YELLOWHEAD CARNIVORE WORKING GROUP
WORKSHOP OVERVIEW

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1.0 BACKGROUND

1.1 Yellowhead Carnivore Working Group

The Yellowhead Region, located in west-central Alberta and east-central British Columbia, encompasses an area of approximately 68 000 km^2. A diverse array of ecosystems within this region support a rich community of large mammalian carnivores (Westworth et al., 1996). Multiple land use practices, including natural resource extraction and recreational use, may threaten ecosystem integrity and health and potentially the survival of large carnivores within the Yellowhead Region. The need for strong management direction and interagency co-operation prompted the formation of the Yellowhead Carnivore Working Group, one of several working groups established under the auspices of the Yellowhead Ecosystem Working Group. The Carnivore Working Group includes representatives from industry and federal and provincial governmental agencies, and is committed to ensuring the long-term survival of carnivores within the Yellowhead Region.

1.2 Workshop Purpose

The first major activity of the Carnivore Working Group was to commission a Carnivore Status Report (Westworth et al., 1996) which detailed the existing published and unpublished material on a selected list of large carnivores in the region. Upon completion of this report, a workshop was held September 26-27, 1996, to develop an action plan based on expert opinion and on the knowledge gaps and conservation needs identified in the report. Specific objectives of the workshop were as follows:

1. Review the present state of knowledge of carnivores in the Yellowhead Region, based on the Status Report and the expertise of carnivore specialists.
2. Identify and prioritize the major gaps in knowledge that prevent effective conservation of large carnivores in the Yellowhead Region.
3. Identify and prioritize research, monitoring and other activities that would help fill these gaps.

2.0 MANAGEMENT SCOPE

2.1 Policy Making

Interagency and transboundary co-operation is a crucial component of an effective conservation program. The United States Interagency Grizzly Bear Committee (IGBC) is a successful example of inter-jurisdictional policy development (Weaver, pers. comm.). However, the lack of a federally legislated mandate for protection of endangered species and varying provincial laws relevant to large carnivore protection in Alberta and British Columbia make a similar scenario in Canada unlikely. In view of these circumstances, a firm commitment towards ground-level regional co-operation between all involved parties (industry, federal and provincial representatives) was promoted by the Carnivore Working Group.

2.2 Scale

Both spatial and temporal scales must be considered when planning carnivore conservation efforts. Large carnivores typically possess large home ranges (e.g. 1628 km^2 - adult male grizzly bear [*Ursus arctos*], Jasper National Park) and are capable of long-distance dispersal (e.g. 264 km - mean dispersal distance, female gray wolf [*Canis lupus*]) (Westworth et al., 1996). Management actions must encompass a large enough geographical region to satisfy these area requirements and maintain connectivity for individual and gene flow between local populations. Inter-agency co-operation is crucial because the spatial scale must transcend administrative boundaries and focus on ecologically meaningful boundaries.

The temporal scale at which management plans are carried out is equally important. Ecological processes frequently occur over much longer periods than social or political agendas (Paquet and Hackman, 1995). Research and monitoring programs that estimate critical population parameters such as reproductive rates, and response to disturbance, must be of long duration.

2.3 Specificity

While the use of existing external databases may be necessary to provide important population biology information and to develop an initial management framework, all management programs

and research topics should focus on the needs of carnivores and the disturbance forces *within* the Yellowhead Region.

3.0 TARGET SPECIES SELECTION

The grizzly bear (*Ursus arctos*) was chosen by the Carnivore Working Group and agreed upon by the experts as a species of primary management concern. The rationale for selection of the grizzly bear will be detailed below in the Species Discussion. The following techniques for ranking or selecting species in order of management priority were also discussed during the workshop.

3.1 Umbrella Species

An umbrella species is a species with large area requirements and general habitat use (Noss et al., 1996). By protecting the habitat and area requirements of an umbrella species, the ecological requirements of many other species, although not all, may also be preserved. A suite of umbrella species may be jointly selected to provide greater niche coverage. However, this concept should be reviewed critically as there has been no strong empirical evidence to support an umbrella effect (Noss et al., 1996).

