gap and provide the tool necessary for managers to make informed decisions regarding natural resource management and grizzly bears in the area. It is important to keep in mind that while WHA establishment protects specific habitats for grizzly bears at the operational level, it does not address landscape level considerations such as habitat fragmentation, genetic diversity and population viability (MoE 2004).

Significance of High Value Habitats

Grizzly bears require access to reliable food sources with high protein and energy values to maintain fitness (Joslin & Youmans 1999). Food value is the primary driver in habitat selection (MoE 2004), and food abundance and distribution influences seasonal movements and population densities (Martinka 1974). The Kalum LRMP (2002) describes high value forage for grizzly bears as critical patch habitats. Grizzly bears use critical patch habitats predictably as food values develop throughout the seasons, particularly in coastal areas (Martkina 1974; McHutchon, et al. 1993). This typically begins with exploitation of low elevation south facing herb-dominated avalanche slopes and swamp forests in early spring, and ultimately leads to salmon spawning areas in the fall (MoE 2004; McHutchon et al. 1993). Habitat loss or displacement of grizzly bears from critical foraging areas can diminish individual nutritional status, reproductive rates and influence population viability (Joslin & Youmans 1999). See Appendix I for a copy of a more detailed life history of coastal grizzly bears (MacHutchon –Draft 2, 2007).

The following describes more specific seasonal food selection as it applies to the study area. High value habitats include:

- rich, receiving-site forests,
- wetlands and wetland complexes,
- floodplains,
- swamp forests,
- sub-alpine parkland meadows,
- herb dominated avalanche tracks, and
- herbaceous meadows.

Areas with high berry production also provide important seasonal foraging, but are difficult to distinguish on orthophotographs and most often occur within the matrix of mesic habitats. Other habitats that have high value include birthing areas for moose, salmon fishing and scavenging locations, and spring scavenging areas below mountain goat winter range. However, these sites are not specific to a particular ecosystem, so their value must be assigned on a site by site basis.

Assumptions and Limitations

Human Settlement, Private Land and Recreation Areas

The establishment of WHA as a grizzly bear conservation measure does not apply to areas in proximity to human settlement or high use recreation sites (MSRM 2002). The City of Kitimat has been excluded from the map base. Several seasonal float camps occur on a regular basis in the study area but are not considered permanent habitation. There is no commercial camping in the area, but there are several wilderness parks and Forest Service Recreation sites. In addition, while owners of private land have no legal obligation to manage for WHA on their property, the delineation of WHA in this project does not differentiate between land owners.

Resource Extraction Activities

Although the WHA selection process aims to protect existing high value grizzly habitat, it also considers the capacity of the landscape to recover from historic disturbance and to provide critical values in the future. This means that disturbances associated with current resource harvesting activities are assumed to be transient or temporary within the landscape, and do not exclude sites which have been developed or are in development from WHA selection. The use of recruitment forest as WHA is highly dependent on the diversity and distribution of historic harvesting within a landscape.

RIC Standardization

The methodology for identification of candidate WHA polygons for grizzly bears has evolved through an iterative process over the last 5 years. Every year small changes have been made to produce a better product and to bring it closer to existing RIC standards. As of yet, there is no standard RIC methodology for this process, but parallel work by MacHutchen (2007) for coastal grizzly bear habitat appears to have general support at a provincial level and it, or some minor variation, will likely become the standard approach for identifying high value grizzly habitats. The approach presented here is very similar to the MacHutchen method with a few minor differences due to their required end products. The following outlines the variations between techniques and why they are necessary to meet the goals of this project.

Habitat Suitability / Capability Ratings

The RIC standard for wildlife suitability/capability ratings for grizzly bear habitat includes a 6 class suitability/capability rating scheme. Suitability can be defined as the ability of a habitat, in its’ current state, to support a given number of animals of a specific species. The capability of a habitat is defined by the ability of a habitat, in its’ optimal successional stage, to support a given number of animals of a specific species (MoE, 1990). During initial development of this current

WHA process, it was determined that since only ratings of moderate, high, and very high quality habitats would be selected for further investigation, a 3 class system would be sufficient to represent the corresponding moderate, high, and very high value habitats. While this approach, used in the Kalum Landscape Unit (Pollard and Buchanan, 2006) provided reasonable results, it significantly limited the flexibility of the product. Comparative analysis of differing protection strategies was limited to varying the buffer width. Consequently, in the subsequent year a more expansive rating system with a 10 point spread was used (Pollard and Buchanan, 2007). This depth allowed for fine adjustments in the level of protection to establish the level of timber supply impacts.

During the most recent grizzly bear habitat project (Pollard 2007) direction was provided that final ratings had to be within the 6 class system to comply with RIC standards. To achieve this, the 10 class system was converted to the standard 6 class system for presentation although the depth of the 10 class system remained so exploration of the timber supply impacts could still occur.

This approach has been incorporated into the current project with a slight alteration based on input from Tony Hamilton, the contract monitor, and other MoE personnel. The intent in this project was to evaluate polygons based solely on their vegetative values and evidence of use within the RIC standard 6 class rating system. However, influencing factors would then be considered, such as access to salmon streams or landscape influences, to arrive at a Management Priority rating based on a 10 point rating system. These ratings are then used to identify the most critical WHA candidate areas. See Figure 2 for a flow chart describing this approach.

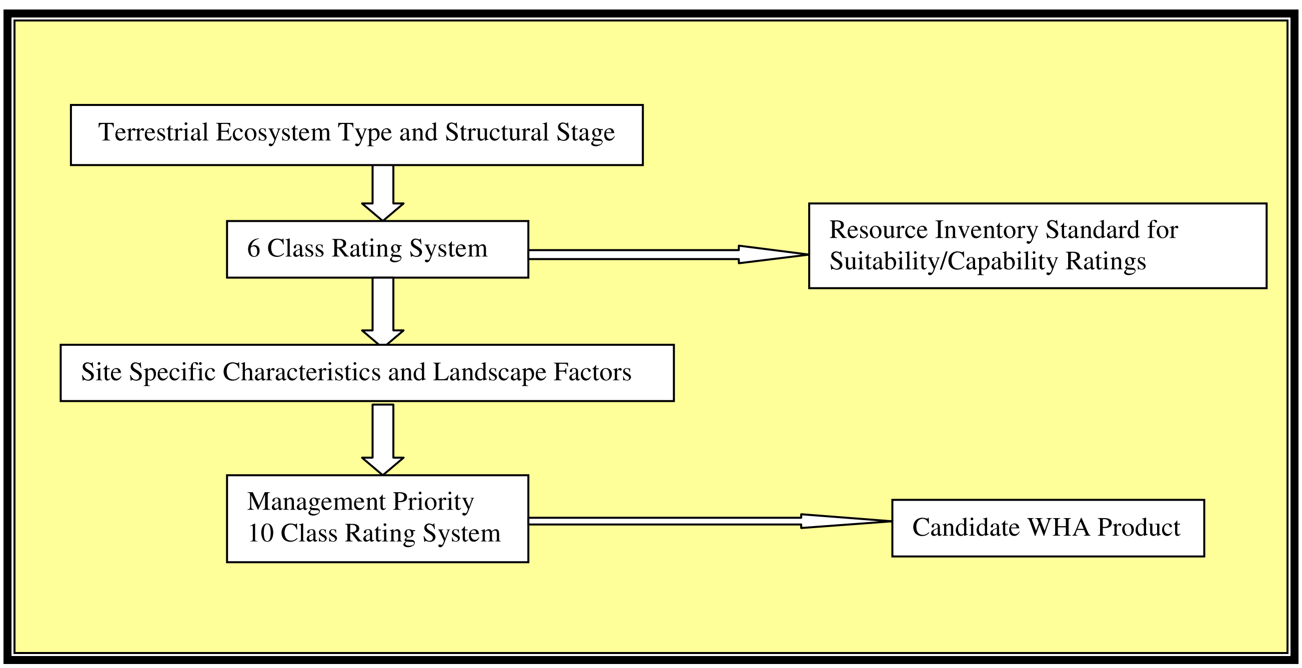

Figure 2: Flowchart describing how the RIC 6 class rating system is related to the 10 class rating system used to select grizzly bear candidate WHA in the Western Kitimat River study area.

