THE COGNITIVE DIMENSIONS OF A BIOLOGICAL HAZARD:
A Study of Livestock Predation in British Columbia
Within a Hazards Framework

by

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A Dissertation Submitted in Partial Fulfilment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

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ABSTRACT

This study focuses on the cognitive dimensions of two important aspects of the predator-livestock problem in British Columbia: the concrete coping strategies adopted by individual livestock producers and the institutional responses adopted by, or available to, the Provincial Wildlife Branch.

The threat posed to domestic stock by wild predators is conceptualized as a biological hazard, and the advantages of this approach are discussed. A conceptual framework integrating theoretical insights from geography, social psychology, psychology, and political science is developed. Several hypotheses are derived from this framework, and a number of these are linked to form two conceptual models, one designed for an analysis of ranchers' cognitions, the other for the examination of nonranchers' cognitions. Both models relate several cognitive variables to the perceived acceptability of a number of lethal methods of wolf control. These variables include: ecological orientation (as measured by the New Environmental Paradigm Scale); attitudes towards wolves; and perceptions of the wolf threat.

Two mail survey questionnaires were developed, one (Version A) for nonranchers, the other (Version B) for ranchers. Version A was satisfactorily completed by a total of 574 respondents: 259 from the city of Victoria; 95 from Williams Lake; 87 from Kamloops; and 133 from the Northwest

Wildlife Preservation Society (NWWPS). The data from the three urban samples were combined to form a "general public" sample. Version B was completed by 283 ranchers. Questionnaire data were supplemented by the content analysis of several relevant documents and informal interviews with selected personnel from the B.C. Wildlife Branch, the ranching community, and a number of wildlife interest groups.

A variety of statistical techniques, including simple correlation, multiple regression, analysis of covariance, and discriminant analysis, were used to analyze the data. The analyses provided strong support for most of the hypotheses. Several of the more important findings are noted here. For all three sample groups (general public, ranchers, and NWWPS), significant relationships were found between ecological orientation and attitudes towards wolves; between attitudes towards wolves and perceptions of the threat that wolves pose to individual cattle producers and the cattle industry as a whole; between attitudes towards wolves and the acceptability of certain lethal wolf control measures; and for nonranchers, between attitudes towards wolves and the perceived humaneness of lethal wolf control, and between the perceived humaneness of lethal wolf control and the acceptability of lethal wolf control. A number of variables exhibited significant differences across the groups: ecological orientation; attitudes towards wolves; and perceptions of the wolf, coyote, and bear threats.

Several management implications suggested by the research are discussed and a number of policy recommendations and suggestions for further research are offered.

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ACKNOWLEDGEMENTS

The acquisition of a Ph.D. is, in many ways, a solitary pursuit. Solitude is an integral, even a necessary, part of the academic journey. Yet one is never entirely alone. Along the way, a helping hand, an encouraging word, a constructive criticism, a listening ear help to make the way less difficult, the challenges more exciting, the hours, even the days, of discouragement less intense.

A number of people have made the journey less onerous than it might have been. Dr. Mike Edgell was willing to take me on as a graduate student when my academic programme was in disarray due to the untimely death of my first supervisor, Dr. Derrick Sewell. Dr. Edgell was light on the reins but always there to provide encouragement, advice, and constructive criticism when I needed them. Working with him has been one of the genuine pleasures of my graduate career. To the rest of my committee, Drs. Colin Wood, Dave Duffus, Alan Drengson, Robert Gifford, and Pat Gregory, and to Dr. Phil Dearden, who until recently served on my committee, I offer my sincerest thanks for making the journey remarkably smooth.

My gratitude to my family is immense. My wife, Donna, had faith in me when I didn't. She encouraged me when I was down, listened when I needed an uncritical ear, and never complained when graduation day seemed to recede further into the future. This thesis is dedicated to her. My children, Julie, Angelea, and Conor, never complained when I was locked

away in my own solitary world, never grumbled when I gave my work far more time than I gave them. They deserve a full-time father. Yet they never responded with acrimony, only with understanding. My mother's faith in me was boundless, and her love was a constant encouragement. To Brad, thanks for your concern and your friendship.

To my fellow travellers, John Dumbrell, Jim Windsor, Dave Nowell, Barbara Carmichael, Patrick Lucey, and Alistair McVey, thanks for your friendship, your help, the lunches, the coffee and the beer. Cheers!

And finally to Dr. Derrick Sewell, who left us before his work was done, goes my deep gratitude for simply believing in me.

CHAPTER 1

INTRODUCTION

This study focuses on the cognitive dimensions of two important aspects of the predator-livestock problem in British Columbia: the concrete coping strategies adopted by individual livestock producers and the responses adopted by, or available to, the Provincial Wildlife Branch.[1] More specifically, the research pursued several objectives:

1. To define the nature of the predator hazard in terms of geographical and temporal distribution, species of predator, predation intensity, and financial impact on the basis of currently available information.

2. To assess the perceived importance of livestock predation to ranchers relative to certain other threats to their livelihoods.

3. To identify the range of adjustments (or coping strategies) to the predator hazard that have been adopted at the individual and institutional levels.

4. To identify some of the cognitive factors related to the adjustments adopted at the individual level.

5. To identify some of the cognitive factors believed to be directly or indirectly related to support amongst ranchers and nonranchers for several alternative institutional adjustments or responses to the hazard.

The following discussion is designed to accomplish several aims: to provide a rationale for the study by underscoring the importance of livestock predation as a public

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[1]The term "cognitions" is used in this study as a general taxonomic category to refer to beliefs of various kinds, including values, attitudes, and perceptions.

policy issue; to provide a rationale for focusing on the cognitive dimensions of the issue; to highlight the advantages of exploring the topic within a hazards framework; to identify the scope and limitations of the investigation; and to outline briefly the organization of the study.

Livestock Predation as a Public Policy Issue

In the past three decades, livestock predation has become an increasingly visible, volatile, and complex public policy issue in North America. Much of the controversy surrounding the issue stems from attempts to eliminate or reduce livestock predation through predator culling programmes. Yet the challenge to such programmes is a recent phenomenon. Prior to the advent of the environmental movement in the late 1960s, (lethal) predator control was generally accepted by the public, even by most wildlife-oriented organizations. Wildlife interest groups were, by and large, devoted to the protection of game animals or song-birds and exhibited little concern for predators of any kind -- unless they were of the two-legged variety (Dunlap, 1988). It is true that wildlife biologists and lay activists occasionally voiced concerns about the intensity, scope, and methods of control, but these concerns were usually expressed in private meetings or scholarly journals, rarely in public fora.

Over the past 25 years or so, however, the number of wildlife-oriented groups has grown dramatically. Many of them

are articulate, well-funded, media-wise, publicity conscious, and scientifically literate. Consequently they bring a powerful and persuasive voice to the public policy arena. And an increasing number of these groups -- e.g. Greenpeace, the Audubon Society, the Defenders of Wildlife, and the Sierra Club -- are focusing considerable attention on the issue of predator control. Nevertheless, the lobby for control remains strong, not only in terms of numbers but also in terms of political clout and financial resources. Arguments for continued control are articulately voiced by a variety of groups representing farmers, hunters, and guide/outfitters. These groups have managed to convince governments, which tend to be particularly sensitive to economic arguments, that predator control can be justified on economic grounds.

Yet in spite of the strength of the control lobby, wildlife managers can no longer assume that predator control schemes will continue to be endorsed -- or at least greeted with indifference -- by the public or by the biological community. Managers are now confronted with a profound ideological revolution, evidenced not only by changing attitudes towards predators but, it appears, by a wholesale transformation in beliefs about humankind's proper relationship with the natural environment.

In the United States, where the wolf has been eliminated from most of its historic range, the controversy has centred largely on predation by coyotes and coyote control, although

debates have erupted in Minnesota over predation by wolves and in Montana and Texas over predation by golden eagles. In Canada, particularly in British Columbia where coyotes, bears, and cougars also prey on livestock, the controversy has tended to focus on wolves. However, the reasons for this focus are not entirely clear. It may well be that wolves pose the greatest threat to livestock producers in the province, but there are no hard data to support this. Or perhaps the wolf's status as a symbol of wilderness, which is for many people a repository of important spiritual, aesthetic, ecological, and intrinsic values, has tended to focus attention on the wolf rather than other species that do not share its symbolic value. In any event, wherever the problem of livestock predation has occurred and whatever the species of wildlife involved, contemporary conflicts over livestock predation and predator control share several characteristics.

First, although it is generally acknowledged that some individual livestock producers do suffer serious financial losses due to predation, the overall economic impact on the livestock industry in most geographical regions is poorly understood. Second, there is little hard evidence that reactive, site-specific predator control, which is now practised in many political jurisdictions in North America, provides significant protection against livestock predation. Third, there is no scientific evidence that lethal forms of predator control are more effective than nonlethal procedures;

nor have there been any attempts to determine what combinations of procedures, both lethal and nonlethal, might provide the highest level of protection against predation in any given geographical setting. Fourth, the ecological impacts of various predator control techniques are not well understood. Fifth, predator control in agricultural regions is always justified on economic grounds. Indeed there appears to be no other justification. However, this rationale is based on a frequently unspoken assumption that human needs and desires take precedence over those of other sentient creatures. And finally, although the defense of predator control tends to be onedimensional, opposition to the practice tends to be multidimensional, with arguments against control being based on one or more of a number of economic, ecological, or ethical considerations. Economic arguments against the practice focus on the lack of data supporting the economic necessity for control or the cost effectiveness of certain types of control. Ecological arguments emphasize the possible impacts of reducing predator numbers on prey species and the impacts of control techniques such as poisoning, trapping, and relocation on nontarget animals. Ethical objections raise the issues of humaneness, and the intrinsic value and rights of all sentient beings.

In principle, while some of the issues noted above could be resolved by further economic and biological research, many of the major controversies stem from, or are exacerbated by,

unresolved value and attitudinal conflicts. Indeed, many of the unresolved scientific and economic questions become relevant only under a particular set of assumptions or beliefs. For example, some protagonists consider predator control illegitimate, in part, because, they argue, the practice of exploiting animals for food or clothing is unethical and therefore ought not to be supported in any way. For people with such views economic arguments for predator control carry no weight. Other people may grant the legitimacy of animal agriculture and concede to livestock producers the right to defend their animals against predators under certain circumstances but may deny that human needs and desires are always superordinate to those of other species. Yet again, others may find economic arguments convincing only if it can be demonstrated that control techniques will have no serious ecological impacts. Even those issues with a major unresolved scientific component have strong ethical, emotional, and value-laden undercurrents. It is clear, then, that the issue of livestock predation is thoroughly enmeshed in the conflict between different belief systems. And it is evident that there is little hope of comprehending or resolving many of the problems associated with livestock predation without an understanding of the conflicting beliefs and attitudes driving the present conflicts.

Livestock Predation as a Problem in Human Management

The problems associated with livestock predation share a feature common to all environmental or natural resource problems: they are related to the ways in which the human mind perceives and organizes the external world. It is for this reason, no doubt, that Paul Shepard (1967) has called the relationship of the mind to nature the "central problem of human ecology." And as Evernden (1985) points out, how we see nature and what we expect from it are intimately related to our commitments to particular beliefs and institutions. Mary Douglas (1972: 139) puts it this way:

> Tribal peoples who worship their dead ancestors often explicitly recognize that each ancestor exists in so far as cult is paid to him. When the cult stops, the ancestor has no more credibility. He fades away, unable to intervene, either to punish angrily, or to reward kindly. *We should entertain the same insight about any given environment we know. It exists as a structure of meaningful distinctions* (emphasis added).

This "structure of meaningful distinctions" is essentially a complex filing system, a system of categories that the human mind uses to organize its experience of the external world. These categories are determined in large measure by communal or personal values, which are closely associated with commitments to political, social, religious, and economic institutions. This process of categorization is evident in the human perception of natural resources. Gilbert White (1966; 105) observes:

> At the heart of managing a natural resource is the manager's perception of the resource and the

> choices open to him in dealing with it. At the heart of decisions on environmental quality are a manager's views of what he and others value in the environment and can preserve or cultivate. . . . [N]atural resources are taken to be culturally defined, decisions are regarded as choices among perceived alternatives for bringing about change and any choice presumes a view of the resource together with preferences in outcome and methods.

White's analysis may be amplified by introducing the concept of "positive" and "negative" resources (see, e.g. Burton *et al.* 1978). A "positive" resource is an aspect of nature that a group or individual views as an asset, i.e. a source of physical sustenance, economic wealth, spiritual or aesthetic satisfaction. An element of nature regarded as a threat to human life, safety, health, mental wellbeing, or institutions is termed a "negative" resource. The categorization of natural phenomena exhibits considerable spatial, temporal, and cultural variation. Volcanism in Iceland, for example, is both a positive and negative resource. Harnessed by technology it provides energy for industry and public utilities; unleashed it poses a major threat to the survival of many of Iceland's communities. Wild animals in the wilderness may be a spiritual or aesthetic resource; wild animals on the farm, a threat to one's livestock. Resources are, therefore, a matter of individual or collective perception determined by the value placed on a natural object, phenomenon, or creature at a particular time and at a specific place. Consequently all resource problems are fundamentally matters of perception, attitude, and

preference. Questions of (physical) science and technique are always secondary.

The perceptual nature of natural resources and its relationship to attitudes, values, and commitments to particular institutions is clearly evident in the problem of livestock predation. Predators -- wolves, for example -- are valued by some, disliked by many, and viewed with ambivalence by others. Moreover, the strategies of choice for managing predators vary from person to person and group to group. These variations in the perception of predators and different preferences for various management strategies are intimately related to commitments to agricultural institutions.

It is certainly possible to view livestock predation simply in terms of "problem" animals. But this would severely restrict the ability of policy makers to resolve the problem in a creative fashion, since it would ignore the fact that our "predator problems" are, in large measure, a function of our values, perceptions, and institutions and are therefore really human problems. This point is emphasized by Aldo Leopold who, speaking of wildlife management in general, argued that:

> The real problem of wildlife management is not how we shall handle the [animals] . . . the real problem is one of human management. Wildlife management is comparatively easy; human management difficult (cited in Flader, 1974; 188).

If then, the real challenge of wildlife management is managing people, an understanding of the cognitive factors that influence human behaviour and shape public debate is crucial

to the development of a successful management plan. Yi-Fu Tuan (1974; 1) sums it up well:

> Without self-understanding we cannot hope for enduring solutions to environmental problems, which are fundamentally human problems. And human problems, whether they be economic, political, or social, hinge on the psychological role of motivation, on the values and attitudes that direct energies to goals.

Indeed, there is encouraging evidence that what is sometimes called "wildlife values" research can help clarify the decision process.[2] Three examples of such research are briefly outlined below. They not only illustrate its potential usefulness but also provide interesting parallels to problems associated with livestock predation.

The use of values research as a wildlife management tool has been motivated in part by a genuine desire to respond to the needs and preferences of a rapidly changing, pluralistic society (see, e.g. King, 1980; Witter, 1980; Schweitzer, 1980). Accordingly, there is a growing awareness that environmental management problems are multi-dimensional in nature. For example, Hendee's (1974) "multiple satisfaction approach" to game management is based on research indicating that the hunting experience is composed of a wide array of

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[2]The definition of "values" adopted in this thesis (and set out in Chapter 2) differs somewhat from that found in the wildlife-related literature. For the time being, the term "wildlife values" may be understood as including any of a number of social, psychological, and behavioral indicators -- including attitudes, motives, preferences, and interests -- that reveal something about the value an individual places on wildlife, a wildlife-related experience, or wildlife-related behaviour (Witter, 1980).

satisfactions; bagging game is only one element in a complex recreational experience. This knowledge provides wildlife managers with some of the information required for shaping physical, biological, and social conditions in order to (attempt to) maximize the human benefits realized from the management of a recreation resource.

Game management problems are clearly multidimensional in character, as Hendee's research indicates; but no less so than the management of predator-livestock problems. Just as the satisfactions with hunting vary dramatically from person to person, so too the values attached to wild predators and to agricultural traditions. An understanding of these values and how they are distributed in society should help managers develop programmes that address the real concerns of people both in and out of the agricultural community.

Based on research examining college students' attitudes towards hunting, Shaw and Gilbert (1974) argue that hunting-antihunting controversies may depend less on philosophical considerations and more on concerns about hunter conduct, e.g. game law violations, raucous behaviour, property damage, and accidental shooting of people. Information of this kind, the authors suggest, allows managers to address what may be the major source of discontent, rather than assuming that antihunting sentiment is directed primarily at the killing of wildlife. Similar conclusions were reached by Rohlfing (1978;

409), who comments that the "public has no sense of outrage about hunting where the kill is quick, clean and skilful."

Similarities between antihunting and antipredator control sentiment are also apparent. For example, a study of public opinions about coyote control in the United States conducted by Arthur (1981) suggests that opposition to coyote control stems largely from concern about the cost, specificity,[3] and humaneness of the control methods and the level of damage caused by coyotes rather than from any philosophical or ethical objections to killing wildlife. Arthur did not attempt to determine the extent to which nonlethality was a consideration in the acceptability of control techniques. Her data do indicate, however, that under a hypothetical scenario in which the level of lamb losses to coyotes increases incrementally from 5 to 40 percent, the percentage of respondents supporting the "Kill no coyotes, sustain losses" option dropped from 13 to 2 percent. The relatively low level of support for this option under various levels of predation suggests that nonlethality, *per se*, is not an important consideration for a majority of the general public.

Arthur's study, however, was conducted in the United States over ten years ago. In the interim, animal "rights"

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[3]The term "specificity" refers to whether or not control measures are aimed at reducing the overall population of a predator species in a particular area (proactive control) or whether only those specific animals that are believed to have killed, injured, or harassed livestock are targeted for control (reactive control).

groups have become more aggressive, and questions concerning the ethical treatment of animals have become highly topical. Indeed, John Robbin's (1989) frontal attack on the livestock industry, in *Diet for a New America*, has prompted the publication of a major document (Cross and Byers, 1990) by the National Cattlemen's Association in response to his arguments and accusations. In light of these increased sensitivities to the treatment of animals, it would be useful to assess the degree to which opposition to predator control is related to concerns about the killing of predators and to other beliefs concerning the proper relationship between humans and nature, and to do so in a Canadian context.

One of the problems associated with values research and wildlife management has been the lack of an appropriate conceptual framework to guide the incorporation of research findings into a management plan (Witter, 1980). A promising advance in this direction has been made in the context of wildlife-agriculture conflict. Drawing on the concepts of biological carrying capacity (BCC) and social carrying capacity[4] and building on earlier work by Brown *et al.* (1978) and Brown and Decker (1979), Decker and Purdy (1988) have begun developing a concept they call wildlife acceptance capacity (WAC). Since WAC, like BCC is regulated by several dynamic factors, it is not a static number. WAC depends on

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[4]This concept that has been applied in the context of outdoor recreation management (see, e.g. Graefe *et al.* 1984).

people's varying acceptance thresholds for numerous forms of damage and nuisance related to a particular wildlife species in a specific location. It also depends on several other factors: the perceived competition of the "problem" species with another that is of value to people; the role a particular species may play in transmitting disease to humans or their livestock; and the values people place on the perceived "problem" species. While the BCC for any given animal population varies over time, at any specific time it has a *single* value. In contrast, the WAC will often vary from one segment of the population to another. Hunters, for example, may desire a higher deer population than orchard owners who are concerned about damage to their crops.

A crude assessment of WAC can be made in a couple of ways. Brown *et al.* (1978) and Brown and Decker (1978) suggest that a threshold of acceptance can be identified in some cases by employing estimates of economic loss or by identifying preferences for, say, deer population trends as dependent variables and deer density as the independent variables.

Management alternatives based on an evaluation of WACs for various population segments must be assessed in conjunction with wildlife management population objectives and the BCC. Generally, management objectives are set lower than the BCC. When WACs are higher than the BCC or management objectives this sends a signal to managers to implement programs designed to improve public understanding of the

biological and management constraints for the species of concern. Where WACs fall below management objectives, wildlife officials may choose to assist people with the problems caused by "nuisance" animals; for example, training ranchers and farmers about the benefits and procedures of certain damage control techniques.[5]

The concept of Wildlife Acceptance Capacity provides a technical name for a problem that has plagued wildlife managers for some time: attitudes towards and tolerance for wildlife frequently display significant spatial variation. For example, several studies (see, e.g. Kellert, 1985; 1986; Dunlap, 1988) indicate that urbanites tend to be more tolerant of, and exhibit more positive attitudes towards, wolves than their rural counterparts. Kellert (1985) has obtained similar results with respect to the coyote. His work on wolves also indicated a rural-urban split on support for various predator control methods, with lethal techniques receiving greater support in rural districts (Kellert, 1986). These spatial variations in attitudes towards predators and predator control

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[5]This illustration provided by Brown and Decker (1978) appears to assume that management population objectives are established independently of WACs. Management alternatives, therefore, essentially consist of an effort to "sell" management objectives rather than an attempt to formulate these objectives in light of WACs.

often issue in conflicts concerning wildlife management programs.[6]

Although one would expect to find similar associations between place of residence -- specifically rural versus urban -- and attitudes towards predators and predator control in Canada, there are no empirical data to confirm this. Hoffos' (1983) study of the controversy surrounding wolf management in British Columbia examined attitudes towards several wolf control methods. The results, however, were classified in terms of livestock owners, hunters, and nonhunters; rural-urban differences were not reported. A survey conducted by the Northwest Wildlife Preservation Society also examined attitudes towards predator control, but again no indication of geographical variations in response was noted (Pettigrew, 1989). This study will attempt to fill that information gap.

To sum up, there are compelling reasons to believe that livestock predation and the management problems that attend it are intimately related to beliefs about nature in general, and predators, predator control, and agriculture in particular; and that an examination of some of these beliefs will help wildlife managers clarify the decision process by identifying some of the salient issues in the related public policy debates.

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[6]These spatial variations can probably be attributed to several factors including the influence of special interest groups and, as will be noted in Chapter 2, occupational interests and certain features of the physical environment.