3.2 Resiliency Framework

Carnivores may be ranked for management priority by their resiliency, that is, the ability to deal with environmental disturbance (Weaver et al., 1996). This approach involves a multi-scale framework by examining: 1) individual response (foraging flexibility) to habitat loss, 2) population response (demographic compensation) to overexploitation, and 3) meta-population response (dispersal) to landscape-level habitat fragmentation (see Weaver et al., 1996).

3.3 Trophic Representation

Target species could also be selected to represent a range of trophic levels. Selection would be based on primary prey species taken. For example, carnivore species that primarily prey on large, (e.g. ungulates), mid-sized (e.g. lagomorphs) or small prey (e.g. microtines), respectively, could be targeted for management actions. This tiered approach may provide effective coverage for

carnivores and other wildlife species that operate on a range of spatial scales and have varying habitat requirements.

4.0 SPECIES DISCUSSION

4.1 GRIZZLY BEAR (*Ursus arctos*)

4.1.1 Rationale

A combination of many factors, including conservation status, life-history traits and existing research programs, resulted in the selection of the grizzly bear as a management priority within the Yellowhead Region. The grizzly bear is designated as a species at risk (blue listed) in Alberta and British Columbia and as vulnerable by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Westworth et al., 1996). Should the proposed federal endangered species legislation be approved, a national recovery plan for the grizzly bear may be developed.

Large area requirements and low reproductive rates make the grizzly bear extremely susceptible to impacts from human disturbance. Increasing recreational use and natural resource extraction activities within the Yellowhead Region have tremendous potential to negatively affect grizzly bears and their habitat needs.

By protecting the habitat requirements of the grizzly bear, many other wildlife species may also be protected. The potential for an umbrella effect is attractive to land managers in the Carnivore Working Group who have neither the time nor the resources to focus on multiple species. Because the grizzly bear is sensitive to human disturbances, it may also act as an indicator of the integrity and health of other ecosystem processes and wildlife populations.

Finally, the existence of well-established grizzly bear conservation, research and monitoring programs in both British Columbia and the United States provides a platform for the transfer of management strategies and research frameworks.

4.1.2 Stressors

The following issues were identified as the primary stress factors (stressors) affecting grizzly bears within the Yellowhead Region. All of these stressors relate to disturbance due to human activity.

4.1.2.1 *Changes in Ecosystem Structure and Function*

Ecosystem structure and function are being changed throughout the Yellowhead Region by a variety of human activities. Fire suppression and forestry operations (logging, silvicultural practices, site preparation) have affected the historical disturbance regime in this region, resulting in altered successional pathways and patterns. This in turn affects prey species composition and distribution as well as predator distribution.

4.1.2.2 *Loss of Habitat and Habitat Effectiveness*

There are many human activities within the Yellowhead Region which change or degrade habitat. These activities result in the direct removal of grizzly bear habitat and may also cause a reduction in the use of remaining habitat due to the initial or perhaps ongoing disturbance. The usefulness or value of a habitat to grizzly bears can be expressed as the habitat's effectiveness. For example, habitat fragmentation, the conversion of large habitat patches into smaller, isolated patches, often results in a loss of habitat effectiveness. In addition to causing habitat loss, development may increase the risk of grizzly bear mortality, act as a barrier to habitat permeability, or destroy foraging and denning sites. A partial list of disturbance activities and developments which currently occur within the Yellowhead Region is:

- coal mining
- agriculture
- tourism
- limestone quarry
- gravel extraction
- road building/upgrading
- railway upgrading
- hydro-transmission lines
- recreation: hunting, atv use
- natural gas industry
- forestry
- settlement/urban areas
- First Nation expansion
- hydro-electric projects

4.1.2.3 *Loss of Connectivity*

Habitat fragmentation and disturbance often result in the destruction of movement corridors, which affects the ability of grizzly bears to move across the landscape. To date, little attention has been directed towards the importance of high-altitude passes as movement corridors, particularly those on the Alberta-British Columbia border. A co-

operative approach is necessary to examine the effects of increased human activity (e.g. hiking) and development in these sensitive areas.