Seasonality

The four season rating scheme (early spring, spring, summer, and fall), used in the MacHutchon method, was used for this project. This is a change from previous year's work where all the growing season was given a single rating. The four season rating scheme adheres to the prescribed Resource Inventory Committee (RIC) approach, which recommends a 5 season scheme for TEM-based suitability/capability projects, where the fifth season is winter. This was done to ensure RIC standards were met and to ensure seasonal forage distribution throughout the landscape was appropriately evaluated and delineated.

Polygon Complexing and Polygon Size

On comparisons between this methodology and MacHutchon's approach, there are substantial variations with the use of complex polygons and the resulting average size of polygons delineated. MacHutchon uses a vegetation complex approach where important habitat types and their appropriate buffer are included within each individual polygon. Consequently, the polygons created are generally larger than the standard TEM polygon and are most often a complex of several ecosystems including those with no significant forage values (within the buffers). In addition, when complexes contain a variety of suitability/capability ratings, the overall value of the polygon may not reflect the individual value of one of the types contained within the complex. This is further complicated in a 4 season rating approach.

The method used for this project, and others completed previously, uses a more fine-textured approach attempting to isolate specific TEM types that have known high values for grizzly bears. It does not completely exclude complex polygons, but generally reduces them to adjacent sites that have little or no suitability/capability differences. A good example would be sites adjacent to a salmon river that includes floodplain forests directly adjacent to rich toe-of-slope sites. In this case, the ecological variation is very limited and the value of the two sites to grizzly bears is very similar.

This more fine-textured approach has several advantages including;

- a finer detailed product,
- a simpler analysis of impacts,
- results more closely scaled to TEM and PEM projects,
- greater resource management flexibility (i.e. varying buffer width), and,
- ratings more reflective of site specific value.

Methods

Background Data Collection

Background information on grizzly bear use in the Kalum LRMP area was polled from a range of knowledgeable people in the community. Interviews were conducted and participants were asked to identify grizzly bear sightings and known foraging areas on hardcopy 1:50,000 and 1:250,000 scale maps. Wherever possible, the specific season of use or approximate date of sighting was recorded. Sighting information was limited to the past 10 years; no temporal limits were placed on habitat based information. Participants were asked to recommend additional local information sources to ensure that the background review process was as inclusive as possible. Grizzly bear sighting and foraging information was mapped by hand. Major salmon spawning areas and fishing sites were also identified and mapped. Fisheries information was based on current and historical records, staff field observations, and local knowledge. Background information was primarily used to focus field assessments

Target Polygon Selection

In order to select appropriate field sites, a thorough review and analysis of existing historical, anecdotal and ecological information was completed. The background review was a small component of this process. The larger portion of planning involved discussions with ministry staff and a detailed analysis of orthophotographs. This process resulted in a selection of target polygons for assessment based on Terrestrial Ecosystem Mapping (TEM) type, structural stage, location, slope position, aspect, and landscape features known to influence grizzly bear use. Other factors that influenced selection of priority field sites included accessibility and discussions with MoE biologists and people familiar with the area. The major polygon types targeted for assessment are shown in Table 1.

High value polygons were then delineated on 1:10,000 orthophotographic prints and submitted to the mapping subcontractor. It should be noted that structural stage did not always direct field site selection. This is because the protection of future security habitat adjacent to core areas (currently in early structural stage due to harvesting) was considered in the WHA assessment and site selection was not limited to older forests with existing values. However, helicopter accessibility often precluded assessment within younger stands due to dense forest cover.

Following target polygon identification, the value of core areas was assessed through three different approaches: ground, aerial and remote survey (photo interpretation). An attempt was made to focus ground and aerial surveys on the highest priority polygons, in order to maintain the highest level of confidence in results. The field examination of these areas helped calibrate the qualitative identification techniques used during the remote assessment of WHA.

Ground Assessment

A field card was developed to record site information and evidence of use for each priority polygon (direct site or core area) and surrounding forest (adjacent site or security habitat). These field cards were initially developed using Resource Inventory Committee (RIC) standards as a basis and then adjusted to ensure that the necessary data was highlighted and optional data removed. Standards used included Wildlife Habitat Assessment, Describing Ecosystems in the Field (1990) site description forms and Wildlife Use Forms. In addition to the field forms, data was collected such that it could easily be converted to RIC standards. Priority polygons identified during planning were delineated and labelled on laminated 11 by 17 inch orthophotographs for field reference.

Table 1: Ecosystem types targeted for assessment of Grizzly WHA.

Biogeoclimatic Zone (BGZ)*	Type**	Ecosystem Name**	Structural Stage**
Alpine	AM	Herbaceous Meadow	2
	AK	Alpine Krummholtz	2, 3
	Wm, Wf, Wb, and Ws	Non Forested Wetlands - marshes, fens, bogs and swamps	2, 3
	SL	Avalanche track	2, 3
MHmm[1] / MHmm[2]/ MHmmP	YH	Yellow Cedar - Hellebore	2-7
	YC	Yellow Cedar – Skunk Cabbage	2-7
	Wm, Wf, Wb, and Ws	Non Forested Wetlands - marshes, fens, bogs and swamps	2, 3
	SL	Avalanche track	2, 3
CWHvh[1]	SD	Western redcedar – Sitka Spruce	2-7
	RC	Cedar Spruce – Skunk Cabbage	2-7
	LS	Pine – Sphagnum	2-7
	SP	High tidal influence	2, 3
	SE	Sedge- adjacent to estuaries	2, 3
	SL	High Bench Floodplain	1-7
	ST	Mid-bench Floodplain	1-7
	AL	Lower Bench Floodplain	2-5
	Wm, Wf, Wb, and Ws	Non Forested Wetlands - marshes, fens, bogs and swamps	2, 3
	SA	Avalanche track	2, 3
CWHvm[1] / CWHvm[2]	AD	Amablis Cedar – Devil's Club	2-7
	RC	Cedar Spruce – Skunk Cabbage	2-7
	LS	Pine – Sphagnum	2-7
	SP	Sitka spruce – Pacific crab apple; estuarine site	2,3
	SE	High tidal influence	2-3
	SS	High Bench Floodplain	1-7
	CD	Mid-bench Floodplain	1-7
	CW	Lower Bench Floodplain	2-5
	Wm, Wf, Wb, and Ws	Non Forested Wetlands - marshes, fens, bogs and swamps	2, 3
	SL	Avalanche track	2, 3
	IF	Herb Dominated Avalanche track	2, 3
CWHws[1] / CWHws[2]	AD	Amablis Cedar – Devil's Club	2-7
	RC	Cedar Spruce – Skunk Cabbage	2-7
	LS	Pine – Sphagnum	2-7
	SS	High Bench Floodplain	1-7
	CD	Mid-bench Floodplain	1-7
	CW	Lower Bench Floodplain	2-5
	Wm, Wf, Wb, and Ws	Non Forested Wetlands - marshes, fens, bogs and swamps	2, 3
	SL	Avalanche track	2, 3
	IF	Herb Dominated Avalanche track	2, 3

*Describing Ecosystems in the Field. (MoE Manual 11) (1990).