The Advantages of a Hazards Approach to Livestock Predation

In spite of the fact that natural hazards are generally classified as one of two types, geophysical or biological (see, e.g. Kates, 1971), with but few exceptions (see, e.g. Dearden, 1983) the study of biological hazards has been almost entirely ignored by geographers. Whilst there is a small but vibrant specialty in the discipline known as medical geography, apparently no attempts have been made to investigate disease within a hazards framework. Yet, as Lewis and Mayer (1988) have recently argued, medical geography might be substantially enriched by conceptualizing disease as a natural hazard.

Two considerations suggest that the investigation of livestock predation might be similarly enhanced. Prompted by frequent claims from critics of the sheep industry that ranchers *routinely* inflate predation loss figures, a number of studies (see, e.g. Nass, 1977; Schrivner, 1985; Tigner and Larson 1977) have been undertaken in the United States in an attempt to provide reasonably objective, independent assessments of predation losses. While this research provides some evidence that these accusations are unfounded, the debate continues. There is, however, anecdotal evidence that *individual* ranchers do, from time to time, overstate the severity of the predation problem. And there is certainly no doubt that ranchers' perceptions of the importance of the problem generally vary considerably from those of

protectionist groups such as Greenpeace, or the Association for the Protection of Fur-bearing Animals. Several "theories" might be advanced to explain the tendency of some ranchers to inflate the seriousness of the problem and to explain differences between groups in perceptions of its severity. For example, it could be argued that the exaggeration of predation losses is merely a rhetorical ploy designed to promote (increased) government support and funding for predator control; or that predators are scapegoats for other problems of a less tangible nature, particularly those related to a depressed economy.

To date, however, no one has attempted to explain variations in perception of the predator hazard in terms of the unconsciously employed heuristics that individuals routinely apply when they are confronted with difficult judgmental tasks (Tversky and Kahneman, 1974). Hazards researchers frequently appeal to the existence of such rules or simplifying strategies to explain differences between "expert" and "lay" opinion concerning the level of risk posed by certain hazards (see, e.g. Slovic *et al.* 1979). Regrettably, there is no objective data base to which one can appeal to judge the accuracy of expert or lay opinion regarding the severity of the livestock predation problem.[7] However, these heuristics do provide a partial explanation for

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[7]Claims that predation could easily bankrupt the cattle industry can be readily dismissed, however.

the diversity in perceptions concerning the severity of the predator threat.

In addition to the useful contributions that it can make to explanation and hypothesis development, one of the great advantages of a hazards approach to livestock predation resides in the link that has been forged between natural hazards research and human ecology (Burton and Hewitt, 1974; Lewis and Mayer, 1988). An ecological approach to hazards research encourages investigators to focus on the relational character of natural hazards. In this approach, natural hazards are defined in terms of the risk faced by humans stemming from their use of natural systems. Natural phenomena are hazardous only to the degree that they occur in "the presence of a *vulnerable* human community" (Hewitt, 1983; 5). But the vulnerability of human communities is as much a function of human activities, decisions, and institutions as it is a function of (nonhuman) natural processes.

Livestock predation provides a vivid illustration of the relational character of natural hazards. Livestock predation is in fact a product of human ingenuity. Prior to the advent of herding and farming, certain animals, particularly large carnivores, undoubtedly posed a threat to human life and limb. But the direct threat they presented to a community's possessions was very limited. The domestication of animals changed that, however. This innovation transformed the natural behaviour of the predator into a new threat to human

communities. Moreover, humans soon learned that selective breeding, a practice so closely related to domestication that Paul Shepard (1973) equates the two, enabled them to exert control over the characteristics of their animals, making them more productive both as sources of food and labour but also more docile and submissive and hence more manageable. Unfortunately, it also made them more vulnerable to predator attack than their wild counterparts. So while domestication and selective breeding provided a number of benefits to human communities, they also brought a new source of uncertainty and vulnerability.

It would be a mistake, then, to attribute livestock predation solely to the predatory urges of wild (and in some cases, domestic) animals. Although this insight is hardly revolutionary, it is important to emphasize it in this context because there appears to be a growing recognition, even in the ranching community, that practical and socially acceptable solutions to the problem of livestock predation require a multidimensional approach, incorporating modifications in both natural and human use systems. Much of the controversy associated with the problem, however, hinges on the degree to which its resolution is tied to modifications of the natural system where the emphasis traditionally has been placed. But increasingly preservationists are arguing that the emphasis ought to be placed on modifications to the human use system.

Scope and Limitations of the Study

The problem of livestock predation is, of course, multidimensional, and cannot be fully explicated in terms of cognitive processes alone. Undoubtedly, a number of geographical, biological, economic, and institutional variables contribute in some way to the intensity, scope, and spatial distribution of livestock predation and to the formation of cognitions related to the issues that attend the problem.

Although the study includes three predator species -- wolves, bears, and coyotes -- the focus is clearly on wolves. This focus was chosen for several reasons. First, an examination of many of the important issues as they relate to all of these wildlife species would have been prohibitive. Second, if one takes media coverage as a guide, it is clear that the public controversies surrounding predator control in British Columbia have focused on wolves. Consequently, individuals in the general population will be more likely to have formed an opinion on the issue. Third, there is some opinion, both in the Wildlife Branch and in the ranching community, that wolves pose the greatest economic threat to cattle producers in the province.

The study is limited not only in terms of the range of variables examined but in terms of the conclusions that can be drawn about causal relationships. Although hypothesis identification and formulation were based on theoretical

considerations that causally link cognitions to one another and to behaviour, and while statistically significant relationships between a number of variables were observed, the cross-sectional nature of the study precludes drawing conclusions about causation.

A final limitation of the study should be noted. Because of difficulties associated with the development of comprehensive sampling frames for ranchers and the general public, no claims concerning the general representativeness of the data can be made. Extrapolations to *target* populations must be made with care.

Organization of the Study

The remainder of the study is organized in the following way. Chapter 2 is devoted to a discussion of the theoretical issues underlying the investigation. The theoretical framework for the study draws heavily on Rokeach's (1968; 1973) system of human beliefs, Gilbert White's (1960; 1961; 1969) work on decision-making processes, and Kates' (1971) general systems model of natural hazards. Emphasis is also placed on the influence of cultural paradigms on attitudes towards specific issues and the role of judgmental heuristics in formulating assessments of the predator hazard. The hypotheses that guided the study's empirical investigation are outlined in this chapter. Chapter 3 describes data collection procedures and the development of two mail survey

questionnaires, the primary research instruments used in the investigation Chapter 4 describes the statistical techniques used to analyze the questionnaire survey data and the results of these analyses. Chapter 5 covers several related topics: the spatial, temporal, and species distribution of livestock predation; individual and institutional adjustments to the hazard; and a discussion of a number of related cognitive variables. And finally, in Chapter 6 the principal conclusions of the investigation are summarized, and several implications of the study are examined.

CHAPTER 2

CONCEPTUAL FRAMEWORK

Introduction

Although an interest in natural hazards can be traced back as far as Strabo (63 B.C. - 21 A.D.; Hewitt, 1980), the impetus for much of the geographical hazards research undertaken since World War II derives from Harlan Barrows' programmatic address to the Association of American Geographers in 1922. Believing that the increasingly fragmented character of academic geography threatened its very existence, Barrows argued that the science of human ecology provided a much needed unifying framework for the discipline. "Geography," he asserted

> will aim to make clear the relationships existing between natural environments and the distribution and activities of man. Geographers will be wise . . . to view this problem . . . from the standpoint of man's adjustment to environment, rather than from that of environmental influence (Barrows, 1923: 3).

On the whole, Barrows' plea fell on deaf ears, perhaps due in large measure to the fact that he advocated the relinquishing of the physical specialities of the discipline -- e.g. physiography, climatology, and plant and animal ecology -- to other disciplines. But his appeal clearly struck a chord with Gilbert White, one of his graduate students at the University of Chicago, who was to have a major impact on the work of a generation of geographers interested in the management of natural resources.

Barrows' influence on White is clearly reflected in the latter's Ph.D. dissertation title: "Human Adjustment to Floods" (White, 1945). This study, in turn, laid the conceptual foundations for much of the subsequent resources and natural hazards research undertaken by White, his students, and his colleagues. Particularly noteworthy in this regard is White's concern with the range of choice and the modes of selecting various alternatives in decision making processes associated with resources management. These themes were elaborated in a number of studies (see, e.g. White, 1960; 1969) but are perhaps most clearly delineated in his essay "Choice of Use in Resource Management" (White, 1961).

In this paper, White notes that, while the notion of multiple use in both land and water management had been widely accepted, up to that point few attempts had been made to investigate the possible constraints on multiple-use combinations. As an aid to the examination of this question, White developed a model of decision making applicable to a wide range of resource-management problems, including those associated with natural hazards. This model was strongly influenced by the notions of "bounded rationality" and "satisficing," both prominent themes in the work of Herbert Simon (1957), and by the intricate theory of resource use developed by Firey (1960). Briefly, White's model describes the factors and processes that link the resource manager's

selection of management strategies to an array of practical and theoretical choices.

A slightly modified version of White's model (termed the "managerial adjustment decision model") was subsequently incorporated in Kates' (1971) general systems model of natural hazards (see Figure 2.1).[1] Although Kates' model provides a highly simplified view of a very complex natural hazard system, a comprehensive examination of all of its major elements, as they pertain to any given hazard, would be a monumental if not impossible task. Consequently, hazards research based on this model generally draws upon it quite selectively.

Given the objectives set out in Chapter 1, two features of the model are especially relevant to this study of livestock predation: the ecological perspective incorporated into the model, more specifically the notion of natural hazard as a joint function of natural and human use systems; and the "managerial adjustment decision model." These elements from the general systems model can be effectively supplemented by theoretical perspectives from other disciplines. Before

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[1]Although this model is, for the sake of convenience, referred to as "Kates' model," its development was a collective effort, based not only on the work of Gilbert White and Herbert Simon but also on the work of other hazards researchers as well. For example, the concept of natural hazard as a joint function of natural events and human use of natural systems, a characteristic feature of the model, was developed by Kates in conjunction with Russell and Arey (Russell, Arey, and Kates, 1970.)

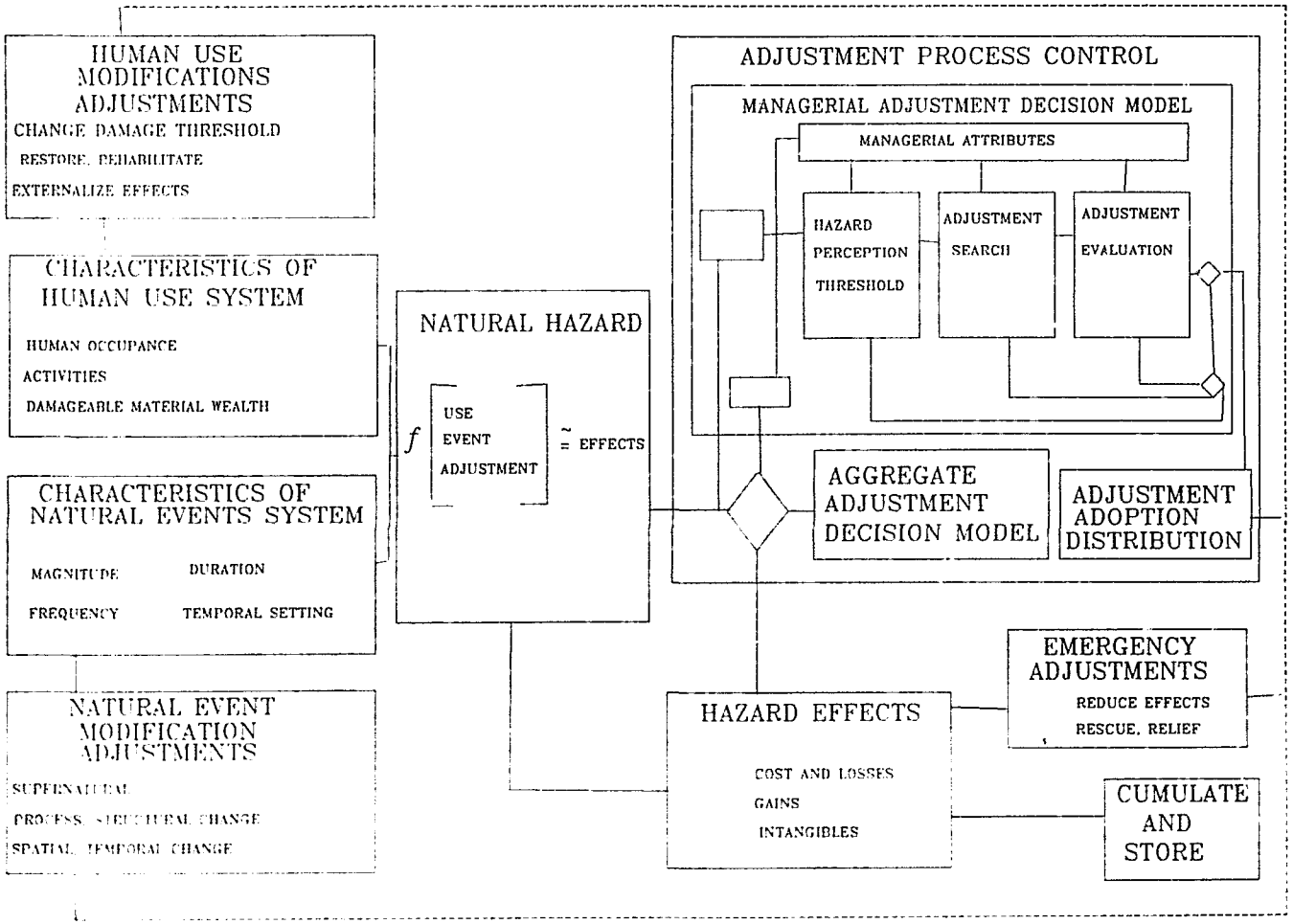

FIGURE 2.1

Human adjustment to natural hazards: a general systems model
SOURCE: KATES (1971)

turning to that task, however, it would be useful to define several important terms.

Definitions

Natural Hazard as a Relational Concept

Writing from an ecological perspective, Kates (1971: 438) defines natural hazard as

> . . . an interaction of man and nature, governed by the coexistent state of adjustment in the human use system and the state of nature in the natural events system. In this context, it is those extreme events of nature that exceed the capabilities of the system to reflect, absorb, or buffer that lead to the harmful effects, ofttimes dramatic, that characterize our image of natural hazards.[2]

Kates' definition has the great merit of explicitly relating natural hazards to human-environment interactions rather than

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[2]One could argue that, while Kates' recognition that natural hazard is a relational concept is wholly consistent with an ecological perspective, the distinction between nature and human use systems evident in the definition is not. It betrays, one might suggest, a failure to appreciate the fact that a truly ecological view would characterize the natural world as an internally differentiated unity composed of human and nonhuman elements. However, Kates' terminology may well be a linguistic convenience rather than a betrayal of his underlying views about nature. Nevertheless, the approach taken in natural hazards research, including the approach taken here, is usually highly anthropocentric. There is a real tendency to view events or natural processes as hazardous if they pose a threat to human interests. Yet many phenomena that humans consider hazardous are natural processes that serve to maintain the integrity of ecosystems. So if one were to take a more detached, ecological view of hazards, one might define "'hazards' as those events which seriously undermine the overall patterns and variety of life, or threaten all life on earth" (Burton and Hewitt, 1974; 265).

to the malevolence of natural forces. However, it presents several minor difficulties.

First it does not clearly distinguish between natural hazard as *risk* -- e.g. the risk associated with living in an area subject to hurricanes -- or natural hazard as *event* -- e.g. a hurricane sweeping through a residential area. This distinction is made clear in *The Environment as Hazard*, a joint effort of Burton, Kates and White (1978), wherein they define "hazard" as "the risk encountered in occupying a place subject [for example] to lightning or flood." They emphasize that "The actual hazard, not the natural event, is the . . . subject of inquiry" (p. 19). The crucial point, however, is that, whether viewed as *risk* or *event*, natural hazards are a joint product of nature and human use systems, and Kates' definition does make this clear.

Kates' characterization of natural hazards in terms of "extreme events" raises a second concern. As Hewitt (1983) argues, the tendency for researchers to refer to hazards as extreme, unscheduled, unprecedented, or unexpected events suggests that hazards are neither viewed as an integral part of the continuum of human-environment interactions nor, despite frequent protestations to the contrary, are they seen to be dependent upon them. Hewitt's point is that hazardous events, though frequently rare and cataclysmic, are nevertheless part of the fabric of everyday life, a

consequence of deeply ingrained patterns of cultural adaptation to the natural environment.

This is particularly true of certain hazardous events such as disease and floral and faunal infestations. Moreover -- and this raises a third concern -- phenomena such as these can often best be described as chronic problems rather than extreme, unprecedented, or unexpected events. Livestock predation, for example, though rare in some areas, is a chronic problem in others. Moreover, since it is a joint product of animal domestication (a practice deeply embedded in contemporary North American culture) and the *natural* instincts of certain animals, it is hardly an extraordinary phenomenon. It is simply what one ought to expect, given the circumstances.

To sum up, then, the term "extreme" seems inappropriate for two reasons: it appears to detract from the fact that hazards are implicated in the flow and pattern of everyday life; and certain hazardous events may be chronic and of relatively low intensity.[3]

Given these considerations, a number of changes in Kates' definition of natural hazard seem appropriate. These changes are designed to accomplish two objectives: to define natural

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[3]There are, of course, instances in which the term "extreme" is entirely appropriate. In terms of physical force, natural phenomena such as hurricanes and earthquakes can certainly be described as extreme events. But as a general description of all hazardous events, the term is clearly inappropriate.

hazard clearly in terms of *risk*; and to make the definition more comprehensive by taking account of the fact that some hazardous events are chronic, some very subtle or insidious, and others rare and catastrophic. Accordingly, a natural hazard may be defined as:

> the risk to humans, human property, or human works that stems from the interaction of humans and nonhuman nature. The level of risk confronting a human community is a joint function of the capacity of the human use system to reflect, absorb, or buffer potentially harmful natural events and the state of the natural events system. Risk from a particular hazard can be avoided either by eliminating, modifying or relocating the potentially harmful nonhuman agent, by structuring the human use system in such a way as to wholly neutralize any potentially harmful effects, or by relocating or avoiding certain human activities. Risk can be reduced in a similar fashion.

For livestock owners, then, the predator hazard is the risk they face by raising cattle in areas frequented or occupied by wild predators.[4] The risk, which can be characterized more precisely in terms of the potential for financial loss or emotional trauma, is a function of several factors, including predator densities and the animal husbandry practices employed by livestock owners.

Biological Hazard

A biological hazard is a natural hazard in which the risk is a function of the interaction between humans, human

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[4]Although domestic and feral dogs are frequently a problem for livestock producers, this study is confined to predators born in the wild.

property or human works and a nonhuman biological agent or process.

Adjustments

The term "adjustments" refers to any modifications in human activities or human works which, by design or good fortune, eliminate or reduce the level of risk associated with a natural event or mitigate the impact of hazardous events. The term may also refer to any intrapsychic responses that help individuals cope with both risk and the costs associated with hazardous events.

Conceptual Models

This investigation was based on two fundamental assumptions: that beliefs about specific elements in the environment and beliefs about particular environmental issues are functionally related to a much broader system of general environmental beliefs; and that human behaviour is functionally related to beliefs, material conditions, and self-interest.

Based on these assumptions, a theoretical framework for this study will be assembled using important concepts drawn from Rokeach's (1968; 1973) theory of human belief systems, relevant elements from Kates' (1971) model, and theoretical concepts from the psychological literature. A number of hypotheses based on this framework will be introduced as the

discussion proceeds and will be more formally and precisely stated in a concluding summary statement.

Rokeach's Theory of Human Belief Systems

Rokeach (1973) has proposed that a person's total belief system is organized along a ten-level, central-peripheral continuum; the more central the belief, the greater the influence on the formation and maintenance of more peripheral beliefs. For instance, cognitions concerning the self, those beliefs that collectively define a person's self-concept, are most centrally located, whereas beliefs concerning nonsocial objects are most peripheral.

Several elements from his systems are particularly germane to this study: the functional relationships between self-cognitions, values, and attitudes; the definitions of attitudes and values; and the tripartite character of all beliefs.

The most fundamental set of beliefs in Rokeach's system consists of cognitions about self, which perform the function of person constancy. That is, they allow persons to maintain fixed, secure images of themselves and others as well. A limited number of studies have linked cognitions about self to ecologically related beliefs and behaviours. Borden (1985: cited in Gray, 1985) found that compared to less environmentally concerned individuals, environmentally concerned individuals rate significantly higher on measures of

poise, self-assurance, socialization, maturity, responsibility, and intelligence. And Sims and Baumann (1972; 1974) found some evidence that locus of control may play a role in determining the nature of the response to the tornado hazard. In the United States, Midwesterners, who tended to believe that they had control over their own lives (internals), tended to adopt active types of coping behaviours, whereas their Southern counterparts, who tended to believe that their lives were controlled by external forces (externals), reacted more passively and fatalistically.

Gray (1985: 126) suggests that the study of self-cognitions ought to include explorations of "how environmental problems are perceived to impinge upon us personally." This suggestion has, of course, already been taken up by many hazards researchers who have given considerable attention to the question of risk perception and how it influences responses to environmental hazards.

In Rokeach's system, values are functionally dependent upon self-cognitions. In his view, a "value is an enduring belief that a specific mode of conduct [instrumental value] or end-state of existence [terminal value] is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence" (Rokeach, 1973: 5). By "end-state of existence" Rokeach means any ultimate goal or end that a person judges to be of value, e.g. peace of mind, freedom, or equality. Individual values are embedded within a value

system, which is an enduring organization of individual values arrayed along a continuum of relative importance.