4.1.2.4 *Human-Induced Mortality*

An increase in habitat disturbance and human access along roads and seismic lines reduces habitat effectiveness and elevates the risk of death due to vehicle collisions, hunting and poaching. Management killing and potential deaths resulting from translocation of problem bears may also contribute to the decline of the grizzly bear in the Yellowhead Region.

4.1.3 Information Needs

Based on expert opinion and Carnivore Working Group consensus, the following topics were selected as key management issues within the Yellowhead Region:

1) Cumulative Effects of Human Pressures
2) Mortality and Movement

For each of these management issues, information gaps were identified, and potential projects using current research approaches and techniques were proposed.

4.1.3.1 Cumulative Effects of Human Pressures

The effects of habitat disturbance on grizzly bears should be examined directly and indirectly. The indirect approach focuses on the use of several modelling techniques and existing data sources from other areas. These techniques can be separated into two stages: an initial broad-scale modelling exercise using a friction model (determines landscape permeability to animal movement) and fragmentation analyses; and an intensive finer-scaled modelling exercise using a Cumulative Effects Model (determines impact of human development on habitat suitability). A modelling approach is advantageous because the assumptions are explicit and the models can be dynamic and extremely flexible. However, a key disadvantage of modelling is that the model may not reflect

reality if key parameters are overlooked. Actual data are needed to verify model utility. The following sub-components of a cumulative effects assessment were recommended.

4.1.3.1.1 *Regional Ecological Land Classification*

Prior to modelling, and dependent on the selected study area, a common ecological land classification (ELC) system and mapping framework is required. Currently several classification systems at different scales exist throughout the region. The Yellowhead Ecosystem Working Group has initiated development of a regional ELC which will incorporate existing biophysical and ecological land classification information from Alberta, British Columbia and Jasper National Park into a common framework (Mercer, pers. comm.). This project is jointly funded by Foothills Model Forest, Jasper National Park, Alberta Environmental Protection and Forest Renewal B.C. and will be completed in 1997. This ELC will be produced as a GIS based digital-attribute database at a scale of 1:250 000 and will serve as a framework for identifying future needs of finer-scale habitat detail. Additionally, since 1993, Weldwood of Canada Ltd, Hinton Division, has classified approximately one-fifth of their Forest Management Agreement (FMA) using a 1:15 000 classification system developed for west-central Alberta (Beckingham et al., 1996). The Carnivore Working Group anticipates the need of habitat mapping at a scale of 1:15 000 (or finer) to address habitat use and disturbance related questions.

4.1.3.1.2 *Friction Model*

Friction models were developed to determine the permeability of a landscape to animal movement (Paquet, pers. comm.). Human activities are quantified and modelled in combination with a suite of other factors, such as movement data, fire history, vegetation types, climate and prey biomass, to determine the subsequent use of the landscape by the target species. Modification of existing friction models is recommended as an initial management action to determine the impact of current and proposed human activity and development on grizzly bears within the Yellowhead Region.

4.1.3.1.3 *Human Use Model*

Jasper National Park has compiled a database which details the types and intensity of human use and activity throughout the Park (Bradford, pers. comm.). The spatial extent of this database needs to be broadened to incorporate human activities and levels throughout the Yellowhead Region. Habitat effectiveness could be determined by modelling the human use information with habitat type and habitat capability data for grizzly bears.

4.1.3.1.4 *Fragmentation Analyses*

In addition to a friction model, fragmentation analyses would provide key information necessary to understanding the effects of habitat change and loss on the grizzly bear. Habitat fragmentation in the Yellowhead Region can be further described by the following parameters:

Core Area Analysis, Habitat Patch Dispersion and Linkage Zones

A core area is the minimum foraging area needed per day for a female grizzly bear. Linkage zones - landscape features and areas which provide access across boundaries - should also be identified. Using a GIS approach, core areas and linkage zones of varying quality and size could be identified. Habitat effectiveness can be examined by determining the configuration and dispersion of core areas, linkage zones and other key habitat patches (e.g. used for security, denning) across the landscape.