**Source: Standard for Terrestrial Ecosystem Mapping in British Columbia (1998) and Wetlands of BC (2004).

Prior to starting field work, staff were field trained by the project biologist to ensure that crews were familiar with identifying evidence of use, vegetation communities and were consistent in rating grizzly bear values. Ministry staff participated in field work whenever possible.

During ground-based field work, the following information was recorded for both the direct and adjacent site (where applicable):

- crew, date, time, weather, field site number, associated site number,
- BGC zone, TEM type, landscape unit, TRIM mapsheet number,
- slope position, structural stage, soil moisture regime, nutrient regime,
- potential grizzly bear use, evidence of use, photographs,
- suitability/capability ratings (vegetative field value), and,
- overall candidate WHA rating and comments.

Potential site use included foraging, resting, travelling (movement corridors), fishing, and cover. Actual evidence of use included observation of tracks, trails, daybeds, mark-trees, hair, bears, body, parts, foraging activity (diggings, cropping) and scat. Comments and photos were taken for each site.

Photographs

Field photographs were taken at all ground sites highlighting evidence of use (diggings, scat) and wildlife habitat features in adjacent security habitats (trails, mark trees, daybed sites). Aerial photographs were also taken to capture larger avalanche and valley bottom wetland complexes. Photographs were downloaded and labelled with the date and site number immediately following field assessment. A selection of site photos from the Western Kitimat River study area is provided at the end of the report (Appendix II) and a complete digital photograph log has been included as part of the digital deliverables.

Aerial Assessment

An aerial survey sheet was developed to record assessment information consistently during helicopter-based assessments. A two person crew was required for aerial assessments, one acting as observer and one as note taker. Aerial surveys allowed for a substantial increase in the density of sites seen in the field, with a minor loss of accuracy relative to ground based assessments.

Information collected during aerial assessments was limited to data available from very low elevation (less than 50 m) overview flights. It was possible to establish TEM type and age class within a limited range of error. In most cases dominant shrub and herbaceous vegetation was visible through the canopy. Moisture and nutrient regime were established relative to the broader hillslope position and associated site characteristics. Structural stage was more difficult to establish during aerial surveys, however estimates were expected to be within one structural stage deviation. Information on potential use and evidence of use, such as the presence of high quality forage, visible trails or actual evidence of foraging were noted. Evidence of use in dense forests however, was not generally possible.

Remote (Orthophotograph) Assessment

The project involved a large study area and resources to conduct comprehensive ground and aerial assessments were limited. Costs associated with helicopter time in particular restricted the amount of field work possible. In order to identify potential high value grizzly bear polygons that field and aerial surveys were not able to capture, a detailed map and orthophotograph assessment was conducted. This was completed primarily by the project biologist following ground and aerial surveys. Experience gained during field work, overflights and familiarity with the study area increased confidence in the accuracy of remote assessment for grizzly bear WHAs. Data collected for this level of intensity included only TEM type, structural stage, seasonal ratings, and overall qualitative assessment.

Data Entry and Mapping

Database

A database was developed for the project to capture pre-field information and results from ground, aerial and remote assessments. This database included planning information as well as data collected at the three levels of survey intensity. Each polygon was originally identified with a unique number assigned by the mapping technician. In the field, if new polygons were identified directly adjacent to existing polygons, they were identified by the known polygon with a modifier for direction to the new polygon. Similarly, if a new polygon was identified from the air, it was sketched onto the field maps and assigned a number. When field work was completed, these areas were re-digitized and assigned a new number. This new number was then transferred back onto the field cards for reference. Finally, the data base was sorted and cleaned to ensure accuracy and completeness.

Mapping

Magellan Digital Mapping, under separate contract, worked cooperatively with MCSL to link the database to the digital map files, apply and adjust buffers, and convert the information into a Ministry standard GIS product. Digital mapping was initiated on an orthophotograph base and completed according to MoE spatial data deliverables. Core area polygons were digitized from field results and tied by polygon identifier to the relational database. Hardcopy maps are in Appendix III and as digital deliverables provided as an Attachment.

Ranking Core Areas and Applying Security Habitats (Buffers)

Important grizzly security cover is found in forests directly adjacent to core areas. The protection of these attributes is addressed by applying WHA buffers. Although 50 m is used as a conceptual target for WHA buffers, there is no standard or limit, and buffer widths vary according to site-specific values and conditions. Some forested WHAs do not require buffers because they are protected by the boundary of the core area itself (i.e.: floodplain or swamp forest sites).

Following field and remote surveys, polygons were delineated on maps and ranked 1-10 based on their RIC suitability combined with landscape specific factors. Factors considered to arrive at the ultimate management priority rating include:

- access to salmon foraging sites,
- commonality/rarity in the landscape,
- access to ungulate calving areas,
- landscape adjacency and habitat juxtaposition, and,
- evidence of use.

Security buffers were established for polygons with management priority ratings ranging from 6-10 based on a subjective evaluation of grizzly bear habitat. The selection of this range of values is relatively subjective although it broadly represents the moderate to very high value suitability/capability ratings from TEM mapping (RIC 1998). If adjustments are required to meet grizzly WHA budgets, a different range of values can be used to determine the impact of varying management regimes.

Initially, a standard 50 m buffer was applied digitally to all candidate core area WHAs. Buffer intersections and overlaps were then adjusted to meet security habitat protection objectives for core areas. In some cases, this involved the amalgamation of several core areas into a single security WHA polygon to maintain the ecological function of a larger collective area. This approach was supported by MoE staff. The total number of candidate security WHA is therefore lower than the total number of core areas identified.

Note that specific delineation of each buffer was not completed in this project. A more detailed site by site analysis is required to ensure that WHA boundaries are located such that they are ecologically justifiable and do not incorporate areas such as roads. Until such time as the "landbase budget" impact can be assessed, this final delineation is not cost effective.

THLB Overlap Analysis

All identified core polygons were assessed by rating to determine what the impact on the THLB would be of protecting these areas with a 50 m buffer. Initially, all very high value polygons (rating 9 and 10) are assigned a 50 m buffer and the impact on the THLB is determined. Next the high value and very high value polygons are given the same 50 m buffer and the impact is determined for both. This process is repeated once more with the moderate value sites to establish the impact.

Data for the THLB was acquired from the integrated Resource Management branch in Smithers and was provided in a format consistent with older standards. Consequently, operability was provided in approximately 70 different categories of operability ranging from 0% to 100%. Consequently, analysis had to be completed in each individual category before the sum impacts were produced. This approach adds a component of error that is difficult to quantify since errors could be hidden in any one of the 70 categories and the assumptions inherent in each category were unknown. That, in addition to the use of a perfect 50 m buffer, could result in an error in the results up to 30%.

Results and Discussion

Field work was completed from September 30 to October 2, 2008. All sample sites were visited by one of three crews over a total of 23 man-days. Priority sites were accessed exclusively by helicopter.

Core Area Results by Survey Method

A total of 3207 polygons were assessed in the Western Kitimat River study area resulting in the identification of 1704 high value core areas. A break-down of results by survey method is provided in Table 2.

Table 2: Distribution of polygons by survey method.