On the face of it, none of Rokeach's values (see Table 2.1) appears to be particularly relevant to environmental issues, although "a world of beauty" (i.e. in nature and art) comes very close. Nevertheless, several studies indicate that Rokeach's value system is indeed relevant to the study of ecological issues. Pierce (1979), for example, found two values, i.e. the value of natural beauty (a world of beauty) and the value of a comfortable life, to be significantly related to support for water conservation. In a study of the possible relationship between values and several issues related to energy conservation, Rankin (1983) found a significant difference between the value rankings of environmentalists, on the one hand, and samples from the general public and the "nuclear neighbours" of a nuclear power plant, on the other. Compared to the latter two groups, the environmentalists placed greater importance on a world at peace, a world of beauty, equality, and national security. An investigation of the relationship between values and recycling behaviour undertaken by Dunlap *et al.* (1983) found that, compared to a sample drawn from the general public, recyclers tended to place greater importance on higher-order values such as aesthetics and self-actualization

TABLE 2.1
ROKEACH'S VALUE SYSTEM

Instrumental Values	Terminal Values
Ambitious	A comfortable life
Broadminded	An exciting life
Capable	A sense of accomplishment
Cheerful	A world of peace
Clean	A world of beauty
Forgiving	Family security
Helpful	Freedom
Honest	Happiness
Imaginative	Inner harmony
Independent	Mature love
Intellectual	National security
Logical	Pleasure
Loving	Salvation
Obedient	Self-respect
Polite	True friendship
Responsible	Wisdom
Self controlled	

Source: Rokeach, 1973

and less importance on lower-order values such as safety and security.[5]

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[5]The influence of Maslow (1970; 1971) is evident here. He theorized that human behaviour is motivated by certain needs or values (he used the terms interchangeably), ranging from lower-order needs, such as physiological and security requirements, to higher-order needs, such as self-esteem and self-actualization. According to Maslow, a person will not be motivated by the higher-order needs (or values) until the lower-order needs are met. Therefore, as Albrecht (1975; 578)

(continued...)

Since it is generally held that attitudes include an evaluative component, the terms "value" and "attitude" are frequently used interchangeably, but in Rokeach's system they are conceptually distinct. He defines an attitude as "a relatively enduring *organization* of beliefs around an *object* or *situation* predisposing one to respond in some preferential manner" (Rokeach, 1968; 112; emphasis added). An attitude object may be concrete or abstract: a person, a group, an institution, a process, an issue. Two or more attitudes organized around a related set of objects or situations form an attitude system. In Rokeach's view, attitudes are less centrally located than values within a person's belief system and therefore are functionally dependent upon them.

Rokeach also argues that attitudes serve an instrumental function stemming from the fact that people tend to develop favourable predispositions towards the objects in their world that are associated with the satisfaction of needs and desires and unfavourable predispositions towards objects that hinder their satisfaction (see also Katz, 1967). Attitudes, therefore, serve as intervening variables between needs (or desires) and the attainment of desired goals or the avoidance of undesirable consequences. Accordingly, one would expect to find a very close relationship between certain attitudes and

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[5](...continued)
suggests: "It may be that only when economic needs are met can one develop an enduring concern for the quality of the environment."

self-interest. For instance, people are inclined to be positively disposed towards objects that tend to promote their economic welfare.[6]

All beliefs are conceived as having three components: an affective, a behavioral, and a cognitive dimension. In this respect, Rokeach's definition of attitudes conforms to the traditional understanding of an attitude as a tripartite construct, sometimes known as the ABCs of attitudes (Myers, 2987). The *affective* (or feeling) component can be aroused under appropriate conditions. The *behavioral* component represents a person's intent or predisposition to respond in a particular way when the belief is evoked. The *cognitive* component represents a person's belief concerning what is true or false, good or bad, desirable or undesirable.

Rokeach's theoretical approach to attitudes and values has important implications for this study. As Rokeach defines the terms, this investigation is concerned principally with the examination of attitudes and attitude systems. Yet if Rokeach is correct in arguing that attitudes are functionally dependent upon values, attempts to generate long-term changes

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[6]Attitudes can also serve a number of other motivational functions -- ie. ego-defensive, value-expressive and knowledge -- which may well be pertinent to the topic at hand, but it is very difficult operationally to assess the importance of the ego-defensive and knowledge functions to attitude formation, particularly in questionnaire-based research. The motivational basis of the instrumental function can often be reasonably inferred from objective conditions, whilst the value-expressive function may be inferred by examining the relationship between a person's values and attitudes.

in environmentally related attitudes may be frustrated if basic underlying value systems remain unchanged.

The whole point of attempting to induce attitude change is based on the premise that attitudes influence behaviour in some way. Rokeach (1968) notes -- and he is not the first to do so -- that social scientists have been plagued by the failure of many studies to show a strong and consistent relationship between attitudes and those behaviours that one might expect to be associated with them. This problem, he avers, is based in part on the tendency to isolate attitude-toward-object from attitude-toward-situation. Attempts to predict behaviour are frequently based on the former He argues that, since attitudes towards a given object are always activated within a particular context, behaviour should be conceived as a weighted linear function of both attitude-toward-object and attitude-toward-situation. Rokeach maintains that behaviours are *always* causally linked to attitudes, but that different situations frequently evoke different attitudes.

Empirical support for Rokeach's two-attitude theory of behaviour has been provided by a study of class cutting behaviour, which yielded attitude-behaviour correlation coefficients ranging from -.38 to -.78 (Rokeach and Kliejunas, 1972). These results are impressive indeed, when one realizes that correlations based on attitude-toward-object tend to be in the neighbourhood of .20 (Wicker, 1969).

Although Rokeach's two-attitude theory represents a positive step in the resolution of the troubling attitude-behaviour discrepancy problem, given the significance of the issue it would be useful to examine the question of attitude-behaviour relationships in greater detail.

The hypothesized causal relationship between attitudes and behaviour is problematic for several reasons. For positivistically minded behaviourists, attitudes are an inappropriate subject for scientific inquiry simply because they are not amenable to *direct* measurement or observation, (see, e.g. Skinner, 1953). Another group of researchers (which includes the present writer) believes that the reality of attitudes can be reasonably inferred from verbal or nonverbal behaviour, and that attitudes can be measured indirectly (though, perhaps, somewhat crudely) through an analysis of oral or written statements. However, this group is divided on several issues.

First, there is some evidence that suggests there may be no consistent relationship between attitudes and behaviours. Second, although many theorists and researchers are convinced that a causal relationship does exist between the two variables, there is some question as to the direction in which causality flows. Finally, since attitudes so frequently reflect individual or corporate self-interest, which is clearly linked to behaviour, it could be argued that the study of attitudes is at best superfluous and at worst of no

practical value. Each of these issues will be examined briefly below.

To repeat a point made earlier, the study of attitudes is generally predicated on the assumption that they, in some sense, cause behaviour. Yet it is widely acknowledged that behaviour is a product of a variety of other variables as well. On that account alone, one would not expect correlations between attitudes and behaviour to be exceptionally strong. However, a number of studies have uncovered what appear to be rather *dramatic* instances of attitude-behaviour discrepancy.

Perhaps the most striking case is the classic study conducted by LaPiere (1934). He noted that, whilst 92 percent of the 250 proprietors of motels, hotels, and restaurants that he surveyed indicated they would not accept Chinese guests, only once was a young Chinese couple refused service in any of their establishments. Numerous cases of a similar nature may be found in Wicker's (1969) review of the literature. More recently, the issue was brought to the attention of geographers quite forcefully in Bunting and Guelke's (1979) critique of perceptual and behavioral geography. Perhaps less well-known, but equally troubling, was O'Riordan's (1971) examination of the issue. In both cases, the writers argued that there was little evidence to support a direct, one-to-one relationship between attitudes and behaviour.

However, in a major review of the literature, Ajzen and Fishbein (1977) concluded that failures to observe a significant relationship between (verbally expressed) attitudes and some measure of behaviour (observed or self-reported) could be attributed to one or both of the following factors: faulty research and questionnaire design; and the use of inappropriate criteria to test the hypothesized relationship between attitude and behaviour. For example, when the attitudes measured are rather general in nature but the behaviours measured are quite specific, attitude-behaviour correspondence tends to be quite low. Similar results obtain when the attitudes measured are of a very specific nature but the behaviours of a general character.

Ajzen and Fishbein (1977) argue that an appropriate measure of attitude-behaviour consistency would take into account the fact that both behaviours and attitudes can be defined in terms of four components: the action, the target at which the action is directed, the context in which the action takes place, and the time at which it occurs. They contend that attitude and behaviour measurements should incorporate each of these components, or failing this, that if attitude measurement is designed to elicit rather general and broadly defined attitudes, behaviour measurement should include a wide range of relevant behaviours. In their view, the degree of correlation between expressed attitudes and observed behaviour depends significantly on the correspondence in specificity

between attitude measurement and behaviour measurement. A similar view is incorporated in Rokeach's two-attitude theory of behaviour noted above. Several studies offer empirical support for this "specificity" hypothesis (Ajzen and Fishbein, 1980; see also Weigel and Veron, 1974).

Recent research, then, appears to provide rather convincing evidence of a reasonably consistent link between attitudes and behaviour, and this is usually taken as support for a causal link between the two. Nevertheless, there is a paucity of evidence supporting the widely held view that the causal link flows from attitudes to behaviour. After reviewing the few studies that attempt to examine the sequence of causation, Weigel (1985) draws two conclusions. First, attitudes have causal priority over behaviour, but attitudinal influence is diminished when predictive models systematically assess the effects of other causal variables, e.g. past behaviour, or subjective norms, on behaviour. Second, for at least some of the areas of human activity studied, past behaviour has been shown to influence the strength and direction of future attitudes.

Although the link between attitudes and behaviour appears to be reasonably well established, the association between behaviour and self-interest appears to be so strong that some theorists argue there is no practical value in distinguishing between attitudes (or values) and self-interest. This, of course, is the basically the position taken by Marx. For him,

attitudes and values are essentially epiphenomena of the economic base of a society and therefore tend to change only as material or economic conditions change. Reflecting on the conflict between Legitimists and Orleanists[7] after the French Revolution, Marx (1963: 47) commented: "What kept the two factions apart, therefore, was not any so-called principles, it was their material conditions of existence, two different kinds of property . . . ." Nevertheless, Marx did not deny that beliefs could, in fact, influence behaviour, for he went on to note:

> That at the same time old memories, personal enmities, fears and hopes, prejudices and illusions, sympathies and antipathies, convictions, articles of faith and principles bound them to one or the other royal house, who denies this (Ibid.)?

He did contend, however, that material conditions held a privileged position with respect to ideas; that is to say, material conditions (and hence self-interest) were far more determinative of behaviour and ideas than the latter were of behaviour or material conditions. Engels (1950: 125) puts it this way:

> . . . the final causes of all social changes and political revolutions are to be sought, not in men's brains, not in man's better insight into eternal truth and justice, but in changes in the modes of production and exchange. They are to be sought, not in the philosophy, but in the economics of each particular epoch.

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[7]Legitimists were supporters of the "legitimate" Bourbon dynasty that ruled France until 1792 and also during the Restoration (1814-30). Orleanists were supporters of the house of Orleans that came to power during the July Revolution of 1830.

Although public choice theorists differ with Marxists in many respects, they share the conviction that all decisions related to public policy are ultimately based on the self-interest of bureaucrats and politicians and not on their desire to advance the public good (Russell, 1979). If, therefore, one wishes to explain or predict the behaviour of bureaucrats, politicians and members of special interest groups, public choice theorists argue that one must merely determine what behaviours are in their individual self-interest (Ibid). This is, of course, often extremely difficult to do, but the principle itself is simple enough.

Yet there are several good reasons for treating attitudes and values on the one hand and self-interest on the other, separately (Pal, 1987). First, attitudes and values may not always coincide with self-interest. This is difficult to demonstrate, however, since self-interest can be so broadly defined. While it certainly includes financial gain, it may also encompass a variety of other goals, including prestige, power, the alleviation of guilt or shame, or the pleasurable feelings frequently associated with "altruistic" behaviour. Consequently it is impossible to find a behaviour that could not be explained in terms of self-interest of one variety or another. Nevertheless, a number of theorists suggest that the dominant view that all behaviour is ultimately motivated by self-interest seems far too cynical. They argue that truly altruistic behaviour, that is behaviour not motivated by self-

interest but by compassion or ethical principles, may also be characteristic of the human species (see, e.g. Batson, 1987; Mansbridge, 1990; Elster, 1990). In the animal rights debate, for example, there is no clear evidence of self-interest amongst animal rights activists in general. The same could be said of "pro-lifers" in the abortion debate. This is clearly not the case, however, with many leaders in these movements, who certainly may have an interest -- money, power, prestige -- in the survival of their organizations. Second, it is just as easy, and perhaps less threatening, to elicit a person's attitude towards a particular object, situation, or issue. And, finally, as Pal (1987: 196) suggests:

> . . . even when interests and ideas do coincide, the nature of policy discourse in public arenas . . . forces interlocutors to address the public interest, not self-interest. Public arguments about policy always take place on the higher plane of the public good. As a consequence, these arguments have a logic which needs to be understood in its own terms.

While one might quibble with Pal's contention that public policy debates are *always* conducted on this "higher plane," there is clearly a need to understand the logic of such debates.

Based on the evidence presented above, it seems reasonably clear that the connection between attitudes and behaviour is sufficiently strong that properly designed and carefully interpreted attitude research can be a useful guide to predicting and understanding human behaviour. Moreover, policymakers frequently are not primarily interested in

predicting behaviour but in gauging public opinion concerning a particular issue. Indeed, although there are a number of constraints placed on majority rule in a democratic society, there are both ethical and practical reasons for arguing that policy makers ought to consider the will of the people in their policy deliberations. In addition, policy makers may wish to determine the nature of the conflict between or amongst various pressure groups, who may in fact share the same interests, but differ in terms of how these interests should be met. To sum up, then, there appear to be sound reasons for believing that attitude research -- whether as a means of predicting behaviour, gauging public opinion, or illuminating conflict situations -- can make a valuable contribution to the development of effective public policy.

This study was designed primarily to gauge and understand public opinion and to illuminate the conflicts that surround predator control rather than to predict or explain behaviour. The latter was, however, a secondary aim, and provided that the cautions outlined above are observed, the data reported here should provide useful clues to that end.

This review of relevant elements from Rokeach's theory of human belief systems provides a basic theoretical skeleton for the study. Having established that general framework, the following discussion will focus on theoretical considerations of a more specific nature. The discussion begins with an

analysis of cultural paradigms and their relationship to the issues at hand.

Ecological Orientation

The term "ecological orientation" refers to the set of beliefs that collectively define a person's general orientation towards environmental issues. A person's ecological orientation may be described in terms of the degree to which s/he accepts (or rejects) the "New Environmental Paradigm" (NEP). The NEP and its relationship to Rokeach's system of beliefs form the central theme of the following discussion.

Since the publication of *The Structure of Scientific Revolutions*, Kuhn's (1962) use of the term "paradigm" has been widely appropriated as a convenient shorthand term to refer to the basic belief structures of major cultural groups or academic disciplines. However, some confusion surrounds Kuhn's use of the term. Masterman (1970) claims to have discerned twenty-one different senses of the term in the first edition of his work. In a postscript to the second edition, Kuhn (1970) argues that most of the confusion is due to "stylistic inconsistencies;" and that in the original work "paradigm" was used in only two different senses.

> On the one hand, it stands for the entire constellation of beliefs, values, techniques, and so on shared by members of a given community. On the other, it denotes one sort of element in that constellation, the concrete puzzle-solutions which, employed as models or examples, can replace

> explicit rules as a basis for the solution of the remaining puzzles of normal science (Kuhn, 1970: 175).

In a slightly modified form, the first of the two definitions given by Kuhn has been widely employed in socio-cultural contexts. For example, Rodman (1980: 75) defines a "cultural paradigm" (or "dominant social paradigm") as the "basic beliefs, values, political ideals and institutional practices of a cultural epoch." It is in this sense that the term "paradigm" has recently come to enjoy extensive currency in the environmental literature.

A number of writers (see, e.g. Pirages and Ehrlich, 1974; Milbrath, 1985; Drengson, 1980; Cotgrove, 1982) have argued that our present environmental problems stem from certain traditional attitudes characteristic of the dominant social paradigm (DSP) of western industrial societies. Those aspects of the DSP which are believed to be particularly germane to environmental issues include: a belief in the necessity of economic growth, an uncritical acceptance of science and technology, a utilitarian resource-oriented attitude towards nature, and a commitment to a laissez-faire economy and the sanctity of private property rights (Milbrath, 1985). According to Cotgrove (1982: 27) the DSP:

> is dominant not in the statistical sense of being held by most people, but in the sense that it is the paradigm held by dominant groups in [western] industrial societies; and in the sense that it serves to legitimate and justify the institutions and practices of a market economy . . . it is the taken-for-granted commonsensical view which usually

determines the outcome of debates on environmental issues.

It has been argued also that the traditional beliefs of the DSP are being challenged by a new point of view -- one that emphasizes the intrinsic value of nature, the use of environmentally benign technologies, limits to economic growth and industrial development, and cooperation with, rather than domination over, nature (see, e.g. Milbrath, 1985). This new outlook has been called the "New Environmental Paradigm" (NEP) (Dunlap and Van Liere, 1978).

There are, however, several difficulties associated with scholarly formulations of a Dominant Social Paradigm or a New Environmental Paradigm. First, it is not clear that there is a single dominant paradigm. There may, in fact, be several paradigms competing for dominance. For example, Routley (1983) argues that the expansionist perspective, evident in western industrial society as a whole, is consistent with at least three different economic systems: neoclassical, democratic-socialist, and state-socialist. But it could be argued that, if one is interested in understanding and predicting environmentally related behaviour, it is the emphasis on economic and industrial growth that is of primary importance and not the political structure under which such growth is promoted. So it may be possible to speak of a number of subparadigms subsumed under an umbrella of economic expansionism. Moreover, if "dominance" is defined in terms of ideological hegemony, as it is by Cotgrove (1982), then it may

be possible to make out a case for a *single* dominant social paradigm in North America, where the "free" market system has been able to operate in a *relatively* unrestrained fashion, usually with considerable support from government. Ultimately, however, these are questions that can only be resolved through empirical investigation.

But the issue of content is more complex when it comes to defining an alternative environmental paradigm. It may well be that in North America a number of such paradigms are challenging the DSP with equal vigour. This would present no major difficulty to the researcher if it could be shown (or reasonably assumed) that these competing paradigms share a subset of environmentally relevant beliefs, and that the beliefs unique to each paradigm are less relevant. Yet this, too, is a matter that can only be fully resolved by a combination of theoretical and empirical work involving a major expenditure of funds and research talent. A compromise involves an appeal to scholarly consensus. If one examines a number of formulations of a new (or alternative) environmental paradigm (see, e.g. Milbrath, 1985; Drengson, 1980; Cotgrove and Duff, 1980; O'Riordan, 1981), there appears to be considerable consensus on a number of elements: the importance of environmentally benign technologies; the basic right of other life forms to exist apart from usefulness to humankind; the need to control economic growth and industrial

development; and the sensitivity of natural ecosystems to human interference.

Since our beliefs about the environment are likely to encompass a variety of topics, issues, dimensions, or variables it is reasonable to assume that environmental attitudes will be complex and multidimensional (Gray, 1985). A cursory examination of several of the hypothetical formulations of an alternative paradigm (see, e.g. Drengson, 1980; Milbrath, 1985; O'Riordan, 1981) quickly reveals a number of conceptually distinct attitude domains: e.g. attitudes towards science and technology; attitudes towards economic and industrial growth; and attitudes towards human-nature interactions. Therefore, in terms of Rokeach's system, the NEP can best be described as an attitude system.

Operationalizing the NEP

Although there have been relatively few attempts to operationalize the NEP, there is some evidence that pro-NEP beliefs are related to other "pro-environmental" attitudes and environmental knowledge. There is also limited evidence that pro-NEP beliefs are associated with "pro-environmental" behaviours.

As part of an ongoing project designed to determine the extent to which the public accepts the content of the NEP, Dunlap and Van Liere (1978) developed an instrument to measure

the New Environmental Paradigm.[8] The scale was first tested in 1976 on two samples of Washington state residents. One sample was drawn from the general population, the other from the mailing list of a state-wide environmental organization. While both samples exhibited a pro-NEP response, the environmentalists, as expected, endorsed the NEP more strongly than the general public. Scores on the NEP scale also correlated significantly with (self-reported) behaviours designed to enhance environmental quality.

Similar studies employing Dunlap and Van Liere's scale have been conducted by other researchers. Albrecht *et al.* (1982) employed the scale to assess the environmental orientation of two populations in Iowa. One sample was drawn from a group of farm operators, the other from eight metropolitan areas in the state. As anticipated, the farmers scored lower on the scale than the city residents. This is consistent with previous research indicating farmers to be less environmentally aware and concerned than nonfarm populations (Van Liere and Dunlap, 1980). Comparable results were reported in a study comparing the environmental beliefs of commercial fishermen on the southern coast of British

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[8]Although Dunlap and Van Liere based their construction of a scale on a careful review of the environmental literature and consultation with other scholars, and while they claim that their NEP scale incorporates all of the important aspects of the NEP, surprisingly, their scale makes no reference to technology. This would appear to be a serious omission. Yet one could argue that attitudes towards technology are implicit in many of the other beliefs tapped in the NEP scale and that explicit references to the topic are therefore unnecessary.

Columbia with those of members of the environmental group Greenpeace and the general public (Edgell and Nowell, 1989). In this case, there was, as expected, a significant difference in the scores. Greenpeace members scored higher than the general public, who in turn scored higher than the commercial fishermen. But this is apparently the first published study in which a group (the fishermen) actually rejected the NEP.

A significant association between support for the NEP and knowledge of environmental issues has also been reported. In a study of Kentucky residents, Arcury, Johnson and Scollay (1986) found that scores on the NEP scale were significantly related to a measure of environmental knowledge (dealing largely with water pollution and water conservation), independent of other socioeconomic variables including age, sex, education, income, and community size.

Dunlap and Van Liere (1984) have also developed a Dominant Social Paradigm Scale (DSP) and have used it in a study designed to test the relationship between commitment to the DSP and expressed concern for environmental protection. As predicted, the study indicated that support for the dominant social paradigm was positively related to lower levels of concern for environmental protection.

A Canadian geographer, Jackson (1986) has developed an NEP-DSP scale[9] based on Dunlap and Van Liere's DSP and NEP

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[9]Note that this is not Jackson's terminology. It is used here as a convenient means of distinguishing it from the NEP scale developed by Dunlap and Van Liere.

scales and additional items drawn from the resources and environmental literatures. The scale was employed in a study designed to test two hypotheses:

> 1.) People who prefer appreciative outdoor recreational activities hold significantly more pro-environmental attitudes than those who prefer mechanized or consumptive activities.
>
> 2. There will be a stronger association between outdoor recreation participation and attitudes towards specific aspects of the environment necessary for pursuing such activities than between outdoor recreation participation and attitudes to more "distant" and general aspects of environmental issues.

