# Methods or Madness? Developing Population Inventory Manuals for British Columbia's Biodiversity

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## ABSTRACT

In 1992, the Elements Working Group began developing standards for the collection of population inventory data about elements of British Columbia's terrestrial biodiversity. As the result of meetings between an assortment of wildlife biologists, the province's biodiversity was divided into 32 element groupings, and inventory methods and standards were developed around each of these, as well as for 5 additional topics relevant to biodiversity inventory. Manuals in the series are available for free via the Internet, and provide an obvious resource for biologists studying species at risk. In addition, developing methods for such a wide array of species has highlighted some of the general limitations of wildlife inventory, particularly for species that are rare or endangered.

**Key words:** inventory, monitoring, populations, standards.

In 1992, the Elements Working Group (EWG) was formed to work as part of a larger body, the Resources Inventory Committee (RIC), towards the development of data collection standards for the government of British Columbia. The EWG is a group of wildlife biologists with the specific task of developing standards for the collection of data about elements of the province's terrestrial biodiversity. These standards are intended to support a vision whereby all provincial data on the abundance and distribution of wildlife populations will be collected using standard methods, documented using common sets of codes and definitions, and will be easily accessible to all users via a centralized corporate data system.

Setting standards for the collection of data on biological populations is a daunting task in any jurisdiction, but particularly so in British Columbia. Although standards for aquatic and marine elements of biodiversity are the domain of other working groups, there are still an impressive number of so-called "terrestrial" species within scope, including many species that occupy the interface between the terrestrial regime and aquatic or marine habitats, such as waterfowl, amphibians, and aquatic mammals. The EWG intends to develop standards for conducting inventory of all of these species' populations in all of the different habitats in which they occur. This encompasses 15 species of reptiles, 20 amphibians, 478 birds, and 87 mammals, as well as more than 2,200 different vascular plant species and unknown numbers of invertebrates (Douglas et al. 1998, Resources Inventory Committee 1998). Included among the vertebrates are 48 species that are threatened or endangered in the province (Red-listed), and an additional 56 considered vulnerable (Blue-listed).

## APPROACH AND PROGRESS TO DATE

As a first step, it was necessary to try to render the wide array of biota in British Columbia into more manageable packages. This was accomplished through a series of meetings in which wildlife biologists from a variety of disciplines were gathered together and formed into 5 specialist discussion tables: birds, mammals, herptiles, invertebrates, and plants/rare ecosystems. Central among the tasks assigned to these tables was the identification of major element groups for which similar methods could be used to collect inventory data. Generally, the inclusion of elements within a group was to depend on similarities between life histories, resource use and/or range, and detectability. Each element group would be the subject of its own manual outlining inventory standards. Manuals would be written by "experts" who were thoroughly familiar with the species in the element group, after which they would be reviewed by experienced peers.

As a result of these discussions, a set of element groups for British Columbia's terrestrial biodiversity was defined (Table 1), with each group requiring a separate manual outlining recommendations for appropriate methodologies and data collection standards. Each manual for an element group was to contain a summary of natural history information relevant to conducting inventory of the species, as well as standards for personnel, equipment, and daily and seasonal timing. In

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B.C. Ministry of Environment, Lands and Parks, Victoria, B.C. and University College of the Cariboo, Kamloops, B.C. 490pp.

**Table 1.** Element groupings and generic manuals proposed for development into standards for British Columbia, and progress to February 1999.

| Broad grouping | Element groupings and generic manuals | Completed to date[a] |
|---|---|---|
| General | Species Inventory Fundamentals | version 2.0 |
| | Vertebrates of British Columbia: Scientific and English Names | version 2.0 |
| | Live Capture and Handling of Wild Mammals, Birds, Amphibians and Reptiles | version 2.0 |
| | Wildlife Radio-telemetry | version 2.0 |
| | Voucher Specimen Collection, Preparation, Identification and Storage Protocol | UD |
| Birds | Marsh Birds: Bitterns and Rails | version 2.0 |
| | Colonial-nesting Freshwater Birds | version 2.0 |
| | Nighthawks and Poorwills | version 2.0 |
| | Marbled Murrelet | version 1.1 |
| | Raptors | version 1.1 |
| | Riverine Birds | version 2.0 |
| | Shorebirds | version 1.1 |
| | Forest and Grassland Songbirds | version 2.0 |
| | Swallows and Swifts | version 2.0 |
| | Upland Gamebirds | version 1.1 |
| | Waterfowl | UD |
| | Woodpeckers | version 1.1 |
| Mammals | Bats | version 2.0 |
| | Bears | version 2.0 |
| | Beaver and Muskrat | version 2.0 |
| | Hare and Cottontails | version 2.0 |
| | Marten and Weasels | version 2.0 |
| | Medium-sized Territorial Carnivores | version 1.1 |
| | Moles and Pocket Gopher | UD |
| | Mountain Beaver, Bushy-tailed Woodrat and Porcupine | version 2.0 |
| | Pikas and Sciurids | version 2.0 |
| | Small Mammals | version 2.0 |
| | Ungulates: Aerial Inventories | version 1.1 |
| | Ungulates: Ground-based Inventories | version 2.0 |
| | Wolf and Cougar | version 2.0 |
| Herptiles | Plethodontid Salamanders | version 2.0 |
| | Pond-breeding Amphibians and Painted Turtle | version 2.0 |
| | Snakes | version 2.0 |
| | Tailed Frog and Pacific Giant Salamander | version 1.1 |
| Other | Terrestrial Arthropods | version 2.0 |
| | Macrofungi | version 1.1 |
| | Rare Vascular Plants, Lichens and Bryophytes | UD |

[a] UD = under development.

addition, standard methods were to be recommended at 3 levels of intensity: the presence/not detected level, providing the least rigorous data identifying the presence or failure to detect a species in a study area; the relative abundance level, providing indices to monitor changes in species abundance over space or time; and the absolute abundance level, providing data on the actual number or density of a species per unit area.