Western Kitimat River Study Area	Total	Survey Method		
		Ground	Aerial	Remote
Total Polygons Identified	**3207**	159 (5%)	576 (18%)	2552 (77%)
Total High Value Core Areas	**1704**	66 (3.9%)	278 (16.3%)	1360 (79.8%)

Survey densities are slightly lower than were originally proposed. For the ground surveys, the proposed density was 5% of the total polygons within the study area. These originally proposed rates are based on estimates of total polygon numbers prior to field work. Original estimates for this study area were 3000, based on a per mapsheet average of 200 polygons. Total ground survey density is approximately 0.5% less than anticipated.

Distribution of Core Areas by BGC Zone and TEM Type

The majority of core areas identified within the Western Kitimat River study area are located in avalanche tracks (18.1%) in the MHmm[1] and floodplain sites (16.4%) in the CWHvm biogeoclimatic zones. Floodplains in the CWHws account for the next highest proportion at 9.3%. Avalanche tracks and wetlands in the CWHvm account for approximately 7.5% and 8.2%, respectively, of identified core areas. Exclusive of biogeoclimatic zone, TEM type and age class, core areas are distributed among general categories of avalanche (32.7%), floodplain (26%), nutrient rich forested areas (16.9%), mesic forests (2.8%), wetlands (21.2%) and other areas (0.4%) habitats, respectively. See Table 3 for a summary of the contents of core areas.

Besides the current suitability of stands in study area, the largest single contributor to candidate WHA distribution was the presence of large populations of spawning salmon. Large runs of sockeye, chum and chinook strongly influenced the WHA distribution in the Bish, Chist, Wedeene, and Little Wedeene watersheds. In addition, large populations of wintering ungulates, both moose and mountain goats, throughout the study area increased the relative value of low elevation floodplains and avalanche tracks that originated in mountain goat winter range for early and late spring seasons.

Table 3: Distribution of core areas and their relative value identified in the Western Kitimat River study area by BGC zone and TEM Type.

BGC Zone	Habitat Type	Total Polygons by TEM Type	Total Polygons Rated 6	Total Polygons Rated 7-8	Total Polygons Rated 9-10	Percentage of Total Polygons Rated High Value by Type
ATunp	Avalanche	32	12	5	0	56.3%
	Wetland	1	1	0	0	100%
	Meadows	3	3	0	0	100%
	Other	5	0	0	0	0%
CWHvh[1]	Avalanche	24	3	9	0	50%
	Wetland	41	2	1	0	14.3%
	Floodplain / Estuary	11	3	2	0	45.5%
	Rich Forests	36	13	12	0	69.4%
	Forested Wetlands	20	6	3	0	45%
	Mesic Forests	9	1	0	0	11%
	Other	1	0	0	0	0%
CWHvm	Avalanche	265	89	38	0	47.9%
	Wetland	333	86	52	2	42%
	Floodplain / Estuary	383	109	131	39	72.8%
	Rich Forests	168	70	37	4	66.1%
	Forested Wetlands	124	31	50	4	68.8%
	Mesic Forests	31	5	3	0	25.8%
	Other	4	0	0	0	0%
CWHws[1]/ CWHws[2]	Avalanche	213	55	31	2	41.3%
	Wetland	103	18	34	2	52.4%
	Floodplain	184	41	96	22	86.4%
	Rich Forests	142	49	51	7	75.4%
	Forested Wetlands	68	20	22	3	66.2%
	Mesic Forests	30	10	1	0	36.7%
	Other	2	0	0	0	0%
MHmm[1]/ MHmm[2]/ MHmmP	Avalanche	640	197	110	1	48.1%
	Wetland	81	9	2	0	13.6%
	Floodplain	5	1	0	0	20%
	Rich Forests	76	35	12	0	61.8%
	Forested Wetlands	114	6	5	1	10.5%
	Mesic Forests	119	25	2	0	22.7%
	Other	15	2	1	0	20%

Distribution of Core Areas by Habitat Quality

On completion of the data processing, a map was produced that identified all polygons assessed and identified their assessment value by colour. This map clearly identified the relatively higher foraging values associated with low elevation wetlands and floodplains, especially those areas known to contain significant fishing values. It also points out that in most of the side tributaries without significant fisheries values, the vegetative values alone are relatively low with the exception of south and south-western facing avalanche tracks. See Figure 3 for the spatial distribution and assessed values of identified core habitats assessed.

Security Candidate WHA Results

A total of 391 security candidate WHA were identified through this process for the Western Kitimat River study area. Some of these WHA are quite large as they encompass 85 separate high value polygons. One example of this is on Bish Creek where salmon fishing values are significant and resulting fall grizzly densities are high. A similar condition occurs along the Wedeene and Chist Creek drainages. To a lesser extent these multiple high value WHA areas occur in steep valleys, predominantly east-west in orientation, where avalanche activity has left only small isolated patches of timber between tracks. A map at 1:150,000 scale showing the rank, location and distribution of candidate security WHA polygons is included in Appendix III.

THLB Overlap Analysis

The analysis of THLB overlap revealed that the impact of protecting all moderate, high, and very high rated core areas in the study area could have an impacts on the THLB over and above the allotment recommended in the Kalum LRMP. The study area has a total area of 202,609 ha with 78002 ha of it being considered operable. The area covered by the WHA polygons is 20,253 ha. Protecting only those rated as very high with a 50 m buffer would impact the THLB a total of 1,118 ha (1.4%) of operable forest. Protection of high and medium value sites would impact the operable forest by a total of, respectively, 6564 ha (8.4%) and 9,813 ha (12.6%). Protection of all core areas rated as either medium, high or very high would have an impact of a total of 12,947 ha (16.6%) of the THLB. As noted earlier, inclusion of non forested areas within the buffers, and overlap with previously constrained landbase, such as riparian management areas, old growth management areas, and ungulate winter range will very likely reduce this impact at least 20-30%.

Figure 3: Western Kitimat River study area orthophoto base, showing polygons identified and assessed for grizzly bear habitat values (approximately 1:400,000). Polygons identified in red, orange, yellow, and green represents very high, high, moderate, and other valued polygons, respectively.

Conclusions and Recommendations

The establishment of WHAs is a fine-filter management tool to protect critical patch habitats for grizzly bears. The inclusion of 391 WHA, as developed through this project, will go a long way toward protecting the viability of grizzly foraging areas in the Western Kitimat River study area. However, the WHA process does not address habitat protection or population concerns at the landscape level. In order to meet conservation objectives for grizzly bears it is important to ensure that fine and coarse filter management strategies are applied jointly to maintain population viability. It is also important that measures to ensure the structural and ecological integrity of WHA are applied at the operational level. These include establishing wind-firm buffers, maintaining natural drainage patterns and applying specific harvesting and silviculture techniques. The IWMS and Kalum LRMP provide operational direction for development near identified grizzly bear WHA.

Following approval of candidate grizzly bear WHA identified during this project, follow-up review and monitoring is essential to ensure that:

- connectivity between high value WHA is maintained,
- connectivity between grizzly bear population units (GBPUs) is maintained,
- development is planned to avoid long-term disturbance near WHA, and
- road access to areas with high grizzly bear values is controlled during and following development.

