

Abstracts

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Seeking Sanctuary – The Life and Times of Arrow Reservoir Bull Trout Through Radio Telemetry

Karen Bray, Columbia Basin Fish and Wildlife Compensation Program.

The bull trout (*Salvelinus confluentus*) is a char endemic to western North America. Populations in British Columbia are considered threatened (blue-listed provincially) and regulations allow for a limited sport fishing harvest. In BC, however, threats to the viability of bull trout populations are a significant concern and include forestry operations in tributary drainages, hydroelectric development, overharvesting, and climate change. Efforts to understand and help sustain bull trout populations in the Columbia River Basin are ongoing through the Columbia Basin Fish and Wildlife Compensation Program with several studies focusing on the Arrow Reservoir. Along with investigations into the genetic structure and early life history of bull trout populations, radio telemetry has contributed to our overall understanding of the species. Identification of adult critical habitats, run timing, and migratory routes were the primary objectives of radio telemetry work, however, results have shed light on mortality, migration, and age at maturity issues, the biological implications of population genetics, and the potential for establishing reserves as an important management option. These additional results are examples of ecological concepts that can be widely applied to other species and systems, both aquatic and terrestrial.

Bio-magnification of Chemical Pollutants in the Food Chain of Southeastern British Columbia

Mark Hall, Majestic Resource Consulting and MSc Candidate at Royal Roads University

As recently as 2000, scientists published findings that show the presence of industrial chemicals and agricultural pesticides in the mountains of western Canada, including the Southern Rocky Mountains. Published research demonstrates that pollutants are being deposited in snow and glaciers along the continental divide between BC and Alberta. The research also shows that persistent organochlorines are bio-accumulating in the aquatic food web of a sub-alpine lake in Banff National Park. It is currently unknown whether these pollutants are present in the food web of terrestrial mammals in this same region. By using gas chromatography / mass spectrometry analysis of fat, muscle, and liver tissue from cougars (*Puma concolor*) and gray wolves (*Canis lupus*) this research will ascertain whether or not chemical pollutants are bio-accumulating at the top of the terrestrial mammalian food chain in the southern Rockies and Purcell Mountains of BC.

The findings of this research could potentially provide information on the bio-accumulation of toxic chemicals in a terrestrial mammalian food web that has not been described in the literature before. The research findings could potentially contribute to the understanding of the global movement of industrial pollutants, provide an understanding of potential environmental stressors that may be affecting wildlife in the southern Rocky/Purcell mountain region of BC and serve as an early warning system for human-environment related health risks in southeastern BC.

Measuring and Predicting Salmonid Egg Survival and Emergence: Lessons learned from a Gaspé, Québec Field Study

André Zimmermann, McGill University

For decades fisheries managers have quantified spawning habitat quality by measuring gravel hydraulic conductivity, grain size, and inter-gravel flow, and then using spawning habitat suitability models to predict egg emergence rates. There is, however, little consensus as to how, when, and what data should be collected to predict egg survival. In addition, there has been only a limited discussion as to which spawning suitability models are likely to give the most accurate results. The purpose of this project was to develop guidelines as to how spawning habitat should be measured and outline which

spawning habitat suitability models might provide accurate results.

Gravel hydraulic conductivity, grain size, and inter-gravel flow were sampled in four streams that are tributaries to the Cascapédia River located in the Gaspé Peninsula, Québec. Eggs were also buried in artificial salmon nest in November 2001 and removed in April 2002 to determine over-winter egg survival rates. By comparing the observed egg survival rates to the predicted egg survival rates based on gravel hydraulic conductivity, grain size, and inter-gravel flow, and a number of habitat suitability models, I concluded that the following techniques and models likely best predict egg survival.