Both hypotheses were confirmed.

The NEP-DSP scale was also used in a study conducted by Kuhn and Jackson (1989) designed to measure the association between general environmental attitudes and support for various energy supply options. Supporters of the DSP tended to voice stronger support for nonrenewable forms of energy, such as fossil fuels and nuclear energy but less support for renewable forms, such as solar, wind and hydroelectricity than did supporters of the NEP. Similarly, pro-NEP respondents placed significantly greater importance on energy conservation than their pro-DSP counterparts.

Two hypotheses specifically related to this investigation are suggested by the preceding discussion. First, there will be a positive correlation between attitudes towards wolves and

pro-NEP sentiment.[10] The stronger the support for the NEP the more positive will be the attitudes exhibited towards wolves. Second, support for the NEP amongst the three groups sampled in this study will be hierarchically arranged: pro-NEP sentiment will be highest in the NWWPS and lowest in the ranching community.

The second hypothesis is based on a number of considerations. First, one would predict support for the NEP to be greatest in the wildlife preservation group simply because there is likely to be a very strong correlation between the NEP and preservationist ideals, ideals that presumably motivated individuals to join the organization and that are less likely to be exhibited by members of the other two groups. Second, several empirical studies have shown that levels of environmental awareness and environmental concern are related to place of residence.[11] Tremblay and Dunlap (1978) and Van Liere and Dunlap (1980) have found that, while there are some exceptions, urbanites tend to be more environmentally aware and concerned than their rural

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[10]For reasons set out in Chapter 3, the NEP scale developed by Dunlap and Van Liere was used in this investigation of livestock predation.

[11]In this context, the term "environmental awareness" refers not to general awareness of the external environment but primarily to the awareness of environmental pollution and degradation. And the term "environmental concern" refers to concern about these matters.

counterparts.[12] Moreover, two studies conducted by Buttel and Flinn (1974; 1978) indicate that "residence" becomes an even more important factor when defined in terms of farmers and nonfarmers: farmers tend to exhibit lower levels of environmental awareness and concern than nonfarmers.

Two basic explanations have been offered to explain this rural-urban split in environmental awareness and concern.[13] First, some researchers (e.g. Manis, 1976) argue that concern for environmental problems is directly related to levels of environmental pollution. Therefore, rural residents are less likely to be concerned about such problems, they suggest, because the severity of many pollution problems is directly related to population densities. For instance, in the United States, the National Center for Air Pollution Control (1968: 28) reported that "air pollution is strongly correlated with population [size]." Similar findings are reported by Van Tassel (1973). Water pollution and noise pollution also tend to be higher in urban locations (Elgin *et al.*, 1974). There is evidence that public awareness of pollution tends to be correlated with the severity of such problems. For example, DeGroot (1967: 680) noted that the "rank-correlation between

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[12]Saying that rural residents are less environmentally aware and concerned should not be construed to mean that they are less "sensitive" or less mature ethically than their urban counterparts.

[13]The following discussion relating environmental concern to place of residence draws heavily on Tremblay and Dunlap (1978)

the frequency with which respondents perceived neighbourhood air pollution as a problem, and the . . . measured level of suspended particulates in that neighbourhood was . . . 0.80." In a similar study a correlation of 0.85 was observed. Consequently, DeGroot (1967: 680) concludes that the major "determinant [of pollution awareness and concern] is the actual level of pollution prevalent in the area of residence."[14]

Although a measure of pro-NEP sentiment is not a direct measure of environmental concern, one would expect the two to be significantly correlated because the impact of pollution on their health, livelihoods, and lifestyles may lead urbanites to question the appropriateness of traditional (DSP) beliefs concerning human-nature interactions.

Attitudes towards nature may be affected by objective conditions in a another way. Someone has said that what one thinks of the environment depends very much on the environment in which one does one's thinking.[15] As Dubos (1980: 13) observes:

> Appreciation of the wilderness began not among country folk *who had to make a living in it*, but among city dwellers who eventually came to realize that human life had been impoverished by its *divorce from nature* (emphasis added).

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[14]Although the research reported here relating environmental concern to objective conditions was conducted in the United States or Europe, it is reasonable to assume that similar results would obtain in Canadian studies.

[15]The source for this idea is not known to the author.

Similar observations have been made by Nash (1982), Thomas (1983) and Huxley (1929). Huxley's comments are particularly appropriate here:

> To us who live beneath a temperate sky and in the age of Henry Ford, the worship of Nature comes naturally. It is easy to love a feeble already conquered enemy. . . . There are . . . wild woods and mountains, marshes and heath, even in England. But they are there only on sufferance, because we have chosen, out of our good pleasure to leave them their freedom. [In the real wilderness] rivers imply wading, swimming, alligators, plains mean swamps, forest, fevers (cited in Dubos, 1980: 17).

For the typical city dweller in the western industrial world, external nature is essentially tame, obedient, and submissive. Tornadoes, floods, and hurricanes may occasionally bring disaster; but for the most part, nonhuman nature presents comparatively few challenges. In contrast, rural residents, particularly farmers, must meet the challenges of nature every day, challenges that often pose serious economic threats.

Recall that Katz (1967) argues that people develop positive attitudes towards those objects in their environments that promote the attainment of personal goals and negative attitudes towards objects that thwart them. One would, therefore, predict that farmers would tend to view processes or products which, in their view, enhance their economic well-being (e.g artificial fertilizers, pesticides, herbicides) in a positive light. Yet individuals who have no immediate economic interest in such processes or products, but who may feel that they pose a risk to health or the environment, may take a more negative view. Similarly, farmers may exhibit

less positive attitudes towards phenomena that thwart their economic objectives (e.g. weeds, pests, predators) than people who are not directly affected by such phenomena.

There is some empirical support for this. Kronus and van Es (1976) observed that Illinois farmers who depended on fertilizers that posed a threat to water supplies were much less concerned about local pollution problems than neighbouring urbanites. In a similar study, Salcedo *et al.* (1971) found that Illinois farmers who relied on environmentally harmful pesticides exhibited more positive attitudes towards the pesticide industry than nearby urban dwellers. Kellert (1985) found that sheep and cattle producers consistently expressed more negative attitudes towards coyotes and wolves than did nonlivestock producers. He also noted that trappers considered several wildlife species -- hawks, bobcats, white-tailed deer, grizzly bears, pronghorn antelopes, raccoons, and coyotes -- to be of greater ecological value than did livestock producers. Similar findings were reported by Buys (1975) in his study of sheep and cattle producers in New Mexico.

Apparently the requirements of nature-exploitive occupations foster (and/or reinforce existing) utilitarian attitudes towards nature by promoting activities designed to bring nature under human control. Therefore, one would expect such attitudes to be more strongly exhibited in rural areas than in urban regions, simply because urban-based occupations

tend to be less directly dependent upon the exploitation of nature.[16] Indeed, Harry (1971) has found a significant relationship between "nature-exploitive" occupations and such attitudes.

Management Adjustment Decision Model

Several elements from the "Management Adjustment Decision Model," a sub-model in Kates' (1971) general systems model of natural hazards, may be usefully incorporated within the general conceptual framework outlined above. The details of this sub-model are presently schematically in Figure 2.1. Three elements in the model -- hazard perception, adjustment search, and adjustment evaluation -- are particularly relevant to this investigation; and each will be discussed in turn below.

Hazard Perception

"Hazard perception" is a term used by many geographers and some psychologists to refer to an individual's assessment of the relative danger or risk that s/he faces by residing in a particular locality or by engaging in a specific activity

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[16]In many cases urban occupations -- e.g. in the service sector -- are highly dependent upon resource-based industries, but individuals holding such occupations may not fully appreciate the extent of this dependency.

(O'Riordan, 1986).[17] The predator hazard may be described in terms of the threat faced by individual ranchers or by the cattle industry as a whole. From the rancher's point of view, the predator threat may also be classified in terms of the threat predators pose to his/her personal livestock operation.

Considerable emphasis has been placed on risk perception in hazards research. This emphasis is wholly consistent with Rokeach's theory of human beliefs, which assigns the greatest importance to beliefs concerning the self. And as Gray (1985) indicates, such beliefs include evaluations of the risk posed to the individual by elements in the external environment. Consequently, one would expect hazard perception (when it relates to personal risk) to be highly determinative of behaviour and other beliefs as well.

Much of the research concerning risk perception has been motivated by a desire to understand why public perceptions of risk are often faulty, or at least appear to be so, and why expert and lay assessments of hazard risk are frequently at odds (Slovic *et al.*, 1979). It is commonplace to find

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[17]In this study, "hazard perception" and "risk perception" are used interchangeably. This is consistent with the definition of hazard as *risk*. The use of the term "perception" departs from traditional usage in the field of psychology, where the term technically refers to sensory phenomena associated with sight, sound, touch, smell and taste (Otway, 1980). Risks, as such, are not perceived with the physical senses. Hazard (or risk) perception, therefore, refers to an assessment of risk based on information derived from a variety of secondary sources, e.g. news media, friends, government officials, as well as direct experience with the nonhuman causal agents implicated in hazards.

"experts" and lay people disagreeing about the risks posed by large public projects, a nuclear power plant, for example, or to find experts disagreeing amongst themselves. In many cases, there is sufficient base-line information available to determine the risk posed by automobile accidents, heart disease, or cancer, for example. In other instances, too little is known about the frequency of hazardous events to determine, with a high degree of accuracy, the risks associated with those events.

This is particularly true of livestock predation in British Columbia. This is unfortunate, because predator control policies are now being challenged by various groups and individuals, often on the grounds that the predator "problem" is not at all serious. Even if objective base-line data were available, there is reason to believe that disagreements would continue to some degree, simply because of the psychological dynamics associated with the perception of risk.

One of the important insights to emerge from the study of human cognitive processes in recent years is the realization that human decisions, judgments, and evaluations are guided by principles of cognitive economy (van der Pligt and Eiser, 1984). Faced with a limited ability to gather, assimilate, and analyze data, the decision maker must take decisions and form judgments on the basis of limited information and according to simple decision rules Frequently, such judgments involve

estimating the probability that certain events will occur in the future or drawing inferences (making generalizations, forming attitudes) based on sample data. Generally, however, these judgments are based not on probability theory and base-line data but on intuitive heuristics applied to small data sets. While such heuristics may sometimes provide an accurate assessment of the probability that a particular event will occur, they frequently yield biased estimates.

Slovic *et al.* (1974; 1979) argue that risk perception is often influenced by unconsciously employed judgmental rules or heuristics, which may systematically distort the perception process. Two of these heuristics -- the "judgment of probability by availability" and the "law of small numbers" -- are particularly germane to this study.

The Judgment of Probability by Availability

Kates (1962) contends that much of the variation in human behaviours related to natural hazards can be attributed to what he calls the "prison of experience." Commenting on perceptions of the flood hazard, he writes:

> A major limitation to human ability to use improved flood hazard information is the basic reliance on experience. Men on flood plains appear to be very much prisoners of their experience . . . . Recently experienced floods appear to set an upper limit to the size of loss with which managers believe they ought to be concerned (p. 140).

He also observes that when people attempt to predict future flooding problems they "are strongly conditioned by their

immediate past and limit their extrapolation to simplified constructs, seeing the future as a mirror of the past" (p. 88). For example, Steinbrugge *et al.* (1969) note that the purchase of earthquake insurance increases dramatically after a quake but declines steadily as memories of the event fade.

The tendency of human beings to view the immediate past as a guide to the future is an example of what has been termed the "availability" heuristic (Tversky and Kahneman, 1973; Slovic *et al.*, 1974). People employ this judgmental device to estimate the probability of a future event on the basis of the number of similar cases that can be called to mind (memorability) or the ease with which pertinent examples are imagined (imaginability). Everyday experience teaches that events that occur frequently tend to be more easily recalled. So when availability is based on the frequency of events, it may provide a valuable clue for assessing probabilities. However, the memorability and imaginability of information can be influenced by several factors unrelated to frequency, which can lead to predictable systematic biases in judgment (Slovic *et al.* 1974). Most of these factors contribute in some way to the vividness of the information, which in turn contributes to its memorability and imaginability. Nisbett and Ross (1980) state that information is vivid to the degree that it is emotionally salient, concrete, and proximate in a sensory, temporal, or spatial way.

Emotional Salience[18]

An event may have emotional salience for at least two reasons (Nisbett and Ross, 1980). First, events that happen to us (see, e.g. Bellaza, 1984; Brown *et al.*, 1986), someone we know, someone emotionally close to us, or something we care about are likely to be more easily imagined or recalled than events affecting strangers or objects for which we have no feelings. Second, the extent to which the event affects the participants' needs, desires, motives, and values -- what Nisbett and Ross (1980) call the *hedonic* relevance of the event -- can influence its emotional salience as well.

Concreteness

Concrete information not only influences availability directly but also indirectly, by intensifying the emotional impact of an event. For example, a report that "A wolf killed a cow and its calf and injured a horse" will have considerably less impact than a report that "A wolf viciously attacked one of Bill's cows tearing open its udder, disembowelling both her and her calf, and ripping a flap of skin from the rump of his favourite horse."

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[18]The hypothesized impact of saliency on judgmental processes is not new, however. In 1927 Bertrand Russell contended that "popular induction depends upon the emotional interest of the instances, not upon their number" (Russell, 1927; 269).

Temporal, Spatial, and Sensory Proximity

A rancher living in the Peace River area, for example, will find the report that "A bear killed the neighbour's prize heifer (spatial proximity) during the night (temporal proximity)" far more vivid that a report that "A rancher in Kootenays lost 12 turkeys to wolves two years ago." Consequently the first report is likely to have a greater impact than the second on that rancher's views of the overall seriousness of the predator problem. Moreover, a firsthand (sensory proximity) account of the above incident, provided by the rancher who lost the heifer, would be believable and hence more vivid than a secondhand or thirdhand recounting of the event.

Slovic *et al.* (1979) report the results of several studies that illustrate the use of the availability heuristic and, in particular, the importance of informational vividness. For example, in one study members of the League of Women Voters were first told the annual death toll for automobile accidents in the United States (50,000) and then requested to estimate the frequency of forty other causes of death. In a related investigation, subjects were given two causes of death and asked to indicate which of the two occurs more frequently. In both studies, people's estimates tended to be accurate in a general sense. On the whole, people knew which of the lethal events occurred most and least frequently. But while estimates were broadly accurate, individuals often gave

strikingly inaccurate estimates that appeared to reflect availability bias. For instance, motor vehicle accidents and several diseases were judged to cause an equal number of deaths, when, in fact, the diseases claim fifteen times as many lives. Homicides were judged to be more frequent than either stomach cancer or diabetes, although these diseases actually take more lives. In addition, homicides were judged incorrectly to be nearly as frequent as stroke; in fact, the latter takes approximately eleven times as many lives. Consistent with the availability hypothesis, the frequency of items that are dramatic or sensational in character and hence more likely to stir the emotions tended to be overestimated; whereas the frequency of items of an unspectacular nature tended to be underestimated.[19]

Commenting on the implications of the availability hypothesis for hazards research, Slovic *et al.* (1974; 195) suggest that "any factor which makes a hazard highly memorable or imaginable, such as a recent disaster or a vivid film or lecture, could considerably increase the perceived risk of that hazard."

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[19]Dramatic, emotionally salient events are also more likely to get coverage in the media, and this will heighten the impression that such events are more frequent than less dramatic events.

The Law of Small Numbers

Hazard perception may also be influenced by another heuristic known as "the law of small numbers." In a series of studies of subjective probability, Tversky and Kanneman (1971) discovered that, despite their formal training in statistics, professional psychologists generally relied upon intuition when making a decision concerning the size of a sample or determining whether they should repeat an experiment to confirm the reliability of their results. After an extensive investigation of decision-making strategies employed by a number of psychologists, Tversky and Kahneman reached several interesting conclusions:

1. These scientists had a poor understanding of the degree of error and the unreliability associated with small samples of data.

2. The typical psychologist wagers his/her research hypotheses on small samples, without realizing that the odds against obtaining accurate results are very high.

3. Psychologists tended to have unfounded confidence in early trends from the first few data points and in the stability of observed patterns of data.

4. These professionals had unrealistic expectations concerning the replicability of statistically significant results and rarely attributed the failure of the data to support research hypotheses to sampling variability; rather deviations from expectations were given a causal explanation.

On the basis of these findings, Tversky and Kahneman argue that people's intuitions appear to conform to a "law of

small numbers," which means that small samples are taken to be highly representative of the entire population. A subsequent investigation, this time involving undergraduates, provided additional support for their initial conclusions. They found that many of the students did not appreciate the fundamental principle of sampling: namely, that sampling error decreases as the sample size increases (Kahneman and Tversky, 1972).

Nisbett and Ross (1980) emphasize that this insensitivity to sample size is exhibited not only by less educated, less intelligent individuals but is typical of highly educated, highly intelligent people as well. Hamill *et al.* (1980) point out that this insensitivity persists even when individuals are aware that the sample is biased. Moreover, the use of the law of small numbers is not dependent upon the memorability or imaginability of the data: it operates even when the data are pallid. However, when the data are vivid or emotionally salient, the potential for misjudgment increases significantly (Hamill *et al.*, 1980).

Implications of Judgmental Heuristics

Although many urbanites will be able to imagine, to some degree, the graphic details of a predator attack, very few will have seen a picture or an actual case of an animal injured or killed by a predator, read explicit accounts of the disembowelling of a newborn calf or a pregnant cow, or heard *firsthand* accounts of a predator kill. Moreover, the

information on which urbanites base their judgments frequently paints a rather benign portrait of predators, particularly the wolf; witness the wide influence and popularity of Farley Mowat's (1963) *Never Cry Wolf*. Newspaper accounts of livestock predation, for example, frequently include comments from biologists or conservation groups claiming that the problem is not as serious as it may appear, and that wolves are really quite timid creatures bound together in very complex social groups. Indeed, the frequent use of the term "family" to describe these social groupings undoubtedly promotes personal identification with the wolf.

Many ranchers, however, will have heard their friends and neighbours recount the gruesome details of predator attacks or will themselves have been witness to them. Even when ranchers have not actually lost cattle to predators, the fact that they themselves own cattle will impart to the telling of predation incidents an emotional impact that could not possibly be felt by the average city dweller. Clearly, then, predation will be far more memorable and imaginable for the livestock producer. Therefore, one would expect that, compared to their urban counterparts, ranchers would tend to perceive predators to be a greater threat to the cattle industry.

Moreover, previous research indicates that hazard perception is closely related to personal experience with hazardous events (White, 1974; Burton, Kates, and White, 1978). Consequently, one would expect to find considerable

variation in ranchers' perceptions of the seriousness of the threat that predators pose to their own operations. Ranchers who have personally experienced livestock predation or who have neighbours who have done so will undoubtedly perceive the threat to their own operations to be higher than those who have not had similar experiences. Therefore, the rancher who perceives the risk of predator attack to be very high is likely to have based that perception on highly vivid, emotionally salient information. Accordingly, one would expect to find a positive correlation between ranchers' perceptions of the threat that predators pose to their own operations and their perceptions of the threat that predators pose to the cattle industry as a whole. Admittedly, some ranchers' assessments of the threat that predators pose to the industry will be based, to some degree, on past experience at other locations rather than experience at present locations. Nevertheless, since temporal proximity appears to have a significant impact on availability, and since farmers tend to be far less mobile than urban residents, assessments of the present personal threat are still very likely to be related to assessments of threat to the industry.

Beliefs About Wolves

Another factor may also influence perceptions of the predator threat, independently of the judgmental heuristics discussed above. Assessments of the predator threat are

undoubtedly closely linked to attitudes towards predators. However, for reasons set out in Chapter 1, the following discussion will be confined to attitudes towards wolves.

A fundamental tenet of cognitive consistency theory is that, while individuals often hold beliefs that are inconsistent, they will feel pressure to reduce these inconsistencies if they become aware of them (Oskamp, 1977).[20] Hence, when people are asked to form judgments that are clearly related to their existing beliefs, there will be considerable internal pressure to adopt judgments consistent with them. For example, nonranchers' judgments concerning the truth of statements about livestock predation will tend to be heavily influenced by other beliefs they hold about predators. People who believe wolves to be vicious and cruel, for instance, are more likely to consider them a significant threat to livestock producers than those who believe them to be timid and shy.

However, consistency theory would also suggest that general beliefs about wolves may be affected by beliefs about the threat they pose to livestock. For nonranchers and some ranchers, livestock predation by wolves will have few direct economic implications. So for them, judgments about the threat posed by wolves are more likely to be influenced by other beliefs about wolves, rather than the reverse. For many

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[20]Note that Rokeach's system is one example of cognitive consistency theory.

ranchers, however, wolf predation will have serious implications and hence be highly ego-involving. Therefore, their beliefs concerning the threat that wolves pose to their own cattle operations will strongly influence other beliefs about wolves. So for ranchers threatened by wolf depredation, the question becomes: Is there reason to believe that beliefs about wolves are significantly influenced by factors other than livestock predation, and that beliefs based on these factors will affect assessments of the predator threat?

It is difficult to believe that the intense vilification of the wolf and the passion with which it has been hunted and slaughtered derive simply from the fact that wolves kill livestock or compete with human predators for game. Certainly, other animals do these things -- and they are often killed for doing so. But, as Lopez (1978: 139) observes:

> the wolf is fundamentally different because the history of killing wolves shows far less restraint and far more perversity. A lot of people didn't just kill wolves; they tortured them. They set wolves on fire and tore their jaws out and cut their Achilles tendons and turned dogs loose on them. They poisoned them with strychnine, arsenic, and cyanide . . . . [T]hey . . . burned down their own property to get rid of wolf havens.

Lopez offers a very plausible explanation for this apparently irrational behaviour.