Road access is a particularly important consideration in land use planning for grizzly bear conservation. Road access increases the likelihood of grizzly bear fatalities (McLellan & Shackleton 1988; MSRM 2002; BC Ministry of Environment Lands and Parks 1995). Roads may also fragment habitat and/or displace bears from important foraging areas with potential long-term impacts at the population level (Kansas 2002; Gibeau in Kansas 2002). Impacts to grizzly bears associated with roads depend on a number of factors; however, traffic volume and public access play key roles (Chruszcz, Clevenger, Gunson & Gibeau 2003; Joslin & Youmans 1999; Weilgus, Vernier & Schivatcheva 2002; Weiglus & Vernier 2003). Grizzly bears are known to avoid open access roads (Wielgus et al. 2002; Wieglus & Vernier 2003) however; they do not appear to avoid restricted access roads with exclusive (forestry) use (Wieglus et al. 2002, Wieglus & Vernier 2003). Impacts to grizzly bears due to road development can be mitigated by design, seasonal or permanent access restrictions, and/or deactivation following development. The development and implementation of access management plans for proposed development in identified grizzly bear watersheds within the Kalum LRMP is recommended.

References

B.C. Ministry of Environment, Lands and Parks. 1995. *A Future for the grizzly: British Columbia Grizzly Bear Conservation Strategy.* British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria.

B.C. Ministry of Sustainable Resource Management. 2002. Kalum Land and Resource Management Plan.

B.C. Ministry of Water, Land and Air Protection. 2004. Procedures for Managing Identified Wildlife – V. 2004. B.C. Ministry of Water, Land and Air Protection, Victoria, B.C. Available: http://www.env.gov.bc.ca/wld/identified/procedures.html (accessed [February, 2006]).

B.C. Ministry of Water, Land and Air Protection. 2004. [Grizzly Bear (*Ursus arctos*)] in Accounts and Measures for Managing Identified Wildlife – Accounts V. 2004. B.C. Ministry of Water, Land and Air Protection, Victoria, B.C. Available: http://www.env.gov.bc.ca/wld/identified/accounts.html (accessed [February, 2006]).

Joslin, G. & Youmans, H. coordinators. (1999). Effects of recreation on Rocky Mountain Wildlife: A review for Montana. Committee on effects of recreation on Wildlife, Montana chapter of the Wildlife Society.

Kansas, J. 2002. Status of the Grizzly Bear (Ursus arctos) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association, Wildlife Status Report No. 37, Edmonton, AB. 43 pp

MacHutchon, A.G., Himmer, S., & Bryden, C.A. 1993. Khutzeymateen Valley Grizzly Bear Study: Final Report. Province of British Columbia: Ministry of Environment Lands and Parks, Wildlife Working Report. No. R-25. BC Ministry of Forests, Wildlife. Habitat Research Report. No. WHR-31. 105pp.

Martinka, C.J. 1974. Ecological Role and Management of Grizzly Bears in Glacier National Park, Montana. International Conference on Bear Research and Management. 40 (13): pp. 147-156.

McLellan, B.N. and D.M. Shackleton. 1988. Grizzly bears and resource extraction industries: effects of roads on behaviour, habitat use and demography. J. Appl. Ecol. 25: pp. 451-460.

Province of British Columbia. 1990. Describing ecosystems in the field. B.C. Ministry of Environment and B.C. Ministry of Forests (MoE Manual 11). Luttmerding, H.A., Demarchi, D. A., Lea, E.C., Meidinger, D.V., and T.Vold (eds.). Victoria, BC.

Province of British Columbia. 1998. Standard for Terrestrial Ecosystem Mapping in British Columbia. Ecosystems Working Group, Terrestrial Ecosystems Task Force, Resources Inventory Committee. Victoria, BC. 100 pp.

Sellers. R. & Aummiller, L.D. 1994. Brown bear population characteristics at McNeil River, Alaska. International Conference on Bear Research and Management. 9(1): 283-293.

Wieglus, R.B., Vernier, P.R., & Schivatcheva, T. 2002. Grizzly bear use of open, closed, and restricted forestry roads. Canadian Journal of Forest Resources, 32: 1597-1606.

Wieglus, R. B., & Vernier, P.R. 2003. Grizzly bear selection of managed and unmanaged forests in the Selkirk mountains. Canadian Journal of Forest Resources, 33: 822-829.

Appendices

Appendix I: Grizzly Bear Life History (MacHutchon 2007)

The following description of Grizzly bear ecology and seasonal food habits has been quoted directly from Grant MacHutchon's 2007 report Mapping Methods for Important Coastal Grizzly Bear Habitat – Draft 2.

Coastal Grizzly Bear Ecology

Common Name: Grizzly bear
Scientific Name: *Ursus arctos*
Species Code: M_URAR

Status and Distribution

Global

The grizzly bear has a circumpolar distribution once covering most of North America, Europe, and the northern part of Asia. In many of these areas it has been exterminated or its numbers have been greatly reduced. Most of the world's grizzly bears now occur in north-western North America and Russia.

In North America, grizzly bears once ranged over most of the west, from Alaska south to Mexico, and from the Pacific coast east to Manitoba, and the Missouri River (Banci 1991). In the wake of westward development and settlement, especially in the plains, the range of the grizzly shrank to its present distribution of Alaska, the Yukon Territory, and British Columbia, with small populations in Alberta, the Northwest Territories, Nunavut, Montana, Idaho, Wyoming, and Washington.

During their last status review of the grizzly bear in Canada in 2002, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) considered the northwest population of Alberta, British Columbia, Yukon, Northwest Territories and Nunavut to be a species of special concern. They consider the grizzly bear population that formerly occupied prairie regions of Alberta, Saskatchewan and Manitoba to be extirpated.

British Columbia

Only one subspecies of grizzly bear, *U. arctos horribilis*, is recognized for British Columbia. British Columbia's grizzly bear population estimate was revised in 2004 and the new provincial population estimate is approximately 17,000. Earlier provincial estimates had been 13,000 to 14,000 bears. B.C. is considered to have approximately half the Canadian population and one quarter of the grizzly bears remaining in North America. The current provincial population is only half of estimated historic numbers in the province and grizzly bears have been extirpated from approximately 10% of their former range. This decline in numbers and range has been attributed to unsustainable levels of human-caused mortality and the loss of effective habitat. Local population declines are considered to be occurring in several areas of the province due primarily to concentrated mortality within specific populations, habitat loss, and fragmentation. In some areas of dense human rural and urban settlement, grizzly bears are threatened or have been extirpated while over much of their range populations remain healthy.

Under a provincial Grizzly Bear Conservation Strategy launched in 1995, individual grizzly bear populations in B.C. were delineated as Grizzly Bear Population Units (GBPUs). GBPU boundaries were meant to identify similar sub-populations of bears. Each GBPU has been assigned a conservation status of extirpated, threatened, or viable (Figure 1). Conservation status is based on the difference between the current population estimate and the estimated habitat capability for the GBPU where habitat capability is defined as the inherent, idealized ability of the land to support a specific density of grizzly bears independent of human influence. Where the current estimate is less than 50% of habitat capability, the GBPU is designated as threatened.

Grizzly bears historically occurred throughout B.C., with the exception of Vancouver Island, the Queen Charlotte Islands, and smaller coastal islands. They have since been extirpated from much of south and south-central B.C.; lower elevations of the Okanagan, the lower mainland, parts of the Cariboo and northeast B.C. Nevertheless, grizzly bear are occasionally sighted in the southern interior plateaus and other areas from which their populations are considered effectively extirpated.