- a. Directly measure the hydraulic conductivity of salmon nests shortly after eggs have emerged and relate emergence to hydraulic conductivity using Chapman's (1988) model.
- b. Calculate hydraulic conductivities with the Stickler and Hazen formula based on non-truncated subpavement freeze-core/bulk samples of the substrate in spawning nests shortly after the eggs have emerged. Emergence is then related to hydraulic conductivity using Chapman's (1988) model.
- c. Directly measure, or infer, inter-gravel flow velocities in salmon nests and predict survival with Cooper's (1965) emergence model.
- d. Take non-truncated subpavement freeze-core/bulk samples of the substrate in spawning nests shortly after the eggs would have emerged and predict egg survival using the Sand-Index.

Using DNA to Monitor Free-ranging Wildlife: The Road from Bear Research

John G. Woods, Clayton Apps, John Boulanger, Michael Gibeau, Bruce McLellan, David Paetkau and Michael Proctor.

We used non-invasive tissue collections as a source of DNA to determine the species, sex and individual identity of free-ranging bears in the Upper Columbia Basin, British Columbia during 1995-1998. DNA systematically collected from hair trapping was used as a self-marking system to produce mark/recapture estimates of bear populations. For grizzly bears, we used DNA-based occurrence records across geographic and environmental gradients to develop a bear density-gradient map. Our attention is now focused on developing a long-term (20 – 50 years), large-scale (e.g., >9,000 km²) bear-monitoring programme. We are seeking a design that will allow resource managers to track change over time in a manner that provides insight into the factors driving change in the population (e.g., apparent survival, recruitment, geographically explicit changes in relative bear density, and individual movements across barriers). We intend to develop a DNA-based monitoring strategy for the area between Revelstoke, BC and Kananaskis Country, Alberta using constant effort monitoring and open mark-recapture analysis models. Simulations will be used to explore trade-offs in designs in terms of power to estimate demographic change, power to estimate change over space, and monitoring cost. Potential exists to use similar techniques with other species (e.g., shed hair from mountain goats, trapped hair from wolverine and lynx, scat from caribou, buccal swabs from amphibians and reptiles).

Wildlife Habitat Relationships in BC's Columbia River Basin

Chris Steeger, Pandion Ecological Research

The *BC Columbia Basin Database (CBD) for Wildlife-Habitat Relationships* was developed to provide biologists, resource managers and other potential users with baseline information for modelling and monitoring possible effects of resource development on terrestrial vertebrate species and their habitat. The BC database is an extension of the original US wildlife-habitat database that was compiled for the Oregon and Washington portions of the Columbia River Basin. Its main features are a list of 447 species occurring in the BC basin and a set of digital matrices (MS Access tables) that relate species to *Wildlife Habitats, Structural Conditions, Habitat Elements, selected Life History parameters and Key Ecological Functions*. Management activities can be linked to habitat elements and, in turn, to individual species. In order to achieve widespread awareness and application of the database, a web site has been developed for the project, which has recently been incorporated in the Columbia Basin Trust web site (www.cbt.org). A first application of the database for resource management involved habitat supply modelling on Tembec's TFL 14. Further work on the database and the website includes development of: (i) species range maps for use in connection with the digital matrices, (ii) habitat element accounts for elements with high ecological value (e.g., snags), and (iii) individual species accounts with information summaries from the digital matrices and range maps.

The Canadian Intermountain Joint Venture

Larry Halverson, Kootenay National Park

The Canadian Intermountain Joint Venture (CIJV) is a new program. The CIJV includes the Canadian portions of the Great Basin and the Northern Rockies Bird Conservation Regions and follows the boundaries of the Montane Cordillera Ecozone. The region covers 473,000 sq. km and includes all the mountain national parks. It is delineated by the crest of the Coast Mountains on the west, the eastern crest of the Rocky Mountains, the southern extent of the boreal forest to the north, and the boundary with the United States on the south.