Although the hatred of wolves was certainly based, in part, on the fact that they killed livestock, the hatred went much deeper than this: it was rooted in religious beliefs --

"the wolf was the Devil in disguise"; and in feelings about wilderness, which have both religious and secular origins. Lopez contends that, because wolves scavenged on the human corpses on battlefields and were frequently seen "in the eerie twilight of dawn and dusk, they were feared not just as predators but as physical and metaphysical dangers" (p. 140, 145). Lopez presents compelling evidence of the strong links that have been drawn between the Devil, greed, sin, sexual lust, and the wolf in Christian tradition and literature. For example, in the *Divine Comedy*, Dante portrays a (female) wolf as a symbol of greed and covetousness:

> . . . for this beast . . . lets no man pass her way, but hinders them till she takes their life, and she has a nature so vicious and malignant that her greedy appetite is never satisfied and after food she is hungrier than before.[21]

Biblical references to the wolf are uniformly pejorative. The use of the wolf as a symbol of corrupt and deceitful religious and political leadership is a common biblical theme. For instance, the prophet Ezekiel referring to rampant social injustice in the city of Jerusalem says: "Her leaders . . . are like wolves tearing their prey, shedding blood and killing people to steal their possessions" (Ezek. 22:27).[22] The gospel of Matthew (7:15) speaks of false prophets who disguise themselves "as sheep but underneath are ravenous wolves."

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[21]*Inferno*, c. 1, 11. 94-99. Translation by John Sinclair. (1939; 27).

[22]Biblical quotations are from the *Jerusalem Bible*.

Similar words are attributed to St. Paul in the book of Acts (20:29-30):

> I know quite well that when I have gone fierce wolves will invade you and will have no mercy on the flock. Even from your own ranks there will be men coming forward with a travesty of the truth on their lips to induce the disciples to follow them.

These biblical images are drawn from the experiences of agricultural communities, for whom the wolf was a very real economic threat, but the association of the wolf with spiritual evil undoubtedly deepened and exaggerated a legitimate fear.

In colonial America spiritual darkness, the wolf, and the wilderness were intimately related (Lopez, 1978). Speaking of the North American pioneers, Roderick Nash (1982: xii) writes:

> Wilderness was the unknown, the disordered, the uncontrolled . . . [T]he European colonists reexperienced in America their old, insecure relationships to wilderness. There was too much wilderness for appreciation. The first white visitors regarded wilderness as a moral and physical wasteland fit only for conquest and fructification in the name of progress, civilization, and Christianity.

Nash argues that this distaste for wilderness stemmed from two sources: a secular (i.e. a non-religiously motivated) fear of dark uninhabited, inhospitable places; and a religious belief, based on the Bible, that wilderness was the haunt of demons and witches, a place without God, and that it was the duty of each person to assist the Creator in reclaiming the wilderness from the Enemy. To push back the wilderness meant, says

Lopez, that the wolf had to be eliminated. If the wolf survived, so did the wilderness.

> The wolf represented "a fierce, bloodsucking persecutor" (as Roger Williams called him) of everything that was high-born in man. Theodore Roosevelt, spoke gravely of wolf predation on his ranch in North Dakota, of the threat to progress represented by the wolf. He called him "the beast of waste and desolation" (Lopez, 1978: 142).

Anti-wolf sentiment was not confined to the agricultural community, however. The naturalist, William Hornaday (1904: 22), for example, termed wolves the most "despicable" of all animals on the North American continent:

> There is no depth of meanness, treachery, or cruelty to which they do not cheerfully descend. They are the only animals on earth which make a regular practice of killing and devouring their wounded companions, and eating their own dead.

Moreover, as the historian Dunlap (1988) notes, many wild carnivores, including the wolf, were disliked by people, many of them city dwellers who otherwise showed great appreciation for animals, because predators "'murdered' the 'innocent' deer and songbirds" (p. 15). This attitude is aptly described by Allen (1954: 148):

> To them a carnivorous animal is not wildlife; he is the enemy of all honest wildlife. The wolf doesn't live in the forests; he *infests* it . . . . You don't just kill a predator; you *execute* him. You don't hunt him for sport; you track him down in a crusade for moral reform.

Ironically, people in the humane movement had the most unbending attitudes towards predators. This was especially true of individuals who espoused vegetarianism on ethical

grounds; for them predation was a profound embarrassment (Dunlap, 1988).

It is clear that our society has inherited a powerful legacy of anti-wolf sentiment. And much of this sentiment can be attributed to factors other than livestock predation. It seems reasonable, therefore, to assume that this legacy will, to a greater or lesser degree, continue to influence our attitudes towards the wolf.

There is little doubt, however, that attitudes are changing not only in the general population but in the agricultural community as well (Dunlap, 1985). Certainly a good deal of this change can be attributed to scientific studies that emphasize the important role that predators play in controlling prey species in natural ecosystems and that promote an understanding of the complex social structures that characterize certain species like the wolf. As Dunlap (1985; 611) observes: "By the late 1930s, . . . scientific studies were presenting a vision of order in nature which struck a responsive chord in many people and provided a 'rational' justification for protecting nature." Yet, not surprisingly, the change in attitudes towards wolves is also intimately associated with changing conceptions of wilderness. For many people, wilderness has become a natural cathedral; a place of solace, romance, and beauty; a reservoir of intrinsic value; a storehouse of biotic diversity; or an irreplaceable spiritual resource -- quite the opposite of what it was to the

early pioneers (Nash, 1982; Thomas, 1983). For many the wolf now epitomizes the mystery and beauty of wilderness and all that remains unspoiled by human hands. To them the future of the wilderness is tied to the future of the wolf: no wolf; no wilderness. Numerous examples can be found.

For instance, a brochure recently published by the Sierra Club, entitled "The Wolf: Symbol of Wilderness," closely associates the need to preserve the wolf with the equally urgent need to preserve wilderness. The wolf is portrayed as a symbol of biological diversity, ecosystem integrity, and ecological health. Indeed, Susan Flader (1974), Aldo Leopold's biographer, has argued that this (i.e. the wolf as symbol) is what he had in mind when he wrote "Thinking Like a Mountain." She writes:

> Because the wolf stood at the apex of the [biotic] pyramid, it became Leopold's symbol of the pyramid itself, of land health. He did not elaborate on this symbolism in "Thinking Like a Mountain," but it is there. One who could listen objectively to the total life process of the ecosystem through time, not just as it might effect one's own immediate interests -- was thinking ecologically, like a mountain (p. 2).

The winter (1987-88) edition of "Northwest Wildlife Focus," a publication of the Northwest Wildlife Preservation Society, included an article written by Erich Klinghammer, director of Wolf Park Indiana, who stated that "the wolf is our symbol and ally in this struggle" to preserve the wilderness.

And "The Spirit" (Summer 1990), a newsletter produced by The Alaska Wildlife Alliance, advertised T-shirts and sweatshirts with a wolf and the words "THE WOLF SPIRIT OF WILD ALASKA" emblazoned on the front.

So the wolf remains a powerful symbol; but for many a symbol of beauty, mystery, and ecological health rather than a symbol of "waste and desolation." A new image of the wolf is emerging, nurtured by popular books such as Farley Mowat's (1963) *Never Cry Wolf*[23], R.D. Lawrence's (1986) *In Praise of Wolves*, and Barry Lopez's (1978) *Of Wolves and Men*, and scientific studies conducted by, for example, Adolph Murie (1944), David Mech (1970), and Douglas Pimlott (1967). Of course, there is much about the wolf that remains a mystery

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[23]Farley Mowat's book is widely viewed, and in some circles vilified, as a work of fiction. Several ranchers responding to the survey undertaken for this study, for example, complained that Mowat (and "people like him") must bear much of the blame for what they believe to be the highly romanticized and distorted images of the wolf purveyed by some wildlife preservationists.

Most wildlife biologists seem to share Mech's (1970) opinion that the book is largely a piece of fiction. For example, Pimlott (1966), who claims to have undertaken an extensive investigation to determine if the book is indeed nonfiction, as Mowat and his publisher claim, concludes that, while *Never Cry Wolf* may be loosely based on Mowat's limited experience with wolves during the time he worked for the Canadian Wildlife Service, it contains much that "is a blend of fancy, fantasy, and the published data of other workers, to whom no reference is made in the book" (p. 236).

A major problem with Mowat's book is his claim that wolves tend to feed largely on mice and other small rodents, a claim that has been discredited in numerous studies (see, e.g. Mech, 1970). Nevertheless, as Mech (1970) points out, *Never Cry Wolf* has served a useful purpose by offsetting the impact of traditional views of the wolf embodied in fairy tales such as "Little Red Riding Hood."

and much that is still controversial. But when the mystery and the controversy are set aside, what we garner from these accounts is a portrait of an animal who bears little resemblance to the fiend in "The Three Little Pigs" or "Little Red Riding Hood." Wolves are generally timid creatures, who must work hard for their food, generally kill only to obtain it, and tend to select the sick and the vulnerable. Their intraspecies relationships are governed by a complex social system; and they play an important ecological role in helping to control populations of prey species.

There appears to be little doubt, then, that attitudes towards wolves have been (and are) influenced by factors other than livestock predation. It is therefore reasonable to suppose that assessments of the threat that wolves pose both to individual cattle producers and to the industry as a whole will be influenced by other beliefs about wolves.

But what factors influence our views of the wolf? There are surely several at work, and an examination of all of them would be prohibitive. But three of them -- ecological orientation, self-interest, and a common cultural heritage will be examined here. The first, ecological orientation, is likely to be positively related to attitudes towards wolves. The reasons for this relationship are self-evident and need not be elaborated here. The two remaining factors, self-interest and a common cultural heritage, may well account for differences in attitudes towards wolves between ranchers and

nonranchers, independently of ecological orientation. Since ranchers are more likely to have had negative experiences with wolves, they will, according to the functional approach to attitudes, also tend to exhibit less positive attitudes towards them. While it is true that western society as a whole has historically been antagonistic to wolves, ranchers are heirs of a cultural heritage that has tended to be particularly and virulently anti-wolf. It is likely that vestiges of this heritage will continue to influence ranchers' attitudes towards wolves.

As for variations in attitudes towards wolves within the ranching community, ranchers' attitudes will likely be negatively related to their perceptions of the threat wolves pose to their own livestock operations and positively to ecological orientation.[24]

A few additional matters related to attitudes towards wolves will be taken up in the next section, where some of the cognitive factors related to the adoption of hazard adjustments will be discussed.

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[24]The relationship between attitudes towards wolves and assessments of personal threat will undoubtedly be a reciprocal one. Theoretically relationships of a reciprocal nature can be analyzed statistically provided certain criteria are met (Heise, 1975). But such an analysis would require access to additional variables not included in this study. Therefore, while the strength of the relationship between the two variables can be determined, the degree to which each variable influences the other cannot be assessed.

Adjustment Search and Evaluation

The Management Adjustment Decision Model assumes that resource managers initiate a search for possible responses or adjustments to a hazard when they perceive that the level of risk, termed the "hazard perception threshold," has reached a certain intensity.[25] In principle, the manager has the option to use any of a number of adjustments that have been employed elsewhere in similar situations, plus a possible innovation or two. White (1961) has termed this array of alternatives the "theoretical range of choice." However, managers rarely have access to the full theoretical range of choice. Some alternatives are unknown to them, and others may be precluded by a number of "social guides," including law, taboo, religious beliefs, dietary practices, tribal customs, or personal values. Of those alternatives known to the manager and not precluded by some constraint, some are quickly dismissed as unwise or unsuitable. The remaining alternatives White (1961) calls the "practical range of choice." Each of these alternatives is subjected to a more thorough assessment governed by four criteria (White, 1974):

1.) Will it significantly reduce the risk?

2.) Is it economically efficient?

3.) Is the required technical expertise available?

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[25]Apparently, no one has yet attempted to determine whether such a threshold exists (O'Riordan, 1986). However, its existence will be assumed.

4.) Will it affect resource use in contiguous or functionally related areas and, if so, in what ways?

Clearly this model does not conform to traditional (normative) theories of economic rationality that consider decision makers to be rational, completely informed, utility maximizers, capable of arriving at decisions on the basis of multi-attribute utility functions. White's model, on the other hand, is more indicative of the "cognitive miser" who employs relatively uncomplicated decision rules to simplify a very complex decision environment.

The decision maker in White's model is more likely to follow a lexicographic process, a noncompensatory mode of decision making[26] in which alternatives are ranked with respect to one attribute at a time (Stokey and Zeckhauser, 1978). Decision makers employing a lexicographic decision rule will first choose a set of decision criteria based on, for example, cost, efficiency, and impact on other resource uses. These criteria are then ranked according to their

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[26]Benefit-cost analysis, which attempts to assign a monetary value to each of the alternatives facing the decision maker(s), is an example of a commensurable decision making process. Theoretically, it permits decision makers to rank each of the alternatives on the basis of a wide range of attributes and allows them to trade-off, say, very high water quality for lower economic cost. Benefit-cost analysis is designed to apply the traditional model of economic rationality to a practical problem. Generally speaking, however, the analysis is usually confined to a relatively small number of alternatives and those attributes of an alternative that are difficult or impossible to define in monetary terms are frequently ignored or given secondary status in the decision process. So, in practice, benefit-cost analysis is not a truly commensurable form of decision making.

relative importance. If, and only if, two or more alternatives are judged to be equally satisfactory with respect to the most heavily weighted criterion, will the next most important criterion be considered germane to the ranking of preferences. The process continues until only one alternative remains. However, if more than one alternative remains after the set of criteria has been employed, decision makers may then be willing to make trade-offs. Apart from a strange twist of fate, decision processes of this sort are not likely to produce optimal results, but they do permit individuals to reduce what would otherwise be overwhelmingly complex decision problems to manageable dimensions.

The use of lexicographic processes has important implications for the study of resource and environmental issues. Because the order in which the criteria are ranked determines the final outcome, knowing something about the relative importance of various criteria will provide important clues to the types of decisions individuals or groups are likely to make. This may help to illuminate certain conflict situations. For example, protagonists in a dispute over the building of a nuclear power facility may hold similar views concerning the criteria to be used to determine whether the construction should proceed but will likely weight these criteria quite differently (van der Pligt and Eiser, 1984). This differential weighting of criteria will be reflected in different attitudes toward the project.

Several studies examining the issue of nuclear energy have shown that different aspects of the issue are judged to be important by different groups participating in the nuclear energy debate. For example, a factor analysis of 39 statements concerning nuclear power, conducted by Otway, Maurer, and Thomas (1978), revealed four underlying dimensions, which they designated as psychological risk, economic and technical benefits, sociopolitical risk, and environmental and physical risk. They found that for the 50 most pronuclear respondents the economical and technical benefits dimensions made the greatest contributions to their overall attitudes towards nuclear power. The attitudes of the 50 most antinuclear respondents, on the other hand, were more closely related to sociopolitical, environmental, and physical risk. Other studies involving attitudes towards nuclear energy conducted by Eiser and van der Pligt (1979) and van der Pligt *et al.* (1982) yielded similar results.

Van der Pligt and Eiser (1984) suggest that dimensional salience can be explained in terms of cognitive consistency theory. Accordingly, one would expect people to consider most salient those aspects of an issue which would be most likely to form a foundation for judgments consistent with their overall beliefs and values. For instance, individuals who are more concerned about the health of natural ecosystems than economic growth will likely place greater importance on the impact of a hydro-electric project on fisheries and wildlife

habitat than on its ability to meet future power needs. In fact, they may entirely reject the project solely on the basis of environmental considerations; unless the energy proposal meets certain minimal environmental criteria, no other aspects of the project will be seriously considered.

The possible link between White's model of decision making, dimensional saliency and cognitive consistency theory has important implications for the study of decision processes and hence the study of adjustments to the predator hazard. Several of these implications will be discussed in the following sections.

Individual Adjustments to the Predator Hazard

Several options for dealing with predator problems are theoretically available to ranchers, but unless they decide to act illegally, they will have to choose from those options sanctioned by law. In British Columbia a variety of legal options, for example, hunting, trapping, guard dogs, electric fences, and range riders are available.[27] Some of these alternatives, the use of electric fences and range riders for example, serve useful purposes other than that of predation prevention. The assessment of their suitability for predator control will likely be governed by several factors: e.g.

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[27]The options available to ranchers will be described in some detail in Chapter 5.

effectiveness, cost, humaneness, and perhaps lethality (i.e., does the procedure involve killing predators?).

Ranchers are likely to use nonlethal techniques only if they perceive them to be effective livestock management techniques, and some may use them for that reason alone. But it is also possible that their use is linked to other variables. Some ranchers may employ nonlethal techniques not merely because they are deemed effective but because they wish to minimize the use of lethal measures. Moreover, ranchers who believe it desirable to minimize human interference with natural processes will be more likely to employ nonlethal techniques. Therefore, one would expect the use of such techniques to be related both to the importance attached to nonlethality and to ecological orientation.

The Perception of Control

Before turning to an examination of institutional responses to the predator hazard, one additional variable that is possibly related to the rancher's choice of adjustments should be mentioned. This variable, termed here "perception of control," refers to ranchers' assessments of their ability to exercise control over livestock predation.[28]

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[28]The term "control" as used here should not be confused with "locus of control," which Rotter (1966) defines as the degree to which persons perceive that rewards of events follow from or are dependent upon their own behaviour or attributes as opposed to the degree to which they believe that these rewards or events are controlled by forces outside of

(continued...)

From time to time, rumours surface to the effect that ranchers are employing illegal practices to control predators (Hoffos, 1987). It is difficult to know how much of this is merely rhetoric and how much is factually based, bu it is, in any event, a cause for concern. If ranchers feel unable to control or prevent predation on their own; if they also believe that existing government policies prevent them from exercising such control; and if they believe that the government is not itself taking adequate steps to control the problem then it seems reasonable to suppose that some ranchers will feel greater pressure to employ unlawful control measures. Although ranchers' perceptions of their ability to control predation are likely related to other factors, one would nevertheless expect them to be significantly related to their beliefs about the impact of government policies on that ability. And if control also turns out to be significantly correlated with assessments of the effectiveness of government control policies, it would certainly be a matter for concern.

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[28](...continued)
themselves and may occur independently of their actions or control. As defined by Rotter, locus of control is a variable which, it is hypothesized, influences behaviour across a wide range of situations, although Rotter's scale focuses on control in social situations. While the perception of control, as it is used in this study, may be related to the locus of control, the measure of control employed here is situation specific.

Institutional Adjustments to the Predator Hazard

Theoretically, a wide variety of responses to the predator hazard is available to public officials in British Columbia: e.g. aerial shooting, ground shooting, trapping, poisoning, aversive conditioning, relocation, bounties, and denning. At the present time, the range of practical alternatives is limited considerably by existing policy (see Chapter 5 for a more detailed discussion). Nevertheless, it would be useful to assess public attitudes towards a range of possible policy alternatives, and to attempt to locate these attitudes within a much broader cognitive context.

For nonranchers, the overall acceptability of lethal wolf control techniques is likely to be positively related to assessments of the humaneness of various control options, negatively related to attitudes towards wolves, and positively related to assessments of the threat that wolves pose to some individual cattle owners and to the cattle industry as a whole. Humaneness, in turn, will be negatively related to attitudes towards wolves and ecological orientation. The reasons for the relationships postulated in the above hypotheses are self-evident and need not be elaborated here. For ranchers, the acceptability of lethal wolf control is likely to be negatively related to attitudes towards wolves and positively related to assessments of the threat that wolves pose to ranchers' personal cattle operations and to the cattle industry as a whole.

It would also be useful to identify the factors that people perceive to be important when judging the acceptability of certain wolf control options. The following is a list of factors that may be important in this regard:

1. Cost.
2. Effectiveness in protecting livestock.
3. Humaneness.
4. Species specificity: i.e. potential harm to other kinds of wildlife.
5. Predator specificity: i.e. does the procedure target only those animals that have killed livestock?
6. Lethality: is the procedure nonlethal: that is, does it attempt to protect livestock using techniques that do not involve killing wolves?

Hypotheses

More precise formulations of the hypotheses introduced in the preceding discussion are presented here. With the exception of several hypotheses postulating significant differences in variables across groups, the relationships identified in these hypotheses relating to institutional adjustments are presented schematically in Figures 2.2 and 2.3. Hypotheses involving more than one independent variable should be construed to mean that each of the independent variables will be significantly related to the dependent variable while controlling for the effects of the other independent variable(s).

The first four hypotheses listed below apply both to ranchers and nonranchers.

1. Ecological orientations (measured by the NEP scale) will vary amongst the various groups sampled. Specifically, ecological orientation will be highest for the NWWPS and lowest for ranchers.

2. Attitudes towards wolves will vary with group membership and (positively) with ecological orientation. Specifically, members of the NWWPS will tend to exhibit the most positive, while ranchers will tend to exhibit the least positive attitudes towards wolves; and after controlling for the effects of ecological orientation, nonranchers will tend to exhibit more positive attitudes towards wolves than ranchers.

3. Assessments of the seriousness of the threat that wolves pose to the cattle industry as a whole will vary with group membership and (negatively) with attitudes towards wolves. More specifically, ranchers will perceive the threat to be greater than will the general public who will in turn perceive it to be greater than will members of the NWWPS; and after controlling for attitudes towards wolves, ranchers will perceive the threat to be greater than will nonranchers.

4. There will be a negative relationship between assessments of the threat that wolves pose to some individual cattle owners and attitudes towards wolves.

The next six hypotheses apply to ranchers only.

5. Ranchers' attitudes towards wolves will be negatively related to their perceptions of the threat that wolves pose to their own cattle operations and positively related to ecological orientation.

6. There will be a positive relationship between ranchers' assessments of the seriousness of the threat that coyotes and bears pose to their own cattle operations and their assessments of the seriousness of the threat to the cattle industry as a whole.

7. Ranchers' assessments of the seriousness of the threat that wolves pose to the cattle industry

as a whole will be positively related to assessments of the threat that wolves pose to their own cattle operations and negatively related to their attitudes towards wolves.

8. There will be a negative relationship between ranchers' perceptions of control and perceptions that government policy has reduced the ability of ranchers to protect their livestock from predators.

9. Ranchers' use of nonlethal livestock protection techniques will be related both to the importance attached to nonlethality and to ecological orientation.

10. Ranchers' assessments of the overall acceptability of lethal wolf control techniques will be negatively related to their attitudes towards wolves, positively related to their assessments of the seriousness of the threat that wolves pose to their own cattle operations, and positively related to their assessments of the seriousness of the threat that wolves pose to the cattle industry as a whole.

The remaining hypotheses apply to nonranchers only.