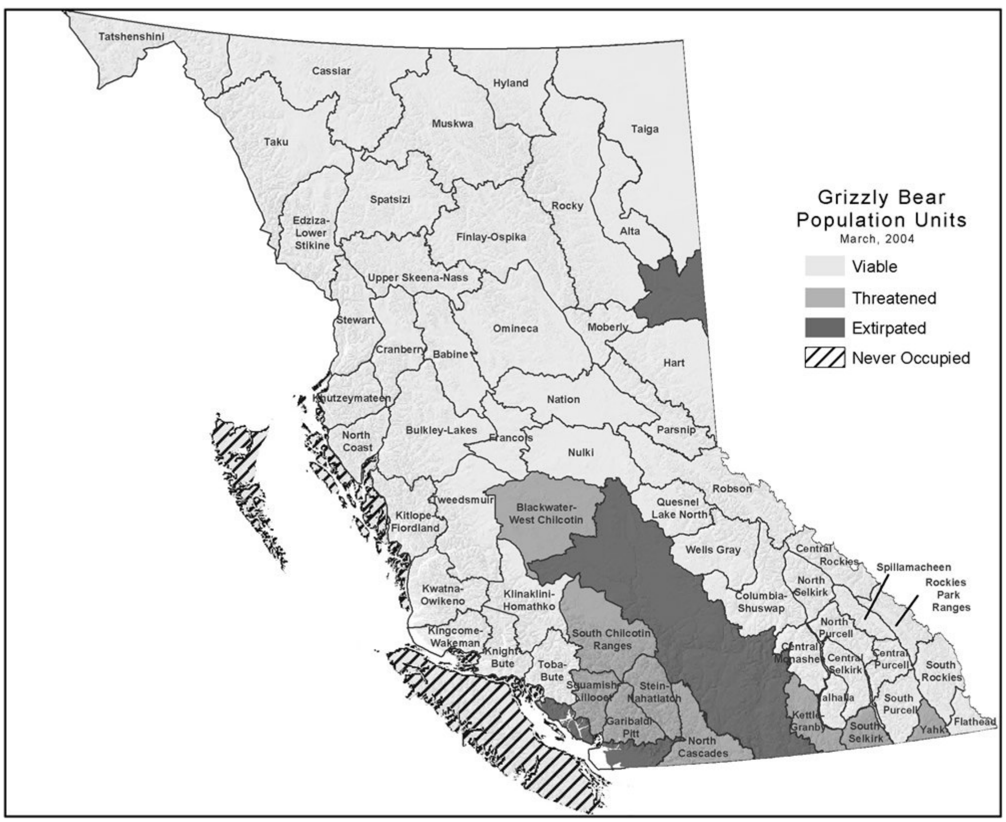

Figure 1. Status of Grizzly Bear Population Units in British Columbia.

Feeding Ecology and Important Habitats

In British Columbia, grizzly bears are efficient predators and scavengers but rely more on a vegetative diet. They are omnivorous and consume a wide diversity of foods including, vegetation, berries, insects, small and large mammals, carrion, and fish. Grizzly bears must consume high quality food in relatively large quantities to meet their daily energy requirements, as well as to develop fat reserves for denning. Consequently, bears use different habitats through the year to exploit seasonal changes in the availability and nutritional quality of foods, from valley bottoms to alpine meadows. Although meeting nutritional requirements is the primary factor in habitat choice, selection is also based on thermal cover (e.g., bedding sites), security (e.g., females protecting cubs), or access to potential mates during the breeding season. Habitat selection is also strongly influenced by intra-specific (social) interactions and the presence and activities of people. As a result, individual grizzly bears or specific age or sex classes of bears may have different habitat selection strategies (Schoen et al. 1986, MacHutchon et al. 1993, Munro 1999, MacHutchon and Mahon 2003), which result from different availability of foods within habitats, different habitat availability within home ranges, different learned behaviour, and intraspecific or interspecific competition, which can affect both the establishment of the home range and choices within the home range (Thomas and Taylor 1990, Craighead et al. 1995). For example, some bears rely more heavily on predation than others, and some use higher elevation annual home ranges as opposed to migrating to lower elevations on a seasonal basis.

Among geographic areas, there is variation in the prominence of various foods in the grizzly bear diet as a result of differences in availability, which in turn affects bear's use of habitat. As an example, the transition from the coast to the interior changes the availability of certain plant species and salmon, therefore, their importance in the diet of grizzly bears.

In general terms, grizzly bear food plants tend to be more abundant in non-forested sites, sites with partial forest, or sites with many tree gaps in older forest. However, security habitat and day bedding areas (for heat relief, rain interception, or warmth) tend to be in closed forest sites near higher quality feeding sites. Some types of food, particularly animal food (e.g., salmon in streams, ants in logs, ungulates), can be found within many different forest types therefore are not necessarily tied to any particular structural stage.

Forest openings such as estuaries, meadows, wetlands, and seepage areas and southerly and westerly aspect, herb-dominated avalanche paths provide the most abundant food plants in spring. Riparian areas may be heavily-used, specifically areas with a low gradient and back channels or meandering streams. Important late spring habitats are avalanche chutes, low to mid elevation riparian habitats, wetlands, seepage areas, cutblocks, and floodplains. Berries tend to be most abundant in natural openings as well as areas that have been disturbed through fire or clear-cut logging. As a result, structural stage can be an important variable when correlated with the availability of berries. Regenerating burns and 10-20 year old clear-cuts typically provide abundant berries and receive relatively high summer use. In forested habitats, canopy closures of 20-50% are optimal for berry production.

Wherever they occur, when grizzly bears first emerge from their winter dens, finding something to eat is a challenge. Grizzly bears typically move from winter dens to low elevation valley bottoms in early spring. However, newly born cubs usually are not strong enough to travel in deep snow, so females with cubs of the year often stay in the vicinity of their dens until the cubs are bigger. Therefore, females with cubs may have little to eat in early spring until they can move to snow-free areas.

Seasons of Use
Grizzly bears require different feeding, security and thermal habitat differently throughout the year. Generally, seasonal feeding and habitat use of coastal grizzly bears can be broken down into five seasons, four of which are described through forage availability and use, while the fifth is the winter denning season. On the coast, denning starts in early November and den emergence occurs in March to early April (MacHutchon et al. 1993). Table 2 summarizes the life requisites (as defined in RIC 1999) of grizzly bears for each month of the year for the Coast and Mountains Ecoprovince.

Seasonal Food Habits & Feeding Habitat Use

Early and Late Spring
In coastal areas, grizzly bears primarily feed on emerging green vegetation in spring, which is found in estuaries, ocean foreshores, wetlands, forested swamps, wet seepage sites, and riparian areas. The main sedge eaten by grizzly bears in estuaries in the spring and early summer is Lyngby's sedge (*Carex lyngbyei*). Lyngby's sedge is often grazed near or in tidal channels where it can be very dense. Shoreline areas, particularly salt marshes, provide early season foraging opportunities on herbaceous vegetation, such as sedges, grasses (family Poaceae, e.g., *Elymus* sp.), and forbs (e.g., *Plantago* sp. and *Triglochin* sp.). This vegetation provides bears with a relatively abundant source of highly digestible protein that can help replace body mass lost during hibernation (Smith and Partridge 2004). Other emerging vegetation in the spring well-used by grizzly bears, include various umbels in the family Apiaceae (e.g., wild celery (*Angelica* spp.), cow parsnip *(Heracleum maximum*)), other sedges (*Carex* spp.), small-flowered bulrush (*Scirpus microcarpus*), grasses, horsetail (*Equisetum* spp.), stinging nettle (*Urtica dioica*), and a variety of other newly emergent forbs

Table 2. Monthly life requisites and general activity of grizzly bears for the Coast and Mountains Ecoprovince.