The rationale for this new joint venture includes its importance to biodiversity, especially birds and species at risk. 373 bird species have been recorded in the region of the CIJV, contributing to one of the most diverse bird faunas in all of Canada. The intermountain contains important breeding habitat for 26 species of ducks as well as Canada geese. It provides habitat for more than 60% of the world's population of Barrow's Goldeneye. The CIJV area has the highest owl, woodpecker, swift and hummingbird diversity of any ecozone in Canada. The entire BC populations of 11 provincially red-listed species (Swainson's Hawk, Ferruginous Hawk, Prairie Falcon, Burrowing Owl, Williamson's Sapsucker, White-headed Woodpecker, Sage Thrasher, Yellow-breasted Chat, Brewer's Sparrow (subspecies *breweri*), Lark Sparrow and Grasshopper Sparrow) are contained within the CIJV area.

The North American Bird Conservation Initiative, Canada Council, has endorsed the CIJV on the condition that the joint venture is fundamentally orientated to all birds and that a "prospectus" is produced. A CIJV technical committee was formed and has now consolidated information for the prospectus and later will be involved with bird conservation planning including:

- Setting priorities and objectives for species and habitats
- Identifying geographic or biophysical areas of special concern
- Identifying common threats and actions needed to address them.

Some possible strategies for the CIJV include:

- Securement
- Enhancement & Management
- Private Land Stewardship
- Outreach & Education
- Influencing Land Use Decisions
- Monitoring, Evaluation & Research

Stand Structure Retention in Old-Growth Forests of the Rocky Mountain Trench, British Columbia.

Harry Quesnel, Ecotessara Consultants, and Chris Steeger, Pandion Ecological Research

A research project has tested the short-term ability to maintain wildlife values and stand structures after partial cutting in the Rocky Mountain Trench of British Columbia. The objectives for the study were to maintain functional old-growth ecosystems through development of partial harvesting prescriptions and to compare the effects of different levels of timber retention (100%, 70%, and 40% basal area retention) on wildlife species which depend on stand structural attributes. The treatments were applied to two sites near Canal Flats in each of the Interior Douglas-fir (IDFdm2) and Montane Spruce (MSdk) biogeoclimatic variants. On these old-growth sites, Douglas-fir (*Pseudotsuga menziesii*) represented most of the basal area and largest trees. Ponderosa pine (*Pinus ponderosa*) in the IDFdm2 and western larch (*Larix occidentalis*) in the MSdk also formed a significant portion of the largest diameter class (>50 cm dbh). The average stand age was 176 years or less, though trees over 300 years old existed on the study sites. The focal wildlife guild selected for this project is the "cavity nesters", a group of species known to require specific stand structural attributes. The main response variables used to assess the wildlife habitat value of the treated stands were: density of active cavity nests, avian species richness, and characteristics of trees

used by foraging woodpeckers.

In the post-harvest breeding seasons on both biogeoclimatic variants, no significant changes in density of cavity nests or species richness were found across the different levels of basal area retention. Most nest cavities were constructed by weak excavators in medium sized snags of Douglas-fir, ponderosa pine, or western larch. In contrast, cavity nesting was preferred in larger snags of deciduous species or western larch. The weak excavators included: Red-breasted Nuthatch, Mountain Chickadee, and Black-capped Chickadee. Four years after treatments, the harvesting prescriptions developed for the old-seral stands of this study were generally adequate for maintaining the wildlife values monitored.

The Northern Leopard Frog in Southeastern British Columbia

Doug Adama

Northern Leopard Frogs (*Rana pipiens*) were once common to southern British Columbia. Today this species is represented by only a single, small population located in the Creston Wildlife Management Area near Creston, BC. Listed as endangered by both the Provincial government (CDC) and COSEWIC, this population is threatened by low recruitment, disease, predation, habitat fragmentation, habitat degradation, and introduced fish species. In 2001, a small scale rearing effort was attempted and 496 *Rana pipiens* were released back into previously occupied habitat. In 2002, the rearing effort was expanded and an adaptive management approach was taken to improve rearing techniques.