4.1.3.1.5 *Cumulative Effects Model*

Cumulative Effects Models (CEM) can be used to estimate the effects of land use practices on grizzly bear habitat and populations. The model incorporates information on habitat characteristics and use by grizzly bears and human use patterns to predict habitat effectiveness. A cumulative environmental effects assessment of a proposed coal mine development (Cheviot Proposal) southwest of Hinton (BIOS, 1996) provides an excellent basis for a regional grizzly bear cumulative effects analysis and CEM. A study area of

approximately 3000 km^2 was established for the Cheviot Project assessment, in which ecosite mapping was completed at a scale of 1:50 000. This original CEM could be greatly enhanced by: 1) expanding the study area to incorporate a larger portion of the Yellowhead Region, 2) using a finer-scaled ecological classification and mapping database (1:15 000) which would provide a more detailed vegetation inventory, and 3) incorporating mortality and reproductive success data.

4.1.3.2 Mortality and Movement

Mortality and movement patterns of grizzly bears within the Yellowhead Region are poorly understood. Knowledge of these parameters is crucial for understanding and monitoring the effects of human disturbance on grizzly bear populations within this area. This information can be obtained most effectively by conducting a large scale and long term (100 female bear-years; e.g. 20 bears for 5 years or 10 bears for 10 years) radio-telemetry study. The following sub-projects were suggested:

4.1.3.2.1 *Identify Patterns of Mortality*

Human-induced mortality is a major factor affecting grizzly bear population viability. For example, a total of 798 grizzly bear deaths were recorded in Alberta from 1972 to 1994; 795 of those deaths were human-caused, 3 were attributed to natural causes (Gunson, 1995). While natural mortalities are probably under-represented, it is unlikely that they would reach the magnitude of human-caused deaths. Human-induced deaths were further broken down into the following categories: hunting - 65%, illegal - 14%, self-defence - 8%, problem wildlife - 7%, Treaty Indian - 4%, accidents - 2% and research - 1% (Gunson, 1995). Within the Yellowhead Region, it is important to determine the patterns of grizzly bear mortality and how they relate to the following:

- human developments
- population viability
- gun use - hunting and self-defence

- black bear hunting - the role of mistaken identity

4.1.3.2.2 *Monitor Population Size, Movements and Reproductive Success*

Relative densities, minimum population estimates and population trends can be identified using several monitoring methods in addition to radio-telemetry. The first method, DNA analysis of hair or scat, is a relatively new technique and can be implemented using a mark-recapture design. The second method involves female/cub sightings. Although both of these methods are less invasive and less costly than a radio-telemetry study, they have some important short-comings. DNA typing is very reliable but there may be circumstances in which not all of the assumptions of a mark-recapture design are met (e.g. equal probability of capture). There are also several biases inherent to the female/cub sighting technique: sightability of individual females may vary; cub estimates may be unreliable; bear appearance may change over the season; and sampling effort may be unrepresentative over space and time.

4.1.3.2.3 *Monitor Effectiveness of Translocation*

Little is known of the effects of translocation on translocated and resident bears. Currently the British Columbia Ministry of the Environment is preparing a review of translocation effectiveness which will be available in 1997 (Hamilton, pers. comm.). Workshop attendees suggested that translocation protocols should be standardized between regions and that new marking techniques are needed to improve the visibility and longevity of marks.

4.1.4 Adaptive Management Framework

The proposed grizzly bear research and monitoring recommendations could be effectively addressed in an adaptive management framework. Data collection and model development could proceed concurrently, allowing models to be tested against movement or mortality data as they become available. Establishment of research and monitoring zones throughout the Yellowhead

Region would allow for replication of studies and integration of an interdisciplinary approach (e.g. avian, invertebrate, botanical studies). The Carnivore Working Group also supported the initiation of pre- and post-disturbance study designs.