Month	Season	Life Requisite (RIC 1999)	Grizzly Bear Activity
January	Winter	Hibernating	Denning
February	Winter	Hibernating	Denning
March	Winter	Hibernating	Denning
April	Early Spring	Feeding/ Security & Thermal	Den emergence to valley floor leaf flush to avalanche chute green-up
May	Late Spring	Feeding/ Security & Thermal	Avalanche chute green-up to berry availability
June	Summer	Feeding/ Security & Thermal	Berry availability
July	Summer	Feeding/ Security & Thermal	Berry availability to salmon availability
August	Summer	Feeding/ Security & Thermal	Berry availability to salmon availability
September	Fall	Feeding/ Security & Thermal	Salmon availability
October	Fall	Feeding/ Security & Thermal	Salmon availability to den entrance
November	Winter	Hibernating	Denning
December	Winter	Hibernating	Denning

In forested and non-forested swamp areas, the corms of skunk cabbage (*Lysichiton americanum*) are a well-used spring food, where they occur. The current year's growth of several fruiting shrubs is often eaten before fruit became ripe. The shoots of salmonberry and thimbleberry, the leaf buds and petioles of devil's club and the leaf petioles of elderberry are commonly eaten. Generally, grizzly bears on the coast will follow receding snow up valleys and avalanche chutes to feed on emerging vegetation there, such as cow-parsnip, lady fern (*Athyrium filix-femina*), fireweed (*Epilobium angustifolium*), and grasses.

Throughout their active period, grizzly bears use the intertidal zone for foraging most often near low tide, particularly when the tide is ebbing. Shore crabs (*Hemigraspus* spp.) are often the main intertidal crustaceans eaten, but barnacles (*Balanus* spp.), mussels, starfish, blenny eels (i.e., gunnels of the family Pholidae) and isopods are also eaten. Grizzly bears often turn over intertidal rocks to feed on the animals underneath. In some areas, they dig for clams on intertidal mudflats. Research in Alaska (Smith and Partridge 2004) found that although clams were only available for a few hours per day, bears could significantly reduce their total daily foraging time by utilizing clams. Smaller single bears and females with dependent young were the most represented groups of bears whereas large male bears, faced with higher energy requirements, appeared to be unable to efficiently exploit these intertidal resources. This research highlighted the significance of intertidal habitats for coastal grizzly bears, especially females.

Summer

In summer as fruit ripens, coastal grizzly bears move to valley bottoms and valley side slopes where they feed on a number of berry species including salmonberry (*Rubus* *spectabilis*), devil's club (*Oplopanax horridus*), elderberry (*Sambucus racemosa*), black twinberry (*Lonicera involucrata*), dogwood (*Cornus stolonifera*), and huckleberry or blueberry (*Vaccinium* spp.). Many fruit species on the coast are eaten by grizzly bears to various degrees, apparently depending on local and annual abundance as well as relative availability. The frequency and timing of use of different berries usually corresponds to the dates of ripening, which vary from year to year and between species. The general chronological order of use on the coast is salmonberry, red elderberry, devil's club, huckleberry, stink currant, high-bush cranberry, red-osier dogwood, and Pacific crab apple. Some bears move to higher elevation mountain hemlock forests or avalanche chutes in late summer with an abundance of black huckleberry (*Vaccinium membranaceum*).

Berries are most abundant and concentrated in open canopy floodplain and alluvial fan forests as well as avalanche chutes and other natural openings. Berries may be abundant in early seral clearcuts or other openings associated with logging if the openings have not undergone intensive vegetation management.

Grizzly bears will feed on insects and insect larva throughout their active period when the opportunity arises. Rotting stumps are torn apart to feed on adult and larval ants and the larvae of ground-nesting wasps are dug up and eaten.

Fall

Coastal grizzly bears typically feed on live and, eventually, dead salmon from mid-summer through late fall depending on local availability. Once salmon availability declines, coastal grizzly bears return to feeding on skunk cabbage, late berries, and other vegetation.

Along the lower Babine River in north central B.C., which is a coast-interior transition area, grizzly bears moved to higher elevation rich forb meadows in the subalpine during late summer through early fall where they fed on cow-parsnip, Sitka valerian (*Valeriana sitchensis*) and other forbs and sedges. Later in fall, higher elevation subalpine habitats were used for digging Arctic lupine roots (*Lupinus arcticus*) and hoary marmots primarily, but also likely for feeding on crowberries and huckleberries. In some areas north facing slopes or mountain basins had late snowmelt, which delayed plant emergence and provided feeding opportunity on forb meadows well into fall (MacHutchon and Mahon 2003).

Security Habitat

Security habitat for grizzly bears is variable, but is used to avoid intraspecific (bear to bear) and interspecific (primarily bear to human) contact. Forested habitats may be used as security from other bears; therefore, forested habitats adjacent to foraging areas are important. Females with cubs tend to use forested habitats older than pole-sapling with diverse understory, and isolated rugged habitats, to avoid adult males. Higher quality habitats adjacent to roads or other areas of human disturbance may not be used if adequate forest cover is not available (McLellan and Shackleton 1989).

Social intolerance and security needs of young bears probably act to distribute grizzlies widely over the available range. In many areas, adult females may inhabit marginal ranges or disturbed areas, such as road margins, where human activities exclude most large males (McLellan and Shackleton 1988).

Thermal Habitat

Bears will seek shelter from precipitation in forested habitats. During hot weather, bears will bed in shady areas, such as forests with coarse woody debris, under rock overhangs, or tall shrubs. Areas of dense cover (e.g., alder thickets, riparian vegetation and dense coniferous forest) are used for bedding. Water sources, such as ponds, streams, and wetlands are important for cooling.

Denning (Hibernating Habitat)

Grizzly bears in B.C. generally enter their dens from mid October to late November and remain in dens until early April to mid May. Dens are generally located at higher elevations in areas of deep snowfall, freezing temperatures throughout the denning period, and relatively slow snowmelt. In coastal British Columbia, most grizzly bear dens are located on steep, well-drained slopes near the transition between the Coastal Western Hemlock and the Mountain Hemlock biogeoclimatic zones (approximately 600-1000 m elevation, depending on latitude and aspect) and often are in the stringers of trees at the edge of avalanche tracks or steep-walled gullies. It has been speculated that snow cover is likely less important for insulation on the coast where temperatures rarely fell below -20°C, but that dens need to be located at dry, cold sites where temperatures generally remain below freezing and melt-water seepage is rare.

Throughout grizzly bear range, dens may be excavated under the roots of trees or dug into steep slopes or may be located in natural caves, rock crevices, hollow trees or logs, or hollows under the roots of wind-thrown trees. On the coast, dens are often dug under large old trees as the tree's root mass creates a stable roof for the den (MacHutchon et al. 1993). Coastal grizzlies may also use very large tree cavities much like coastal black bears.

Summary of Important Habitats

Table 3. Summary of general habitat attributes for grizzly bears.