3858 *Rana pipiens* were reared in captivity between May 13 and September 24, 2002. Tadpoles were reared in 4000 litre cattle tanks filled with 1000 litres of water. The tanks were located outdoors and exposed to ambient temperatures. Water quality was maintained with regular water changes and the removal of waste. An artificial diet of organic spinach, romaine lettuce and bloodworms was fed to the tadpoles. 1925 newly metamorphosed frogs and 1315 tadpoles (Gosner stage 30 to 44) were released back into the wild. Survival was 94 % excluding animals sacrificed for disease monitoring (8.6%).

Research was conducted to examine the effects of density on tadpole growth and the size at metamorphosis, and also to compare the growth of tadpoles on three diets. We found that for the first half of development (45 days) tadpoles grew more at higher densities (0.2 tadpoles per litre) while the effect of density on the size at metamorphosis was inconclusive. We also found that tadpoles grew significantly more when fed a diet of aquatic vegetation over tadpoles fed an artificial diet. These results will be used to improve our husbandry techniques and guide further research in 2003.

Whitebark Pine Restoration and Monitoring in the Canadian Rockies

Brendan Wilson, Department of Renewable Resources, Selkirk College; Jon Stuart-Smith, Parks Canada; and Robert Walker, Parks Canada

Whitebark pine (*Pinus albicaulis*) is threatened by a number of anthropogenic factors in the Canadian Rockies. These include an introduced blister rust species (*Cronartium ribicola*), fire suppression and associated seral replacement by more shade tolerant tree species, and by rapid global climate change. However, the most serious of these problems is the threat of widespread mortality due to blister rust infection. This is more pronounced in the southern regions of the Canadian Rockies, but has serious ramifications for all of the Mountain National Parks. Although blister rust on whitebark pine was observed in several locations in Canadian National Parks in the early 1960's, it took several more decades before it was identified as a serious problem.

In 1998, the Lake Louise, Yoho and Kootenay National Parks Field Unit (LLYK) initiated a prescribed burn and monitoring program to aid in the restoration of whitebark ecosystems. In 1999, Waterton Lakes National Park joined in the developing program. In that same year we drafted a plan to provide background information on the conservation problem and outline a number of options for developing a broader, more effective approach to the conservation of the ecosystem within the Canadian Rockies. The main goals of this strategy were:

1. Initiating a detailed inventory of the species throughout the federally administered land base. Although there is a large-scale ecological land classification and associated maps for much of the region, we have little confidence at

estimating the abundance and structure of the whitebark pine population. We also have only a reconnaissance level survey of the extent and intensity of blister rust infection.

2. Seed collection. As part of an inventory, rust resistant seed sources need to be identified so that a future seed collection may provide sources for a breeding program.
3. Studying the geographic distribution of adaptive traits. As part of a seed collection program, an adaptive traits study should be conducted to provide guidelines for any rust resistant breeding-out planting strategy.
4. Forming partnerships with other interested agencies and organisations. Part of making conservation efforts —such as seedling breeding and adaptive traits studies—a reality, strong partnerships need to be formed with other interested groups that already have the skills in place.
5. Continuing the prescribed burn restoration efforts. We now have four research sites prepared for monitoring the effects of prescribed fire. Of these permanent monitoring sites, only one has had fire introduced as part of the planned treatment. Lack of internal upper management support (financial and political) due to fears surrounding public perception and safety are likely the main obstacle to achieving greater fire restoration success.
6. Exploring existing data resources to generate hypotheses about relationships between the pine, its environment, and its stressors
7. Examining potential provincial and federal species at risk listing for whitebark pine. To date, Parks Canada has approached the Council On the Status of Endangered Wildlife In Canada (COSEWIC) with an expression of interest on the promotion of whitebark pine to a protected status. We perceive that this type of federal legal status for the species will serve to foster a holistic approach that encompasses all of these aspects into an interagency strategy for the conservation of whitebark pine ecosystems.

Water Management in the Columbia Basin

Kindy Gosal, Columbia Basin Trust

The presentation will focus on three specific areas:

1. A general geographic and hydrological overview of the Columbia River Basin with a comparison of the Canadian and US portions of the Basin.
2. An overview of the Columbia River Treaty: Historical background and Treaty Basics.
3. An overview of the impacts on the Canadian Columbia Basin as a result of the construction of the three Columbia River Treaty Dams (Social, Economic, Environmental).