4.2 WOLVERINE (*Gulo gulo*)

Currently, the wolverine is listed as vulnerable by COSEWIC and blue listed by Alberta and British Columbia. Approval of the proposed federal endangered species legislation may lead to the preparation of a national recovery plan for the wolverine. Lack of population information and apparent vulnerability to human disturbance (Paquet and Hackman, 1995) has resulted in the designation of the wolverine as a priority species within the Yellowhead Region. The following knowledge gaps were identified and need to be addressed:

1. Basic population parameters: population size, reproductive success, movement, habitat use
2. Mortality sources and levels
3. Role as a predator and predator-prey interactions

This information could be obtained through a combination of field techniques:

1. Winter ground tracking over large areas
2. DNA/hair analysis
3. Radio-telemetry study

    Several researchers are currently recommending transmitter implants because of the tendency for wolverines to "drop" conventional collars (Hamilton, Herrero, pers. comm.).

4.3 BLACK BEAR (*Ursus americanus*)

The Carnivore Working Group did not focus on management issues for the black bear as it is relatively common throughout the Yellowhead Region and adapts more readily to human developments than grizzly bears (Westworth et al., 1996). However, wide-spread disturbance (e.g. forestry, recreational use) may seriously affect black bear habitat and populations. If black bear management does become a priority, it would be relatively cost-effective and logistically

feasible to combine a black bear study with both the modelling and monitoring aspects of the suggested grizzly bear plan. Future research and monitoring efforts could also investigate the effects of stand and landscape level forestry practices on this species (e.g. the effect of clearcutting on den site availability, [Hamilton, pers. comm.]). One other area of concern, particularly within Jasper National Park, was the high rate of human-induced mortality, due to train and vehicle collisions and management control actions.

4.4 GRAY WOLF (*Canis lupus*)

The gray wolf is yellow listed as a sensitive species not considered to be at risk in either Alberta or British Columbia, and is found throughout the Yellowhead Region (Westworth et al., 1996). This species was not selected as a priority in terms of conservation effort within the Yellowhead Region. However, the gray wolf does have an important ecological role which may be affected by increased development. Additionally, increased highway mortality and continued persecution through hunting and trapping may threaten existing populations (Paquet and Hackman, 1995). This species has been extensively studied in other areas and the existing data could be used in modelling exercises. Cumulative Effects and friction models (BIOS, 1996; Paquet, pers comm.) already exist for this species in the southern Canadian Rockies and could be modified to be applicable to the Yellowhead Region. Effects of linear development, road densities and snow depth on wolf movement and wolf-prey relationships could also be incorporated into these models.

Information gaps which need to be addressed before expanding the existing models are:

1) the need for predation data in this area
2) a regional ecological land classification and mapping framework.

4.5 COUGAR (*Felis concolor*)

Blue listed by the Alberta government and yellow listed by the British Columbia government, the distribution and abundance of cougars is unknown for the Yellowhead Region. Studies conducted in other parts of the cougar's geographic range suggest that cougars are negatively affected by increases in human activity (Paquet and Hackman, 1996). Current and proposed

development within the Yellowhead Region may result in the loss or degradation of cougar habitat and movement corridors. An assessment of the possible effects of a proposed coal mine development southwest of Hinton, on cougars (BIOS, 1996), could be used as the starting point for a region-wide assessment. To date, no research has been conducted on the cougar within the Yellowhead Region, although considerable work has been done in the southern Canadian Rockies (Ross and Jalkotzy, 1992).

4.6 LYNX (*Lynx canadensis*)

Relatively common in the Cheviot Project Area (BIOS, 1996), the status of lynx populations elsewhere in the Yellowhead Region has not been quantified. It is classified as vulnerable in Alberta and as a sensitive species not at risk in British Columbia (Westworth et al., 1996). No specific research or monitoring actions were discussed for the lynx. However, increased development within the Yellowhead Region (particularly forestry and mining operations) has potential to negatively affect lynx populations through direct mortality and habitat loss. For example, linear developments and improved access into remote areas may elevate the mortality risk due to increased hunting, trapping (lynx are an economically important furbearer) and vehicle collisions (BIOS, 1996). Lynx also require a mixture of early and late successional forests to fulfill denning and foraging requirements. Availability of late successional stands may decline due to current forestry and mining operations.

4.7 BOBCAT (*Lynx rufus*)

The bobcat is blue listed in Alberta and listed as not at risk in British Columbia (Westworth et al., 1996). Information needs were not discussed for the bobcat as the presence of this species has not been positively confirmed within the Yellowhead Region.