11. For nonranchers, assessments of the overall acceptability of lethal wolf control techniques will be negatively related to attitudes towards wolves, positively related to assessments of the overall humaneness of lethal wolf control, positively related to assessments of the threat that wolves pose to some individual cattle owners, and positively related to assessments of the threat that wolves pose to the cattle industry as a whole.

12. Assessments of the overall humaneness of lethal wolf control techniques will be negatively related to attitudes towards wolves and to ecological orientation.

MODEL A:

INSTITUTIONAL ADJUSTMENTS - NONRANCHERS

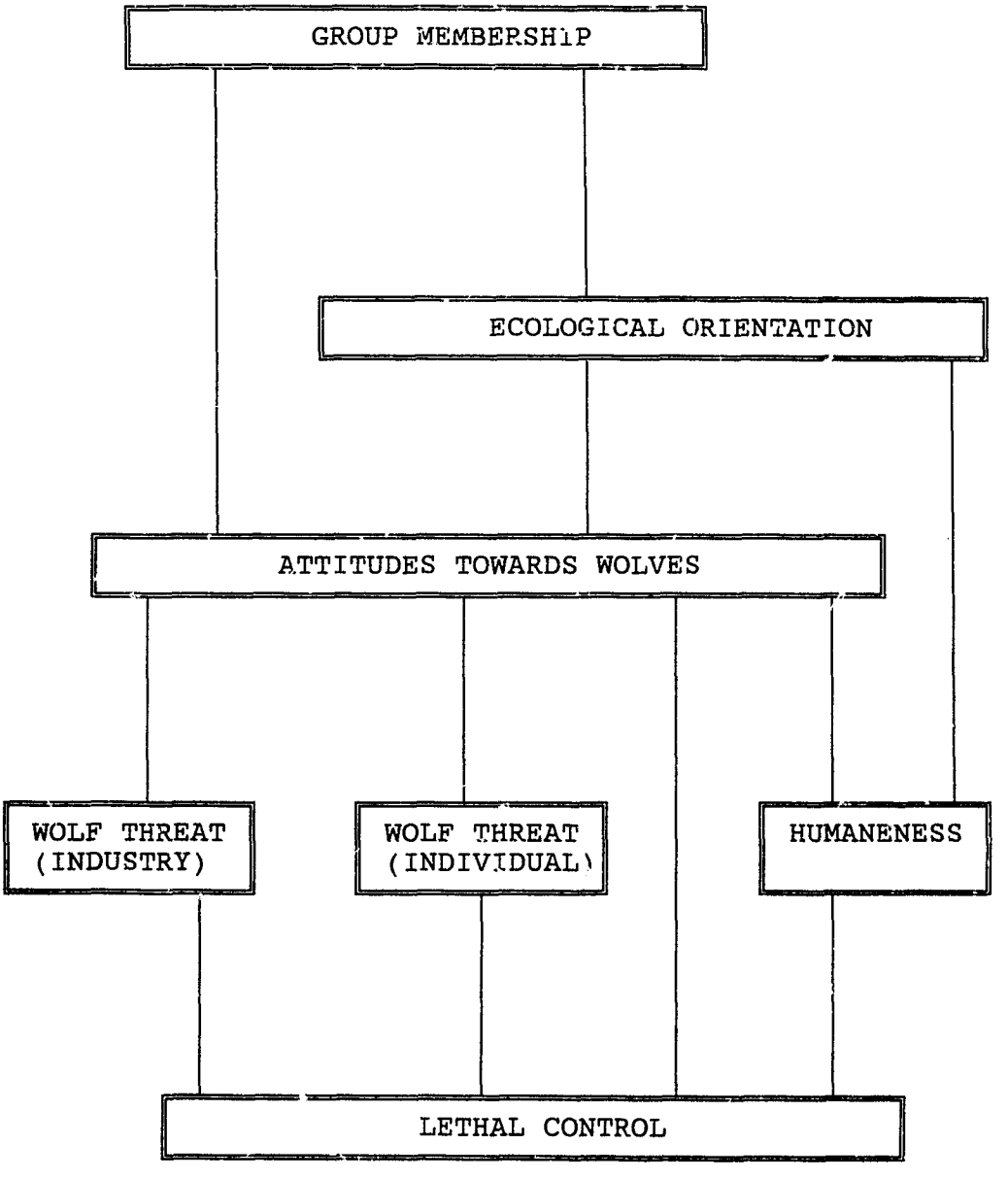

FIGURE 2.2

MODEL B:

INSTITUTIONAL ADJUSTMENTS - RANCHERS

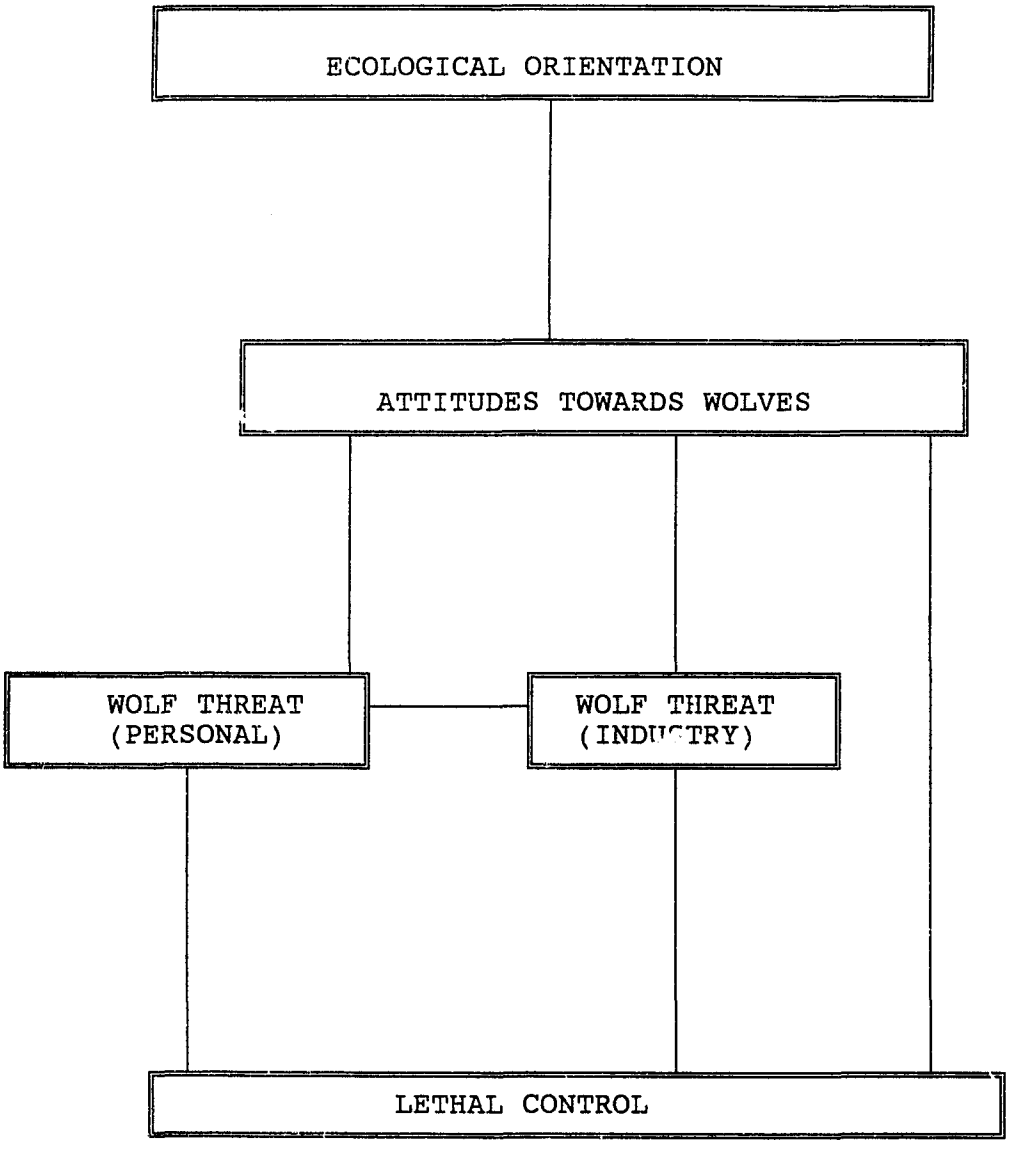

FIGURE 2.3

CHAPTER 3

PROCEDURES: DATA COLLECTION AND INSTRUMENT DEVELOPMENT

Introduction

This chapter outlines both the procedures used for collecting data and the statistical methods employed to analyze certain portions of the *pretest* data. Data for this study were collected by a variety of means: a content analysis of several publications; informal interviews with a number of individuals in public and private agencies concerned with the problems of livestock predation and predator control; and a mail survey questionnaire. Each of these procedures and the rationale behind them are discussed below.

Content Analysis

A systematic content analysis of several publications was undertaken. This analysis was designed to supplement and complement the data gathered in the mail questionnaire survey described below and was guided by several objectives:

1.) To assist in the development and refinement of hypotheses.

2.) To identify the major issues and actors related to the predator control controversy in British Columbia; to identify the positions taken by the principal protagonists on related issues; to identify the reasons offered for the positions taken; and to identify attitudes towards predators, predator control, and associated issues.

3.) To identify perceptions of the predator problem in terms of intensity, geographical distribution, and economic impact on the cattle industry.

4.) To identify changes in relevant beliefs, attitudes, and perceptions over time.

5.) To identify other environmental problems faced by ranchers.

Three publications were selected for review: the *Vancouver Sun; Beef in B.C.*; and *Country Life*. All issues of *Country Life* from 1975 to 1990, and all items -- i.e. news reports, editorials, other commentaries, and letters to the editor -- pertaining to wolves or wolf control contained in issues of the *Vancouver Sun* from 1920 to 1985 were reviewed. Nine issues of *Beef in B.C.* could not be located. Consequently the analysis included approximately 75 percent of the material in this publication.

The *Vancouver Sun* was chosen for the following reasons. It is a major provincial newspaper with wide circulation, containing reports from around the province. Therefore, news reports and letters to the editor are likely to reflect a fairly broad range of opinion. The decision to analyze issues from 1920 to 1985 was based on the hope that some appreciation for changing attitudes towards predators and predator control over time would emerge, coupled with the fact that listings in the B.C. Newspaper Index begin at 1920 and end at 1985. Since the last major controversy over predator control in the province occurred in 1984, it was believed that the unaided search for relevant items in the Sun since 1985 would not yield benefits commensurate with the time involved.

Country Life was selected primarily for two reasons. First, since it contains news reports and commentary on a broad range of agricultural issues and events in the province, it was hoped that it would provide some insight into the environmentally related concerns and attitudes of the agricultural community as a whole in B.C., thereby providing a broader agrarian perspective. Second, much of the news and many of the issues related to the cattle industry that are now covered by *Beef in B.C.*, which began publishing in 1986, were, prior to that time, included in *Country Life*.

Beef in B.C., the official publication of the B.C. Cattlemen's Association, is clearly very sympathetic to ranchers' views and interests, and frequently reports on lobbying efforts, environmental problems, and various wildlife issues.

Interviews

A number of informal interviews was conducted with representatives from the B.C. Wildlife Branch, the B.C. Cattlemen's Association, the Ministry of Agriculture, and several wildlife protection groups.

Mail Questionnaire Surveys

The preparation and administration of the questionnaire surveys consisted of several steps. Two preliminary questionnaires were prepared. (The final versions of both

questionnaires, Version A for nonranchers and Version B for ranchers, may be found in Appendix A.) Both questionnaires were pretested, analyzed for clarity, and some portions of them tested for validity and reliability. Each was revised to reflect both the results of the pretest and matters that had not been previously considered. The modified and final versions of the questionnaires were then administered to selected groups of ranchers and nonranchers.

The mail survey questionnaires were designed primarily to test the hypotheses outlined in Chapter 2, although some questions concerning background, contextual, or demographic information were also included. Both versions of the questionnaire shared a group of core questions or statements dealing with general environmental beliefs, perceptions of the predator hazard, attitudes towards wolves, and the perceived acceptability of various wolf control measures. Version B contained additional material relevant only to ranchers dealing with, amongst other things, additional problems faced by livestock producers and individual responses to the threat of livestock predation (see below for more details).

Pretesting the Instruments

Version A of the questionnaire was mailed to a random sample of 200 telephone subscribers listed in the Victoria telephone directory. Version B was sent to a random sample of 200 ranchers residing in the Kootenay and Peace River

Districts. The sample was drawn from the British Columbia Voters' List. Accounting for questionnaires returned by the postal service as undeliverable, the response rate for the Victoria sample was 36 percent, the response rate for ranchers, 30 percent.

One problem emerged in the pretest administration of version B. An early difficulty encountered in the planning of this study involved the construction of an adequate sampling frame for ranchers in the province. The B.C. Cattlemen's Association was willing to consider sending the survey to its membership for a fee, providing the questionnaire was first approved by its board of directors. To avoid the problems that this might create -- e.g. increased costs, loss of direct control over mailouts and nonresponse follow-up, and possible demands that the questionnaire be changed in ways that might compromise the integrity of the research -- an alternative was sought. Eventually it was discovered that the B.C. Ministry of Environment had used the B.C. Voters' List as a sampling frame for a number of its studies. Since the Voters' List identifies the occupation of each individual it appeared to provide the answer.

However, there were concerns about the addresses on the List. *Street* addresses only are listed, which in urban areas correspond, for the most part, with *mailing* addresses. In rural areas, however, this is often *not* the case. Strictly speaking, the postal service requires correct *mailing*

addresses, but in rural areas mail often gets through at the discretion of local postal officials, particularly when they know the individuals to whom the mail is addressed. Officials in the Ministry indicated that, to their knowledge, in studies utilizing the Voters' List, of those questionnaires delivered to rural areas, the number returned by the postal service as undeliverable was not disproportionately large. Consequently, the decision was taken to use the Voters' List in the pretest to assess its appropriateness as a sampling frame for the study.

Unfortunately, 41 (approximately 21 percent) of the questionnaires mailed to ranchers were returned as undeliverable, most because of incorrect addresses. By contrast, only 4 (2 percent) from the Victoria mailout were returned as undeliverable. Therefore, an alternative to the Voters' List was sought for the final administration of the questionnaire (see below).

Instrument Development

The selection and development of questions that appeared in the final versions of the questionnaires are discussed in the following sections. Several questions included in the pretest instruments were not included in the final versions of the questionnaires. Some were eliminated because of problems with comprehensibility that could not be satisfactorily resolved. Others were eliminated for reasons that will be

described below. Each of the scales discussed here may be found in Appendix B.

Wolf Attitude Scale

This scale was based, in part, on items drawn from Kellert's (1986) study of attitudes towards wolves conducted in Minnesota. A list of questions that appeared in both the preliminary and final versions of this scale is displayed in Appendix B. Items 1-11 were included in the pretest questionnaire; items 1-5, 7-9, and 11-13 appeared in the final questionnaire. Five items (7, 10, 11, 12, and 13) were created specifically for this study. Items 1-6 and 8-9 closely follow the wording employed by Kellert. All of the items incorporate themes which frequently appear in the literature dealing with wolf-related controversies.

In a test of reliability (Cronbach's Alpha), acceptable alpha scores emerged for both versions of the questionnaire (version A, α = .79; version B, α = .69).[1] However, since the reliability test indicated that the elimination of items 6 and 10 would increase the alpha scores (version A, α = .80; version B, α = .73), these items were deleted. This provided

[1]Since Cronbach's Alpha is based on the average correlation of items in a test or scale, it is essentially a measure of internal consistency. It is, however, generally interpreted as a measure of reliability. More precisely, Cronbach's Alpha may be viewed as "the correlation between this test or scale and all other possible tests or scales containing the same number of items, which could be constructed from a hypothetical universe of items that measure the characteristic of interest" (Norusis, 1990).

space for the inclusion of two additional items (12 and 13). Note that in the final questionnaires, item 13 was actually included in the "Animal Preference Scale" discussed below.

The pretest also provided some evidence for the construct validity of the scale. Construct validity refers to the ability of a scale to confirm or support expectations or hypotheses based on theoretical considerations (Moser and Kalton, 1971). Since ranchers are much more likely than urbanites to have had negative experiences with wolves, one would expect the latter to exhibit more positive attitudes towards wolves than the former. The pretest data supported this hypothesis. Based on a reduced scale of 9 items -- recall that 2 items had been eliminated to improve the reliability of the scale -- the mean score for the Victoria sample was 28.85 (s = 4.32) compared to 21.36 (s = 4.35) for the ranchers. This difference was statistically significant ($t(102) = 8.58$; $p < .00025$).

Animal Preference Scale

This scale appeared in both versions of the final questionnaire. It was designed to measure the degree to which respondents like or dislike several different types of wildlife. Since it would not have been practical to include attitude scales for grizzly bears, black bears, and coyotes, this scale was included in the survey to provide a context for assessing attitudes towards wolves by providing a limited

indication of attitudes towards other animals. The scale was meant to be representative of a variety of wild animals found in Canada but was certainly not intended to be indicative of all classes of animals.

Ecological Orientation Scale

Although there are compelling reasons for examining specific attitudes towards predators and predator control in a much broader context of environmentally related beliefs, the decision to do so was based, in part, on the fact that several existing research instruments could be readily utilized for this purpose (see Gray *et al.*, 1985, for a careful review). It would be far too tedious and time-consuming to evaluate all of them here. Therefore, this discussion is confined to an assessment of two closely related attitude scales, one of which -- the New Environmental Paradigm scale -- was ultimately chosen for this study.

In Chapter 2, it was noted that in recent years there appear to have been rather dramatic changes in Western beliefs concerning nature and humankind's proper relationship to it. Support for what has been called the Dominant Social Paradigm (DSP) appears to be giving way -- at least in some sectors of society -- to a new system of beliefs termed the "New Environmental Paradigm" (NEP).

Dunlap and Van Liere (1978) have developed an instrument (NEP Scale) based on 12 Likert-type items to measure the

extent to which selected groups accept the content of the NEP. In the previous chapter, the results of several empirical investigations utilizing the scale were reported. The scale is of particular interest for this study for several reasons. First, the scale has demonstrated ar ability to distinguish between groups whose attitudes to environmental issues of either a general or more specific nature had been previously documented or could be reasonably assumed on the basis of *a priori* considerations. Second, a number of studies have indicated significant correlations between the NEP scale and self-reported behaviours, environmental knowledge, or other environmentally related beliefs. And third, although the scale has been employed in a limited number of studies, it has performed well in terms of several standard psychometric parameters: reliability and predictive and construct validity (Dunlap and Van Liere, 1978; Albrecht *et al.* 1982). However, it was believed that it would be useful to extend the scale's coverage to include explicit references to science and technology -- che one (apparently) important dimension that was lacking. The simplest means of doing this was to use the NEP-DSP scale developed by Jackson (1986).[2]

This scale includes 21 items based on statements drawn from the DSP and NEP scales developed by Dunlap and Van Liere (1984) and several from the resources and environmental literature. Although it contains several statements dealing

[2]This scale may be found in Appendix B.

explicitly with "quality of life" not found in the NEP scale, the only significant difference between Jackson's scale and the former appears to be the addition of material dealing with science and technology. Because it included these statements, and because it had already been tested in several research settings, Jackson's scale was included in the pretest questionnaires. Two minor modifications were made in the scale, however. All twelve (as opposed to only 10) of the items and the 4-point scales employed in the original NEP scale (rather than the 5-point scales used by Jackson) were retained, in order to permit the comparison of data from this study with data compiled in previous investigations utilizing the NEP scale.

The pretest analysis of Jackson's scale did not conform to expectations. Based on previous studies (Buttel and Flinn, 1974; Tremblay and Dunlap, 1978; Van Liere and Dunlap, 1980) indicating that farmers tend to be less environmentally aware and concerned than nonfarm populations, one would have expected the mean score for the Victoria sample for this scale to be significantly higher than the mean score for the ranchers. Yet the mean for the Victoria sample (70.87) was only marginally greater than the mean for the ranchers (70.42). While the difference was in the expected direction, it was not statistically significant ($p > .40$).

To explore the possibility that the questions concerning science, technology, and life-style had obscured significant

differences between the groups, group means for the 12 items included in the NEP scale were calculated, and a difference of means test was conducted. The mean score for ranchers was 38.12 (s = 5.29); the mean score for the Victoria sample, 39.87 (s = 4.66). The difference was statistically significant ($t(111)$ = 1.99; p = .043). These results suggested that the NEP scale alone might be the more appropriate choice for this particular piece of research.

This feeling was strengthened by an examination of several correlation analyses performed on the pretest data. Relationships between scores on the Wolf Attitude Scale on the one hand, and the NEP scale, the NEP-DSP scale, and the additional questions on the latter scale, on the other hand, were tested for strength and direction with Pearson's product moment correlation coefficient. It was hypothesized that scores on the Wolf Attitude Scale would be significantly and positively correlated with each of the three sets of statements. The results are displayed in Table 3.1.

In both samples, the correlation coefficients were highest for the NEP Scale; they were also highly significant statistically. The coefficients for the NEP-DSP scale were smaller and their associated prob-values, higher. In both cases, the correlations were in the expected direction. In the last case, the coefficients for the Wolf Attitude Scale and the additional questions on the NEP-DSP scale were smaller still, and neither was statistically significant.

TABLE 3.1
CORRELATIONS BETWEEN WOLF ATTITUDE SCALE, AND NEP AND NEP-DSP SCALES

Ranchers (N = 44)			
	NEP Scale	NEP-DSP Scale	Additional Questions
Wolf Attitude Scale	.57 ($p < .0005$)	.47 ($p = .001$)	.12 ($p = .226$)
Victoria (N = 62)			
	NEP Scale	NEP-DSP Scale	Additional Questions
Wolf Attitude Scale	.45 ($p < .0005$)	.23 ($p = .044$)	-.03 ($p = .419$)
Prob-values based on one-tailed tests			

The correlation analyses and the test of means noted above suggest that, in this particular research context, the additional items contained in the NEP-DSP scale -- i.e. those not included in the NEP scale -- actually reduce the ability of the scale to predict group membership or attitudes towards wolves. Indeed, the additional items, by themselves, appear to have no value in this regard. In hindsight, this is not surprising when one considers the nature of the additional items in the NEP-DSP. Attitudes towards wolves -- all wildlife for that matter -- are not likely to be directly associated with attitudes towards science and technology. Had this study been concerned with another issue, the construction of a hydro-electric project, the erection of a nuclear reactor, or the opening of a uranium mine, for example, such

attitudes would have been far more relevant and hence may have been important predictors of attitudes towards such projects.