Integrating Ecosystem Restoration and Archaeological Site Protection and Management - Rocky Mountain Trench

Thomas Munson, Ktunaxa Kinbasket Treaty Council and MSc Candidate, University of Victoria.

The Ktunaxa Nation people have occupied the Rocky Mountain Trench of southeastern British Columbia for centuries (see attached map). Past archaeological research has described their cultural association or complex of Ktunaxa campsites with kettle lakes, as evidenced by archaeological artefacts found around numerous small lakes in the Rocky Mountain Trench north and south of Cranbrook.

Ecological restoration projects involving pre-burn timber treatments and prescribed burning are ongoing in the area around these kettle lakes. Archaeological sites near these kettle lakes are vulnerable to site disturbance from wildfire fighting activities and firefighting equipment.

An understanding of the impacts of natural resource harvesting on cultural resources is of critical interest to society at large and First Nations in particular. The connection occurs in two ways: first, through the potential direct disturbance of archaeological sites by harvesting activity and post-harvesting management treatments such as ecosystem restoration; second, through the impact of activities on the biocultural environment, such as the distribution of important plant (ethnobotanical) resources. Impacts can best be minimized or eliminated through wise pre-treatment/intervention planning of

operational activities. Planning must be based on objective, rigorously collected data.

This proposal focuses mainly on the first type of disturbance on archaeological resources, but will also provide insight into impacts on the biocultural landscape. Results of the study will illuminate the nature of the impacts of harvesting and post-harvesting activities and under what conditions such impacts occur. By involving pre and post interference observations the research will provide insights into:

1. What types of cultural sites on what type of landscapes are most sensitive to impact;
2. What monitoring methods work best to avoid impacts;
3. What standards must be met in terms of acceptable impact on the cultural resources and sites.

This research will assess whether timber treatments can be carried out around these archaeological sites, under controlled conditions, on snow and frozen ground, with no disturbance to site context and integrity. Subsequent prescribed burning would fireproof the archaeological sites from future damage.

Work Completed to Date

A number of known sites around kettle lakes were examined in detail in the first year of field studies, using archaeological site inspection techniques. Site surficial and subsurface soil characteristics were recorded. A variety of different timber treatments used in ecological restoration plans were observed in the field. Site monitoring and site soil disturbance survey methodologies were reviewed and recommendations have been made for next phase of research. Timber harvesting plans around the archaeological sites have been discussed with the local Forest District office, and Tembec Inc., a local forest licensee. Timber harvest treatments around the sites will be monitored and soil disturbance measured to arrive at archaeological site management recommendations for this kettle lake complex. This research will form the basis of an applied resource management Masters Thesis at the University of Victoria.

Research Applications

The research provides a model for First Nation involvement in archaeological and cultural site management in British Columbia. The Ktunaxa Nation has been involved in collection of archaeology information for many years, and has developed an Archaeological Potential Model, which is used to predict the likelihood of cultural sites on the landscape, based on a set of physiographic features at the macrosite and microsite level. Using this Model, the Ktunaxa Nation has been able to respond to resource development plans by directing the requirement for further archaeological fieldwork on the ground prior to any development impacts. This research is advancing the process another step, by actively investigating the impacts of resource extraction around archaeological sites. The intention is to arrive at management recommendations for future resource development work around cultural and archaeological sites.

The applications are varied for the different participants: for the Ktunaxa Nation, cultural resource information is being used in applied resource management, and archaeological sites may be protected from wildfires, which is an important process for the Nation as they assume more lands and resources management responsibilities; for the local Forest District, the information will allow their ecological restoration processes to proceed across the landscape without isolating archaeological sites; for the timber licensee, the research may allow more flexible approaches to resource extraction around archaeological sites, which have been avoided to date. The end result is multi-dimensional resource management applied on the ground, respecting the knowledge and experience of all participants.