4.8 RIVER OTTER (*Lutra canadensis*)

The river otter is extremely rare within the Yellowhead Region and as such was not the focus of in-depth discussion at the workshop. River otter research could be included in a broader study

examining the effects of human development and activity on water corridors and riparian ecosystems.

4.9 FISHER (*Martes pennanti*)

Fisher are widely distributed but present in low densities throughout the Yellowhead Region (Westworth et al., 1996). Associated with contiguous, late-successional forests, fisher may be sensitive to forest fragmentation (Powell and Zielinski, 1994). Information on basic population parameters such as habitat use, movement, mortality and reproductive success is needed, however the scarcity of this species and its secretive nature may make implementation of a monitoring program difficult.

4.10 MARTEN (*Martes americana*)

Marten are widely distributed and very abundant throughout the Yellowhead Region. As a commonly harvested furbearer, they have an important social and economic role in this area. Marten are typically found in late successional coniferous forests with complex downed woody debris structure and may be extremely sensitive to forestry operations (Westworth et al., 1996). As a small forest carnivore, marten could serve as a target species to represent meso-scale habitat use in response to fragmentation.

4.11 MINK (*Mustela vison*)

Human development and activity affect not only terrestrial systems and species, but aquatic ones as well. Mink possess several characteristics that may make them useful as an indicator of wetland ecosystem health: mink are generalists, feeding on a variety of smaller animals (birds, mammals, fish, invertebrates and amphibians); they inhabit a variety of wetland systems; and they are moderately abundant in the Yellowhead Region (BIOS, 1996). Prior to using mink as an indicator species, a basic understanding of habitat use, dispersal and population size is necessary.

5.0 SUMMARY

Large carnivorous mammals are coming under increasing pressure from human activities in the Yellowhead Region. Existing and proposed developments threaten the population viability of

many of these large carnivores through habitat loss, obstruction of movement corridors and elevated mortality rates. The need for strong conservation and management direction and inter-agency co-operation resulted in the formation of the Carnivore Working Group, a branch of the more broadly mandated Yellowhead Ecosystem Working Group. At a workshop held on September 26-27, 1996, the Carnivore Working Group, with advice from carnivore specialists, developed a framework for future research, monitoring and conservation efforts.

The grizzly bear was selected as the species of greatest concern based on declining population levels, life-history traits which increase vulnerability to human activities, and the potential to draw from well-established grizzly bear research and monitoring programs in British Columbia and the United States. The cumulative effects of human pressures, and the specific impacts of human activities on grizzly bear mortality and movement were selected as focal points for future management and conservation efforts within the Yellowhead Region. Within an adaptive management framework, a combination of direct and indirect modelling and monitoring techniques, including Cumulative Effects Models (CEM's), friction models and a large scale radio-telemetry study, was recommended to address these concerns.

Conservation and information needs for several other carnivore species were also identified and discussed. Due to a lack of population level information, and high sensitivity to human disturbance, the wolverine was designated as another priority species within the Yellowhead Region. Information on basic population parameters could be obtained through a variety of field techniques including radio-telemetry, winter tracking and DNA analysis of hair or scat.

Of the remaining carnivore species, neither the black bear nor gray wolf were considered priorities at present. However, should these species become targets of management concern, black bear conservation efforts could be combined with the proposed grizzly bear program, and existing CEM's and friction models for wolves could be adapted for the Yellowhead Region.

Marten, an abundant and economically important small forest carnivore within the Yellowhead Region, are potentially sensitive to forestry practices. As such, the marten may serve as an excellent indicator of the effects of forest fragmentation and habitat change at a meso-scale level.

Little information exists for cougar, lynx, fisher and mink within the Yellowhead Region. Basic population parameters are needed prior to developing, if necessary, conservation plans for

these species. Information needs were not discussed for the bobcat or river otter as these two species are extremely rare within the Yellowhead Region.

Having identified the priority species and their conservation needs, as well as information gaps relating to other large carnivores within the Yellowhead Region, the next crucial step for the Carnivore Working Group is to develop an action plan which would see the implementation of these research, monitoring and conservation activities.

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