Certainly it may be helpful to know that ranchers and urbanites vary little in their beliefs about science and technology when such beliefs are relevant to the issue at hand, but they do not appear to be pertinent here. Moreover, one of the major motivations for undertaking this study was a concern for the problems faced by wildlife managers, problems frequently characterized by attitudinal conflict. And it is probably more important to identify the beliefs that separate groups than those they share. In this particular case, the pretest data indicated that the NEP scale would do this as well as the longer NEP-DSP scale, and perhaps better, if comparisons were made on the basis of the complete NEP-DSP scale. Consequently, the NEP scale was employed in this study.

Reliability coefficients (Cronbach's Alpha) based on the pretest responses to the NEP scale were satisfactory (Victoria: α = .81; Ranchers: α = .71). The NEP scale appeared in both versions of the questionnaire.

Predator Threat Scale

This scale, which appeared in both versions of the questionnaire, was designed to assess the degree to which respondents believe that bears, wolves, and coyotes pose an economic threat to some individual ranchers, and the cattle

industry as a whole. Livestock producers were also asked to assess the economic threat these animals pose to their own cattle operations.

Predator Control

Several questions dealing with predator control were included in both versions of the questionnaire. Four were designed to assess attitudes towards both reactive and proactive predator control. A fifth was designed to elicit opinions concerning the consequences of leaving predator control entirely in the hands of livestock owners. A sixth question (Predator Control Scale) was designed to assess the acceptability of eight different wolf control methods: aerial shooting; ground shooting; regular (as opposed to padded) leghold trap; quick-acting poisons; slow-acting poisons; relocation; denning; and aversive conditioning. A question asking respondents if they were aware of any additional procedures that wildlife officials could use to protect livestock from wolves and if they would endorse their use was also included.

Lethal Control Scale

The items in the Predator Control Scale dealing with lethal control techniques were combined to provide a measurement of the overall acceptability of such techniques. Cronbach's Alpha for the pretest data was .81.

Humaneness

A question asking respondents to rate the humaneness of the predator control techniques outlined above was included in version A of the questionnaire. The rationale for its inclusion was provided by previous research conducted in the United States indicating that a sample of the general population rated humaneness as the most important aspect of coyote control in determining the acceptability of particular control methods (Arthur, 1981; see Chapter 2). This question was not included in version B for two reasons: 1.) there was reason to believe that ranchers would consider other aspects of wolf control more important;[3] and 2.) there were concerns that version B was already too long.

The items in this question dealing with lethal control techniques were combined into a single scale (Humaneness Scale) to assess respondent's perceptions of the overall humaneness of lethal control. In the pretest, Cronbach's alpha for this scale was .74.

Predator Control Methods: Factor Importance

This question was designed to determine how important a number of factors (e.g. cost or humaneness) were in determining a person's evaluation of the acceptability of wolf control techniques. This question was included in both versions of the questionnaire.

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[3]This, in fact, turned out to be the case. See Chapter 5.

Compensation

This set of questions, which appeared in both versions of the questionnaire, was designed to determine whether, and under what conditions, respondents would support the payment of compensation to ranchers for livestock lost to predators.

Problem Importance Scale

The purpose of this scale was to determine the perceived importance of livestock predation relative to a number of other problems faced by ranchers. Most, but not all, of the problems listed are environmentally related. The items chosen for inclusion were drawn largely from *Beef in B.C.*

Control and Influence

Several questions were designed to determine the extent to which ranchers felt that they were able, as individuals, to exercise control over livestock predation, or influence government predator control policies. An additional question for those ranchers belonging to the B.C. Cattlemen's Association asked whether they felt that the Association had any influence over government predator control policies.

Individual Adjustments

An open question aimed at determining ranchers' awareness, evaluation, and use of techniques for protecting

livestock from predators was included in Version B. Ranchers were asked to indicate whether they were aware of any effective measures that livestock owners could take to protect their animals from predators, and if so, to list them. They were also asked to list the procedures that they had found a need to employ in their own livestock operations.

Additional Questions

Both questionnaires included a number of questions of a demographic nature. And version B included several questions dealing with predation losses, herd size, and the effectiveness of government predator control programmes.

Administration of the Questionnaires

In lieu of sampling the entire nonranching population of British Columbia, it was decided that a simpler and more manageable plan would be to select samples from several urban populations that collectively are likely to be reasonably representative of urban opinion on the issues under consideration. An additional sample from an environmental group devoted to the protection of wildlife was also selected.

With appropriate revisions having been made, version A of the questionnaire was mailed to 600 individuals selected randomly from the Victoria telephone directory. Care was taken not to re-survey those who had been included in the pretest. Approximately three weeks after the questionnaires

were mailed, a follow-up letter along with an additional questionnaire was mailed to each of the individuals on the sample list who had not yet responded. In total, 259 completed questionnaires were returned, and 64, identified as undeliverable, were returned by the postal service yielding a response rate of 48 percent.

Version A was also sent to random samples of 300 individuals from the Kamloops telephone directory, 400 individuals from Williams Lake (selected from the B.C. Voters' List), and 200 members of the Northwest Wildlife Preservation Society (NWWPS) headquartered in Vancouver, B.C. Ninety-five completed questionnaires were returned from Williams Lake, 87 from Kamloops, and 133 from the NWWPS. Eighteen from Williams Lake, 22 from Kamloops, and 3 from the NWWPS were returned by the postal service as undeliverable. This resulted in response rates of 25 percent, 31 percent, and 67.5 percent respectively. No follow-up work was conducted.

The problem of selecting a group of ranchers to be surveyed was finally resolved by compiling a list based on membership rosters of the B.C. Hereford Association, the B.C. Shorthorn Association, and the B.C Simmentals Association, published in *Beef in B.C.* This list was supplemented with additional names drawn from the advertising sections of that periodical, producing a roster of 700 names.

Version B was mailed to each of the ranchers listed. Approximately three weeks later, another questionnaire

accompanied by a follow-up letter was sent to those who had not yet responded. In the final analysis, 283 completed questionnaires were returned and 56 were returned by the postal service as undeliverable, yielding a response rate of 44 percent.

CHAPTER 4

STATISTICAL ANALYSIS AND RESULTS

Introduction

This chapter includes a description of the statistical techniques used to analyze the mail questionnaire survey data, and the results obtained from those analyses. More specifically, the discussion covers the following topics: the testing of the hypotheses set out in Chapter 2; principal components analyses of the NEP scale; and reliability tests for the NEP Scale, the Wolf Attitude Scale, the Animal Preference Scale, the Lethal Control Scale, and the Humaneness Scale. Other descriptive statistics including those pertaining to the content analysis and a number of *post hoc* comparisons will be described in the appropriate context in Chapter 5.

For most of the analyses, the Williams Lake, Kamloops, and Victoria samples were combined to produce one pooled "general public" sample. To account for the fact that the samples were not proportional to the population of each of these cities, the samples were weighted to reflect the contribution that each city makes to the combined population of the three urban areas. The samples were also weighted to take into account the fact that the number of male respondents in each of the urban samples was disproportionately high. To ensure that the prob-values for each of the significance tests was neither too high nor too low, the weighting was done in

such a way that the weighted number of cases equalled the overall sample size.

Principal Components Analysis[1]

A principal components analysis of the responses to the NEP Scale was conducted for each of the sample groups. (See Table 4.1 for a list of the NEP scale statements). Using an eigenvalue of one as the factor extraction criterion, three factors were extracted for each group. These factors were virtually identical for the pooled general public sample[2] and for ranchers (see Table 4.2).

In accordance with the precedent set by previous studies (e.g. Albrecht *et al.*, 1982; Edgell and Nowell, 1989) the three dimensions were designated: balance of nature (items 1 through 4); limits to growth (items 5 through 8); and humanity over nature (items 9 through 12).

Three factors also emerged for the NWWPS; however, as Table 4.3 reveals there were a number of differences between these factors and those extracted for the other groups. Specifically, factor one includes items 1, 2, 4, 7, and 8 (vs. 1-4); factor two items 3, 5, 6, and 11 (vs. 5-8); and factor three items 9, 10, and 12 (vs. 9-12). These factors are more difficult to interpret than those that emerged for ranchers

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[1]All of the statistical analyses reported here were performed utilizing the SPSS/PC+ computer software package.

[2]Principal components analyses on the responses from each of the urban samples yielded identical factor structures to those reported below for the general public and ranchers.

and the general public. It seems that members of the NWWPS associated industrial growth and economic expansion (items 7 and 8) with the "balance of nature" items (1, 2, and 4).

TABLE 4.1
NEP SCALE

1.	The balance of nature is very delicate and easily upset.
2.	When humans interfere with nature it often produces disastrous consequences.
3.	Humans must live in harmony with nature in order to survive.
4.	Humankind is severely abusing the environment.
5.	We are approaching the limit to the number of the people that the earth can support.
6.	The earth is like a spaceship with only limited room and resources.
7.	There are limits to growth beyond which our industrialized society cannot expand.
8.	To maintain a healthy economy we will have to develop a "steady-state" economy where industrial growth is controlled.
9.	Humankind was created to rule over the rest of nature.
10.	Humans have the right to modify the natural environment to suit their needs.
11.	Plants and animals exist primarily to be used by humans.
12.	Humans need not adapt to the environment because they can remake it to suit their needs.

This association is certainly understandable, since the disruption of nature is frequently related to industrial and economic activities. It is also understandable that item 3 which emphasizes the need for humans to live in harmony with nature would be associated with biospheric limits (items 5 and 6). However, the association of item 11 ("Plants and animals exist primarily to be used by humans") with items 3, 5, and 6

is somewhat puzzling. Under any accounting, it would appear to be more appropriately associated with items 9, 10 and 12. If one were able to probe more deeply into the belief systems of the members of the NWWPS, the reason for this particular association might become clear. As the matter stands, however, it is difficult to comprehend. At any rate, if item 11 were to be eliminated from the scale the three factors could quite reasonably be designated "balance of nature" (items 1, 2, 4, 7, and 8), "limits to growth" (3, 5, and 6), and "humanity over nature" (9, 10, and 12). This means, however, that the three subscales are not commensurate with those extracted for the other groups. Therefore, comparisons were not made across all of the groups on each of the dimensions.

Reliability

Reliability tests employing Cronbach's alpha were conducted on several scales: the NEP Scale; the NEP sub-scales derived in principal components analyses outlined above;[3] Wolf Attitude Scale; Animal Preference Scale; Humaneness Scale; and Lethal Control Scale. Assuming a minimum standard of 0.60, the reliability coefficients for each of the scales noted above met, or far exceeded, minimum requirements.

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[3]See Chapter 2 for the interpretation of Cronbach's alpha.

TABLE 4.2
NEP SCALE FACTOR LOADINGS

General Public

Item	Factor 1	Factor 2	Factor 3
7	.810		
6	.796		
5	.770		
8	.686		
11		.800	
10		.762	
9		.743	
12		.707	
2			.783
3			.725
1			.720
4			.650

The three factors accounted for 60.7% of the total variation.

Ranchers

Item	Factor 1	Factor 2	Factor 3
5	.830		
6	.797		
7	.772		
8	.623		
2		.809	
1		.754	
3		.608	
4		.608	
11			.787
10			.748
9			.739
12			.578

The three factors accounted for 61.5% of the total variation.

TABLE 4.3
NEP SCALE: FACTOR LOADINGS - NWWPS

Item	Factor 1	Factor 2	Factor 3
8	.862		
1	.717		
2	.680		
7	.644		
4	.515		
6		.835	
5		.800	
3		.527	
11		.495	
10			.791
12			.681
9			.644

The three factors accounted for 62.1% of the total variation.

Reliability coefficients for the NEP Scale for each of the groups sampled were as follows: general public 0.83; ranchers 0.85; NWWPS 0.86. Coefficients for each of the NEP subscales are displayed in Table 4.4.

Reliability coefficients for each of the following scales are presented in Table 4.5: Wolf Attitude Scale; Animal Preference Scale; Humaneness Scale: and Lethal Control Scale.

TABLE 4.4
RELIABILITY COEFFICIENTS: NEP SUBSCALES

	General Public	Ranchers
Balance of nature	0.76	0.80
Limits to growth	0.81	0.81
Humanity over nature	0.77	0.73

TABLE 4.5
RELIABILITY COEFFICIENTS
WOLF ATTITUDE, ANIMAL PREFERENCE,
HUMANENESS, AND LETHAL CONTROL SCALES

	General Public	Ranchers	NWWPS
Wolf Attitude	0.85	0.85	0.73
Animal Preference	0.92	0.90	0.94
Humaneness	0.75	-	0.75
Lethal Control	0.76	0.81	0.67

Hypothesis Tests

In this section, each of the statistical techniques used to test the hypotheses set out in Chapter 2 is described, and the results of each test are given. For convenience, each hypothesis is given prior to the presentation of the testing procedures and results.

> *Hypothesis 1*: Ecological orientation (as measured by the NEP Scale) will vary amongst the various groups sampled. Specifically, ecological orientation will be highest for the NWWPS and lowest for ranchers, with the general public falling between.

The data support the hypothesis.

Following an analysis of variance, which indicated that ecological orientation varied significantly with group membership [$F(2, 798) = 93.03$; $p < .00005$], a series of t-tests was conducted to determine if the differences conformed to those specified in the hypothesis. Each of the pairwise

comparisons reached significance.[4] Test results are presented in Table 4.6.

TABLE 4.6
HYPOTHESIS 1: NEP SCALE MEANS

Groups	Means	Std. Dev.
NWWPS	43.53	4.38
General Public	39.39	4.93
Ranchers	36.03	5.88
Pairwise Comparisons		
NWWPS vs. General Public: $t(540) = 8.52$; $p < .00025$		
General Public vs. Ranchers: $t(477) = 7.66$; $p < .00025$		
Ranchers vs. NWWPS: $t(330) = -14.11$; $p < .00025$		

Since some research has found an association between age and education (see Van Liere and Dunlap, 1980 for a review), an analysis of covariance was conducted to determine if observed variations in ecological orientation could be attributed to these factors rather than to group membership. The relationships between these variables and ecological orientation were not significant [$F(1, 753)$ for age = 2.51, p = .113; $F(1, 753)$ for education = .955, p = .319].

> *Hypothesis 2*: Attitudes towards wolves will vary with group membership and (positively) with ecological orientation. More specifically, members of the NWWPS will tend to exhibit the most positive, while ranchers will tend to exhibit the least positive attitudes towards wolves, after controlling for the effects of ecological orientation.
>
> The data support the hypothesis.

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[4]All tests in this section were deemed significant for alpha less than .05.

An analysis of covariance was performed on attitudes towards wolves. The independent variable was group membership (general public, ranchers, and NWWPS) with ecological orientation (NEP Scale) as the covariate. Results of the evaluation of the assumptions of normality, linearity, homogeneity of variance,[5] and homogeneity of regression were satisfactory.

Following adjustments for the covariate, attitudes towards wolves varied significantly with group membership [F (2, 724) = 105.12; $p < .0005$]. However, the strength of the relationship between group membership and attitudes towards wolves was quite modest with $\eta^2 = .37$. Adjusting for the independent variable, attitudes towards wolves varied significantly with the covariate (NEP Scale) [F (1, 724) = 295.87; $p < 0005$]. Multiple R (.744) for predicting attitudes towards wolves from group membership and ecological orientation was significantly different from zero (F (3, 724) = 298.50; $p < .0005$); and multiple R^2 was .553. The adjusted means (shown in Table 4.7) indicate that the most favourable

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[5]Since the analysis of covariance is quite robust, it is not necessary to adhere strictly to the assumption of homogeneity of variance. To ensure robustness, Harris (1975) suggests the following checks: only employ two-tailed tests; preferably sample sizes should be equal, but if this criterion cannot be met, the ratio of largest to smallest sample size for groups should be no greater than 4:1; and finally, the ratio between the largest and smallest variances within each cell should be no greater than 20:1. With sample sizes of 368, 238, and 122 and cell variances of 28.62, 41.90, and 14.82, the data in this particular test more than met these criteria for robustness.

attitudes towards wolves are held by members of the NWWPS, and least favourable attitudes by ranchers. These differences were statistically significant (t = 10.46, general public and ranchers; t = -13.98, ranchers and NWWPS; t = -7.59, general public and NWWPS; $p < .0005$ in each case.)

TABLE 4.7
HYPOTHESIS 2: ADJUSTED AND UNADJUSTED MEANS - WOLF ATTITUDE SCALE

Group	Adjusted Mean	Unadjusted Mean
NWWPS	38.50	40.80 (s = 3.85)
General Public	34.66	34.44 (s = 5.35)
Ranchers	30.44	28.38 (s = 6.47)

Pearson product moment correlations between ecological orientation and attitudes towards wolves were calculated for each of the groups. Although the correlations were modest, each was highly significant.[6] The results for these tests are presented in Table 4.8.

TABLE 4.8
CORRELATIONS BETWEEN ECOLOGICAL ORIENTATION AND ATTITUDES TOWARDS WOLVES

Group	Pearson's r	Prob-value*
General Public	0.55	< .0005
Ranchers	0.52	< .0005
NWWPS	0.67	< .0005
*Prob-values based on one-tailed tests		

[6]The guidelines provided by Cohen and Holliday (1982) for interpreting the strength of correlation coefficients are followed in this study. They suggest the following: below 0.19 is very low; 0.20 to 0.39 is low; 0.40 to 0.69 is modest; 0.70 to 0.89 is high; and 0.90 to 1.0 is very high.

To sum up, the data indicate that differences in attitudes towards wolves can be accounted for (in part) by both group membership and ecological orientation.

> *Hypothesis 3*: Assessments of the seriousness of the threat that wolves pose to the cattle industry as a whole (wolf threat) will vary with group membership and negatively with attitudes towards wolves. More specifically, ranchers will perceive the threat to be the most serious, while members of the NWWPS will perceive it to be the least serious. Moreover, after controlling for attitudes towards wolves, ranchers will perceive the threat to be greater than will non-ranchers.

The data do not fully support the hypothesis.

An analysis of covariance with wolf threat as the dependent variable, group membership as the independent variable, and attitudes towards wolves as the covariate was performed to test this hypothesis. Results of the evaluations of the assumptions of normality, linearity, and homogeneity of variance were satisfactory. However, the evaluation of the homogeneity of regression indicated interaction between group membership and attitudes towards wolves. Under these circumstances, the comparison of adjusted means is no longer appropriate.

An analysis of the within group correlations between industry threat and attitudes towards wolves revealed a substantial difference between the correlations for the NWWPS and the other two groups. This suggested that the interaction noted above was due to the NWWPS sample. Accordingly, another analysis of covariance was performed with the NWWPS data

deleted from the calculations. Results of the evaluation of assumptions in this case were satisfactory.

After adjusting for the covariate, mean assessments of the wolf threat varied significantly with group membership [F (1, 470) = 17.02; $p < .0005$]. Nevertheless, the strength of the relationship between group membership and threat was very modest with $\eta^2 = .18$. Adjusting for the independent variable, the association between wolf threat and the covariate (attitudes towards wolves) was highly significant [F (1, 470) = 190.99; $p < .0005$]. Multiple R (.652) for predicting wolf threat from group membership and attitudes towards wolves was significantly different from zero [F (2, 470) = 173.50; $p < .00005$]. Multiple R^2 was .425. The adjusted means shown in Table 4.9 indicate that assessments of the wolf threat were higher for ranchers than for the general public. Statistically this difference was significant ($t = -10.55$; $p < .0005$).

TABLE 4.9
HYPOTHESIS 3: WOLF THREAT - ADJUSTED AND UNADJUSTED MEANS

Group	Adjusted Means	Unadjusted Means
NWWPS	-	1.30 ($\underline{s}$ = .51)
General Public	1.89	1.61 ($\underline{s}$ = .83)
Ranchers	2.22	2.49 ($\underline{s}$ = 1.02)

Pearson product moment correlations between wolf threat and attitudes towards wolves were calculated for each of the

groups. The correlations were modest but significant (see Table 4.10).

TABLE 4.10
CORRELATIONS BETWEEN WOLF THREAT AND ATTITUDES TOWARDS WOLVES

Group	Pearson's r	Prob-value*
General Public	-0.48	< .0005
Ranchers	-0.59	<. 0005
*Prob-values based on one-tailed tests		

The results of the preceding analyses indicate that assessments of the wolf threat vary directly with group membership and with attitudes towards wolves. However, interaction between group membership and attitudes towards wolves precludes a comparison of adjusted means for all three groups. However, given that members of the NWWPS are clearly not representative of the general population, the second analysis of covariance strongly suggests that, in general, perceptions of the wolf threat are independently related to both group membership and attitudes towards wolves.

> *Hypothesis 4:* There will be a negative relationship between assessments of the threat that wolves pose to some individual cattle owners and attitudes towards wolves.

The data support the hypothesis.

Pearson's product moment correlations are displayed in Table 4.11.

TABLE 4.11
HYPOTHESIS 4: CORRELATIONS BETWEEN INDIVIDUAL WOLF THREAT AND ATTITUDES TOWARDS WOLVES

Group	Pearson's r	Prob-value*
General Public	-.45	< .0005
Ranchers	-.52	< .0005
NWWPS	-.25	.005
*Prob-values based on one-tailed tests		

Hypothesis 5: Ranchers' attitudes towards wolves will be negatively related to their perceptions of the threat that wolves pose to their own cattle operations (personal threat) and positively related to ecological orientation.

The data support the hypothesis.

A standard multiple regression was performed with attitudes towards wolves as the dependent variable and personal threat and ecological orientation as independent variables. Results of the evaluations of the assumptions of normality, linearity, multicollinearity, and homoscedasticity were satisfactory.

The results of the analysis are displayed in Table 4.12.[7] Multiple R for the regression was significantly different from zero [F (2, 227) = 72.66; $p < .00005$].