In addition to species-specific manuals, a small group of more generic standards were proposed, which would provide general guidelines for all population inventories, regardless of taxa. The first of these, *Species Inventory Fundamentals*, discusses general standards for survey design and provides guidelines for survey preparation, habitat description, and data analysis. *The Vertebrates of British Columbia* sets the taxonomic standard for the province, listing the conventional names for all species and subspecies of vertebrates in the province. *Live Capture and Handling* outlines ethical principles and logistical concerns for the capture, restraint, possible containment, and subsequent release of wild animals. *Wildlife Radio-telemetry* outlines generic principles of telemetry, such as types of equipment and study designs, and a literature review of different methods of transmitter attachment and their success on different species. Finally,

*Voucher Specimens* discusses requirements for the collection of vouchers, their preparation, storage, and transfer to a provincial custodian.

To date, manuals outlining inventory standards, including data forms, have been completed for 33 of the total proposed set of 37 (Table 1). All the current manuals in the *Standards for Components of British Columbia's Biodiversity* series are available to download at http://www.for.gov.bc.ca/ric/. From the very beginning, it was expected that the series would evolve as biologists "field-tested" the manuals in different areas of the province. Abundant feedback from different field workers has contributed to the improvement of many of the version 2.0 manuals, newly released in 1998.

## DISCUSSION: SPECIES AT RISK

The inventory manuals in the *Standards for Components of British Columbia's Biodiversity* series provide an obvious resource for biologists conducting studies of species at risk. Each manual contains a selection of well-established methods for evaluating presence and/or abundance of different species, including guidelines to increase likelihood of detection. In addition, the development of this series of manuals has revealed some useful generalities about conducting inventory of wildlife species, which may be particularly relevant to a biologist studying species at risk. Two such generalities concern the importance of understanding limitations of inventory methods and the data they produce.

The first of these involves the limitations of the different levels of survey intensity, specifically the "Presence/Not Detected" level. Biologists attempting to document the range of a rare or endangered species may initially wish to utilize the methods described under "Presence/Not Detected." However, Boulanger and Krebs (1998) emphasize that non-replicated surveys following presence/not detected methods will not yield data of statistical value. Specifically, it is not possible to determine species absence or local extirpation without more structured survey methods. As this may be a crucial objective, especially for species at risk, biologists should consider upgrading methods to those used to evaluate relative abundance. These may not require much more effort, but will be more effective in determining species absence or local extinction if spatial and temporal replication is utilized, particularly for species that occur at very low densities. Surveys that use relative abundance methods also provide preliminary data for future surveys, which can be used to produce rough estimates of the number of samples required to detect a species in a specific habitat.

The second generality centres around study design and its effect on inference. In particular, 1 of the key issues that has emerged from the development of >30 species inventory manuals is the ability to derive habitat inferences from surveys that are generally focused on obtaining data about population numbers. Biologists studying species about which little is known (a common characteristic of species at risk) will likely be tempted to derive as much knowledge as possible from a limited amount of data. They are cautioned to remember some of the fundamental differences in survey design between habitat and population sampling. As an example, population surveys generally try to target periods of greatest detectability in the focal taxa and to shorten the duration of sampling to minimize fluctuations in population size, while habitat studies are more likely to time field work with limiting seasons or periods of specific interest, and to continue for longer durations to get a more complete picture of an animal's life history. Thus, it may be misleading to derive habitat use patterns from the "snapshot" obtained from a population inventory. However, this does not mean that it is impossible to design studies that will provide information about both population size and habitat use, only that biologists should be cautious about assuming every study affords this opportunity. Manly et al. (1993:5) discuss the limitations of making habitat inference at the population level, as would be the case for most population inventories. A well-conceived, dual-purpose study, although likely not capable of discriminating habitat selectivity, may still provide some information on habitat use where little or none existed before. Given the reality of shrinking funding for the inventory of all species, it is only sensible to try to make the most out of every new survey.

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## LITERATURE CITED

Boulanger, J. G., and C. J. Krebs. 1998. Pp. 45–66 *in* Resources Inventory Committee. Species inventory fundamentals. Standards for components of British Columbia's biodiversity, no.1, version 2.0. B.C. Minist. Environ., Lands and Parks, Resour. Inventory Branch, Victoria, BC. 113pp.

Douglas, G. W., G. B. Straley and D. V. Meidinger. 1998. Rare native vascular plants of British Columbia. B.C. Minist. Environ., Lands and Parks, Victoria, BC. 423pp.

Manly, B. F., L. L. McDonald, and D. L. Thomas. 1993. Resource selection by animals: statistical design and analysis of field studies. Chapman and Hall, London, U.K. 177pp.

Resources Inventory Committee. 1998. Vertebrates of British Columbia: scientific and English names. Standards for components of British Columbia's biodiversity, no.2, version 2.0. B.C. Minist. Environ., Lands and Parks, Resour. Inventory Branch, Victoria, BC. 122pp.