Habitat Use	Attributes of Suitable Grizzly Bear Habitat	Structural Stage[1]
Early Spring (PE) Feeding	• High forage plant diversity in lush herb layer with an abundance of skunk cabbage, grasses, sedges, horsetails, cow parsnip, angelica, stinging nettle, etc. • Floodplains, estuaries, valley bottoms and warm lower slopes of avalanche chutes with moist to wet soil moisture regimes and rich soil nutrient regimes.	2-3, 6-7
Late Spring (PL) Feeding	• Similar to PE with additional shrubs and herbs greening up; salmonberry, thimbleberry and devil's club new shoots. • Warm sites as snow recedes up the hillside, mesic to hygric wetlands, floodplains, avalanche chutes.	2-3, 6-7
Summer (S) Feeding	• Fruit producing shrubs and herbaceous plants are the main source of food. • High use habitats are submesic to hygric sites with medium to rich soil moisture regimes. • Young seral, mature seral and old growth floodplain forests, avalanche chutes with berry-producing shrubs, and open forest alluvial fans.	3, 6-7
Fall (F) Feeding	• Salmon spawning areas and adjacent forests. • Berry-producing forests close to salmon streams, e.g., floodplain forests, and avalanche chutes with berry-producing shrubs. • Moist or wet forests with skunk cabbage. • Some bears will move into sub alpine areas with berry production.	3, 6-7
Security/ Thermal Cover	• Mixed young seral > 2m • Mixed conifer/deciduous older forest (5-7) • Mature to old conifer • Shrub cover >50%	3b, 5-7
Hibernating Habitat	• Dry, moisture-shedding site • Higher elevation, steep slope site	6, 7

[1] Structural Stage: 1 = sparse/non-vegetated, 2 = herb, 3 = shrub/herb (<20 years), 3a = low shrub, 3b = tall shrub, 4 = pole/sapling (20-40 years), 5 = young forest (40-80years), 6 = mature forest (80-240 years), 7= old forest (>250 years).

Home Range and Movement

Generally, grizzly bear home ranges in productive coastal habitats near salmon streams are smaller than ranges in interior mountains, which are again smaller than ranges in interior plateau habitats. For coastal British Columbia, home range estimates in the Khutzeymateen River Valley varied from 57 to 220 km^2 for adult males and 23 to 116 km^2 with a mean of 52 km^2 for adult females (MacHutchon et al. 1993).

Grizzly bears require a mix of seasonal habitats in their annual home ranges in order to have sufficient access to the full range of primary food sources (Kansas 2002). Ensuring a mix of seasonal habitats on the landscape is important for long-term grizzly bear persistence. It also highlights the variable spatial requirements of grizzly bears within different ecological regions or conditions, e.g., mountain versus boreal forest or interior (drier and less productive) versus coast (wetter and more productive).

Grizzly bears have low dispersal capabilities relative to other carnivores (Weaver et al. 1986). This is especially true for subadult female grizzly bears, which usually establish their home range within or adjacent to the maternal range (e.g., McLellan and Hovey 2001). On average, male grizzly bears of interior B.C. only dispersed 30 km from the ranges used as cubs with their mothers, and female grizzly bears only 10 km (McLellan and Hovey 2001). This inherent fidelity, particularly of female grizzly bears, to their maternal home ranges may reduce the rate of re-colonisation of areas where breeding populations have been depleted.

References

Banci, V. 1991. The status of the grizzly bear in Canada in 1990. Committee on the Status of Endangered Wildlife in Canada, Ottawa. 170 pp.

Craighead, J.J., J.S. Sumner, and J.A. Mitchell. 1995. The grizzly bears of Yellowstone. Island Press, Washington, D.C. 535 pp.

Kansas, J.L. 2002. Status of the grizzly bear (*Ursus arctos*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division and Alberta Conservation Association, Alberta Wildlife Status Report No. 37, Edmonton, Alberta. 43 pp.

MacHutchon, A.G., S. Himmer, and C.A. Bryden. 1993. Khutzeymateen Valley grizzly bear study: final report. B.C. Ministry of Forests, Wildlife Habitat Research Report WHR-31 and B.C. Ministry of Environment, Lands and Parks, Wildlife Report R-25, Victoria, B.C. 107 pp.

MacHutchon, A.G., and T. Mahon. 2003. Habitat use by grizzly bears and implications for forest development activities in the Kispiox Forest District; final report. Skeena Cellulose Incorporated, Hazelton and B.C. Ministries of Water, Land, and Air Protection, and Sustainable Resource Management, Smithers. 64 pp.

McLellan, B.N., and D.M. Shackleton. 1988. Grizzly bears and resource extraction industries: effects of roads on behavior, habitat use and demography. Journal of Applied Ecology 25:451-460.

McLellan, B.N., and D.M. Shackleton. 1989. Immediate reactions of grizzly bears to human activities. Wildlife Society Bulletin 17:269-274.

McLellan, B.N., and F.W. Hovey. 2001. Natal dispersal of grizzly bears. Canadian Journal of Zoology 79:838-844.

Munro, R.H. 1999. The impacts of transportation corridors on grizzly and black bear habitat use patterns near Golden, B.C. M.Sc. Thesis, University of British Columbia, Vancouver, British Columbia. 55 pp.

Province of British Columbia. 1990. Describing ecosystems in the field. B.C. Ministry of Environment and B.C. Ministry of Forests (MoE Manual 11). Luttmerding, H.A., Demarchi, D. A., Lea, E.C., Meidinger, D.V., and T.Vold (eds.). Victoria, BC.

Province of British Columbia. 1998. Standard for terrestrial ecosystem mapping in British Columbia. Ecosystems Working Group, Terrestrial Ecosystems Task Force, Resources Inventory Committee. Victoria, BC. 100 pp.

Schoen, J., J.W. Lentfer, and L. Beier. 1986. Differential distribution of brown bears on Admiralty Island, southeast Alaska: a preliminary assessment. International Conference on Bear Research and Management 6:1-5.

Smith, T.S., and S.T. Partridge. 2004. Dynamics of intertidal foraging by coastal brown bears in southwestern Alaska. Journal of Wildlife Management 68:233-240.

Thomas, D.L., and E.J. Taylor. 1990. Study designs and tests for comparing resource use and availability. Journal of Wildlife Management 54:322-330.

Weaver, J.L., R.E.F. Escano, D.J. Mattson, T. Puchlerz, and D. Despain. 1986. A cumulative effects model for grizzly bear management in the Yellowstone ecosystem. Pages 234-236 *in* G.P. Contreras and K.E. Evans, editors. Proceedings - grizzly bear habitat symposium. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, General Technical Report INT-207, Ogden, Utah.

Appendix II: Select Field Photographs from the Western Kitimat River Study Area

Photograph 1: Estuary in the Emsley Creek watershed. This site qualified very high habitat with a rating of 9 due to the high evidence of use and forage species (596 20080930 01.jpg).

Photograph 2: Evidence of rice root excavation in an estuary in the Miskatla inlet (3216 20080930 05.jpg).

Photograph 3: Grizzly bear day bed site located in Sitka alder-salmonberry avalanche chute in the Little Wedeene watershed (2413 20081001 01.jpg).

Photograph 4: Subalpine wetland bog in the Anderson Creek watershed (2872 20081001 01.jpg).

Photograph 5: Very rich receiving site in the Emsley Creek watershed showed high evidence of use including scat, tracks, trail networks, bedding sites, and foraging evidence on skunk cabbage, vaccinium, queens cup and bunch berry (598 20080930 02.jpg).

Photograph 6: High quality wetland fen located next to a swamp forest on the Wedeene River (3234 20081001 01.jpg).

Photograph 7: Territorial mark tree located in the Bish Creek watershed (3258 20080930 02.jpg).

Photograph 8: Skunk cabbage excavations at the toe of a high quality Sitka alder-salmonberry avalanche chute in the Anderson Creek watershed (2546 20081001 01.jpg).

Photograph 9: High bench floodplain site on the Wedeene River. Evidence of use included trails and scat in this high quality habitat (1263 20081001 02.jpg).

Photograph 10: Mesic old growth forest site in the Hirsch Creek watershed (3198 20081002 02.jpg).

Photograph 11: Rich toe of slope site in the Hirsch Creek watershed. Evidence of tracks, trails, and bedding sites in this high quality site that was rated 10 (167 20081002 01.jpg).

Appendix III: Maps of Candidate Security WHA Polygons for the Western Kitimat River study area