[7]In each of the regression analyses reported in this chapter, a variable correlation matrix and the following coefficients will be given: unstandardized regression coefficients (B); standardized regression coefficients (β), the squared semipartial correlations (sr^2); multiple R, R^2, and adjusted R^2. The squared semipartial correlation expresses the unique contribution of the independent variable to the total variance of the dependent variable (Tabachnick and Fidell, 1989).

TABLE 4.12
HYPOTHESIS 5: REGRESSION COEFFICIENTS

Variable	B	β	sr^2
Personal Threat (PT)	-2.551	-.371	.14 ($p < .00005$)
Ecological Orientation (EO)	.498	.454	.20 ($p < .00005$)
$R = .63$	WLF.*	PT	
$R^2 = .39$	PT	-.43	
	EO	.52	-.17
Adjusted $R^2 = .39$			
	*Attitudes towards wolves		

Hypothesis 6: There will be a positive relationship between ranchers' assessments of the seriousness of the threat that coyotes and bears pose to their own cattle operations and their assessments of the seriousness of the threat to the cattle industry as a whole.

The data support the hypothesis.

Pearson's product moment correlations were calculated. While modest the correlations (.44 for coyotes and .38 for bears) were highly significant ($p < .0005$ in both cases) and provided very strong support for this hypothesis.

Hypothesis 7: Ranchers' assessments of the seriousness of the threat that wolves pose to the cattle industry as a whole will be positively related to assessments of the threat that wolves pose to their own cattle operations and negatively related to their attitudes towards wolves.

The data support the hypothesis.

A standard multiple regression was performed with threat to the cattle industry (industry threat) as the dependent variable, and threat to personal cattle operations (personal threat), and attitudes towards wolves as the independent

variables. Results of the evaluations of assumptions were satisfactory.

The results of the analysis are presented in Table 4.13. Multiple *R* for the regression was significantly different from zero [F (2, 218) = 25.51; p < .00005]. Both of the independent variables contributed significantly to the dependent variable and in the direction specified in the hypothesis.

TABLE 4.13
HYPOTHESIS 7: REGRESSION COEFFICIENTS

Variable	B	β	sr^2
Personal Threat (PT)	.240	.190	.03 (p = .0057)
Attitudes Towards Wolves (WOLF)	-.057	.303	.07 (p < .00005)
R = .43 R^2 = .18 Adjusted R^2 = .18		INDT* PT PT .30 WOLF -.36 -.43 *Industry threat	

Hypothesis 8: There will be a negative relationship between ranchers' perceptions of control and perceptions that government policy has reduced the ability of ranchers to protect their livestock from predators.

The data support the hypothesis.

The Pearson's product moment correlation coefficient calculated to test this relationship though very low (r = -.14) was significant (p = .033).

Hypothesis 9: Ranchers' use of nonlethal livestock protection techniques will be independently related to the importance attached to nonlethality and to ecological orientation.

The data do not fully support the hypothesis.

A standard discriminant function analysis was performed with the dichotomous variable, use of nonlethal techniques, as the dependent variable. Nonlethality and ecological orientation were discriminating variables. Evaluation of the assumptions of normality, multicollinearity, and homogeneity of variance-covariance matrices were satisfactory.

With a dichotomous dependent variable, only one discriminant function was calculated with Wilk's $\lambda = .91$, $\chi^2 (2) = 12.78$, $p = .0017$. The correlations between discriminating variables and the discriminant function -- .86 for ecological orientation and .72 for nonlethality -- suggest that ecological orientation is the better of the two discriminating variables for distinguishing between the two groups (i.e. users and nonusers of nonlethal techniques). Based on univariate tests, users of nonlethal techniques rate higher on ecological orientation (mean = 37.55) than nonusers (mean = 34.43) [$F(1, 143) = 10.06$; $p = .002$] and higher on nonlethality (mean = 2.80) than nonusers (mean = 2.29) [$F(1, 143) = 6.95$; $p = .009$].

However, a step-down analysis performed with ecological orientation (EO) as the priority variable (based on univariate *F*) indicated that only EO significantly separated users from nonusers [F (1, 143) = 10.06; p =.002], indicating that the

variation shared between nonlethality and the dependent variable is accounted for through overlapping variance with EO.

> *Hypothesis 10*: Ranchers' assessments of the overall acceptability of lethal wolf control techniques (lethal control) will be negatively related to their attitudes towards wolves, positively related to their assessments of the seriousness of the threat that wolves pose to their own cattle operations (personal threat), and positively related to their assessments of the seriousness of the threat that wolves pose to the cattle industry as a whole (industry threat).

The data do not fully support the hypothesis.

A standard multiple regression was performed between lethal control as the dependent variable and attitudes towards wolves, personal threat and industry threat as independent variables.

Following an evaluation of assumptions, an inverse transformation was applied to personal threat to improve the normality of the residuals. A subsequent evaluation of assumptions then proved satisfactory.

The results of the analysis are presented in Table 4.14. R for the regression was significantly different from zero [F (3, 215) = 37.41; $p < .00005$]. Only two of the independent variables contributed significantly to variation in the dependent variable: attitudes towards wolves, and the inverse of personal threat.

Although the correlation between industry threat and lethal control was .30 and would have been significant in a bivariate analysis ($p < .0005$), industry threat did not

contribute significantly to the regression. Apparently, the association between industry threat and lethal control is the indirect result of the relationships between personal threat, attitudes towards wolves and industry threat.

TABLE 4.14
HYPOTHESIS 10: REGRESSION COEFFICIENTS

Variable	B	β	sr^2
Industry Threat (INDT)	.341	.077	.01 (p = .0869)
Personal Threat* (PT)	-3.289	-.179	.02 (p = .0057)
Attitudes Towards Wolves (WLF)	-.363	-.440	.14 (p < .00005)
R = .59 R^2 = .34 Adjusted R^2 = .33		LC* INDT PT INDT .28 PT .38 .30 WLF -.55 -.36 -.43 *Lethal Control	

*Note that taking the inverse of personal threat has the effect of changing the sign of the coefficients. The relationship between personal threat and lethal control is in fact in the positive direction.

Hypothesis 11: For nonranchers, assessments of the overall acceptability of lethal wolf control techniques (lethal control) will be negatively related to attitudes towards wolves, positively related to assessments of the overall humaneness of lethal wolf control (humaneness), positively related to assessments of the threat that wolves pose to some individual cattle owners (individual threat), and positively related to assessments of the threat that wolves pose to the cattle industry as a whole (industry threat).

The data do not fully support the hypothesis.

Two standard multiple regressions were performed. Lethal control was the dependent variable; humaneness, attitudes towards wolves, individual threat, and industry threat were the independent variables. Because variations in lethal control were not expected to be directly related to group membership, two analyses -- one for the general public and one for the NWWPS -- were conducted.[8]

Results of the evaluation of assumptions led to the transformation of the dependent variable (lethal control) and one of the independent variables (humaneness) to improve the normality and homoscedasticity of residuals. For both groups (general public ard NWWPS), a logarithmic transformation was applied to lethal control. A logarithmic transformation was also used for humaneness in the NWWPS analysis, while a square root transformation was used in the general public analysis.

The results of the analyses are presented in Table 4.15. R for each regression was significantly greater than zero [General Public: F (4, 351) = 149.50; $p < .00005$; NWWPS: F (4, 113) = 34.23; $p < .00005$]. In both analyses, only two of the independent variables contributed significantly to variation in the dependent variable: attitudes towards wolves; and (transformations of) humaneness. In both cases, (the square

[8]A *post hoc* analysis of covariance provided no evidence that group membership contributed directly to variation in assessments of the overall acceptability of lethal wolf control techniques (p = .815)

root or the log of) humaneness was more strongly related to lethal control than was attitudes towards wolves.

TABLE 4.15
HYPOTHESIS 11: REGRESSION COEFFICIENTS

General Public			
Variable	**B**	**β**	**sr^2**
Industry Threat (INDT)	-.003	-.032	.00 (p = .5487)
Individual Threat (IVT)	.004	.029	.00 (p = .5768)
Humaneness* (HMN)	.166	.629	.29 (p < .00005)
Attitudes Toward Wolves (WLF)	-.009	-.266	.05 (p < .00005)

R = .79

R^2 = .63

Adjusted R^2 = .63

	LC**	INDT	IVT	HMN
INDT	.25			
IVT	.30	.58		
HMN	.71	.26	.28	
WLF	-.53	-.48	-.45	-.46

**Lethal Control

*Square root transformation of humaneness

NWWPS			
Variable	**B**	**β**	**sr^2**
Industry Threat (INDT)	.001	.013	.00 (p = .8999)
Individual Threat (IVT)	.003	.026	.00 (p = .8162)
Humaneness* (HMN)	.561	.575	.22 (p <.00005)
Attitudes Towards Wolves (WLF)	-.009	-.237	.04 (p = .0029)

R = .74

R^2 = .55

Adjusted R^2 = .53

	LC	INDT	IVT	HMN
INDT	.13			
IVT	.32	.58		
HMN	.74	.13	.25	
WLF	-.[illegible]	-.17	-.26	-.52

*Log transformation of humaneness

Tested *a priori*, bivariate analyses indicated that individual threat and industry threat were both significantly related to lethal control (see Table 4.16). These relationships are probably the indirect result of the

association between attitudes towards wolves, and these two variables.

TABLE 4.16
CORRELATIONS BETWEEN WOLF THREAT AND LETHAL CONTROL

General Public		
Variable	**Pearson's r**	**Prob-value***
Industry Threat	.24	<. 0005
Individual Threat	.20	< .0005
NWWPS		
Variable	**Pearson's r**	**Prob-value***
Industry Threat	.16	.037
Individual Threat	.27	.001
*Based on one-tailed tests		

Hypothesis 12: Assessments of the overall humaneness of lethal wolf control techniques will be negatively related both to attitudes towards wolves and to ecological orientation.

The data do not fully support the hypothesis.

A standard multiple regression was performed with humaneness as the dependent variable and attitudes towards wolves and ecological orientation (NEP) as independent variables. Because group membership was not expected to be directly related to humaneness, two separate analyses were undertaken: one for the general public; the other for the NWWPS. Evaluations of assumptions were satisfactory.

Table 4.17 displays the result of the analyses. *R* for both regressions was significantly greater than zero [General Public: F (2, 359) = 47.79; p < .00005; NWWPS: F (2, 118) = 22.16; p < .00005]. In both cases, the independent variable

(attitudes towards wolves) was significantly related to humaneness (zero-order correlations between humaneness and attitudes towards wolves are presented in Table 4.18).

TABLE 4.17
HYPOTHESIS 12: REGRESSION COEFFICIENTS

General Public			
Variable	**B**	**β**	**sr^2**
Ecological Orientation (EO)	-.044	-.048	.00 (p = .3939)
Attitudes Towards Wolves (WLF)	-.385	-.431	.13 (p <.00005)
R = .46		HMN*	EO
R^2 = .21	EO	-.26	
	WLF	-.46	.53
Adjusted R^2 = .21	*Humaneness		

NWWPS			
Variable	**B**	**β**	**sr^2**
Ecological Orientation (EO)	-.094	-.110	.01 (p = .2981)
Attitudes Towards Wolves (WLF)	-.574	-.589	.19 (p <.00005)
R = .54		HMN*	EO
R^2 = .30	EO	-.29	
	WLF	-.52	.66
Adjusted R^2 = .29	*Humaneness		

TABLE 4.18
CORRELATIONS BETWEEN HUMANENESS ATTITUDES TOWARDS WOLVES

Group	Pearson's r	Prob-value*
General Public	-.46	< .0005
NWWPS	-.52	< .0005
*Prob-values based on one-tailed tests		

However, ecological orientation was not significantly related to humaneness, although bivariate correlation analyses indicated a statistically significant relationship between the

two variables in both sample groups (see Table 4.19). It appears then that the relationship between humaneness and ecological orientation is an indirect result of the relationships between humaneness, attitudes towards wolves and ecological orientation.

TABLE 4.19
CORRELATIONS BETWEEN HUMANENESS AND ECOLOGICAL ORIENTATION

Group	Pearson's r	Prob-value*
General Public	-.26	< .0005
NWWPS	-.29	< .0005
*Prob-values based on one-tailed tests		

Revisions to the Conceptual Models

Based on the statistical analyses outlined above, several modifications to the conceptual models presented in Chapter 2 were required. Three relationships were deleted from Model A (Nonranchers): industry wolf threat and lethal control; individual wolf threat and lethal control; and ecological orientation and humaneness. In Model B (Ranchers), the relationship between industry wolf threat and lethal control was eliminated. The revised conceptual models are presented schematically in Figures 4.1 and 4.2.

Formal causal modeling was not attempted in the analyses because of the strong likelihood of reciprocity between some of the variables. This would necessitate the development of a nonrecursive model. However, the data set for this study does not meet the criteria for a nonrecursive model.

The results of the analyses discussed in this chapter will be presented in summary form in the appropriate context in Chapter 5.

MODEL A - REVISED:

INSTITUTIONAL ADJUSTMENTS - NONRANCHERS

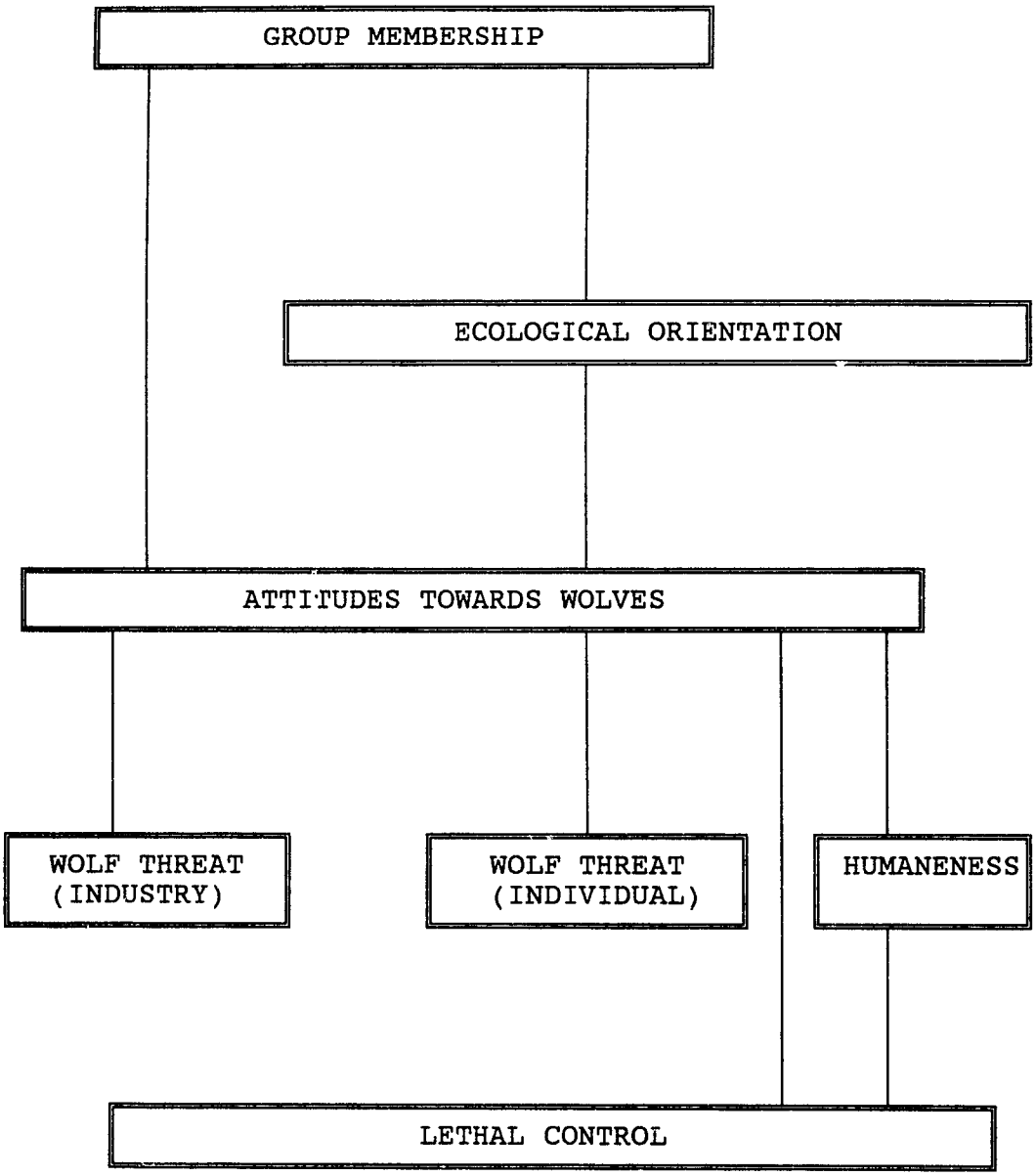

FIGURE 4.1

MODEL B - REVISED:

INSTITUTIONAL ADJUSTMENTS - RANCHERS

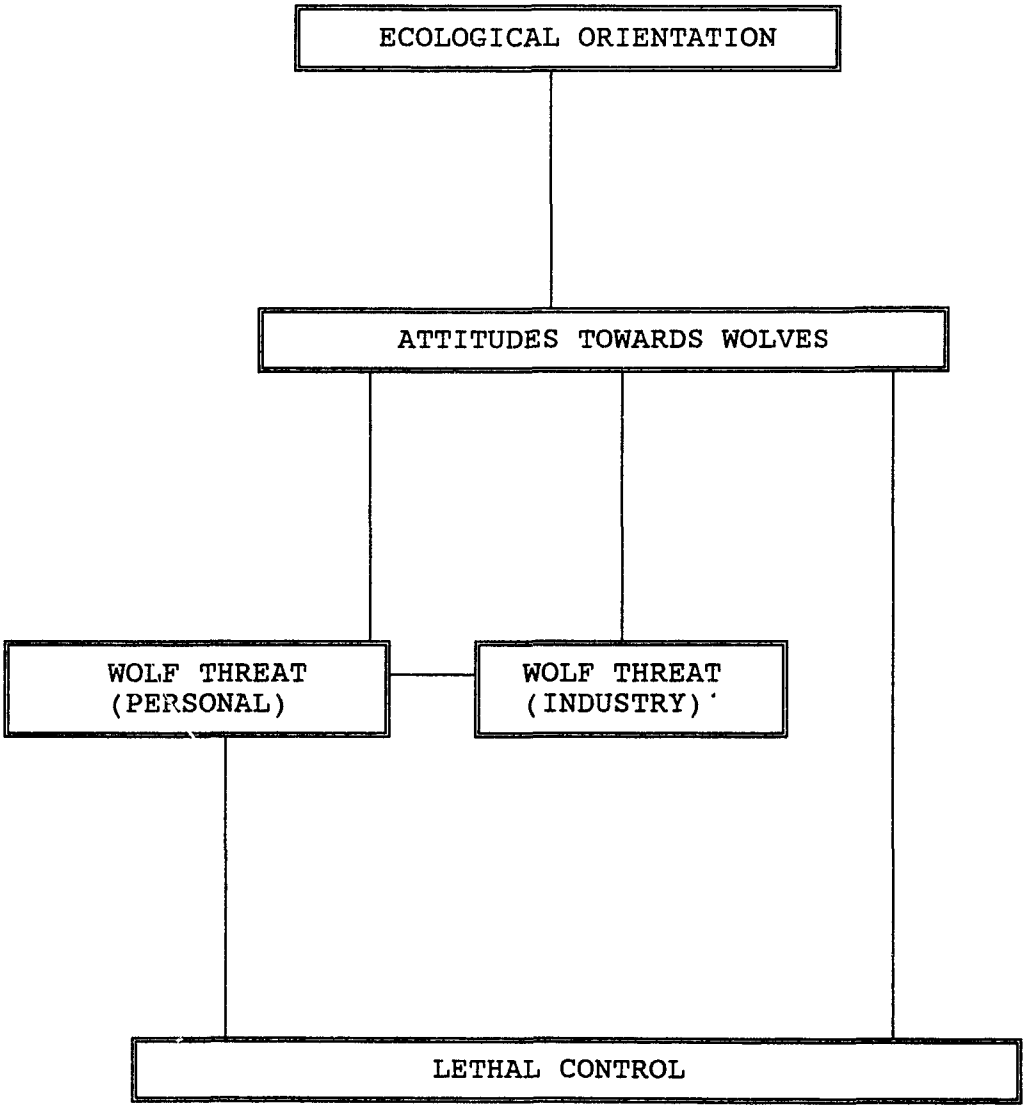

FIGURE 4.2

CHAPTER 5

NATURE OF THE HAZARD, HAZARD PERCEPTION, AND HAZARD ADJUSTMENTS

Nature of the Hazard

Insufficient data are available to assign precise probability statements to the risk of livestock predation by any given species at a particular time and in a specific place. Nonetheless, a general picture of the relative level of risk may be determined by examining the spatial, temporal, and species distribution of livestock predation and its economic impacts on the cattle industry in the Province.

Spatial Distribution of Livestock Predation

Most losses occur where livestock are most likely to encounter wild predators: i.e. on the margins of agricultural regions, at the forest-grassland interface (Tompa, 1983b); and on the open range (see Table 5.1). As one would expect, losses tend to be lower on fenced land located near agricultural buildings and human activity.

Data concerning the regional distribution of livestock predation are sketchy, but information collected by the BCCA indicates considerable spatial variation in cattle losses (see Table 5.2). These data show that predation losses in 1986 and 1987 were highest in the Cariboo and Thompson-Okanagan regions. A similar pattern of predation losses emerged in the

TABLE 5.1
CATTLE LOSSES IN 1987
(1986 Figures in Parentheses)

Cause	Inside Fenced Land		On Range		Total
	Grown Stock	Calves	Grown Stock	Calves	
Suspected Theft	37 (49)	17 (63)	170 (142)	312 (144)	536 (398)
Hunters	16 (8)	4 (7)	21 (22)	54 (31)	95 (68)
Road Accidents	25 (9)	9 (9)	37 (21)	80 (28)	151 (92)
Predators*	29 (24)	148 (147)	80 (76)	244 (313)	501 (560)
Bog Holes, Drowning	94 (149)	38 (60)	105 (61)	32 (13)	269 (283)
Other: Sickness, Accident	997 (855)	1535 (1521)	220 (171)	163 (134)	2915 (2681)
Unknown	151 (233)	277 (362)	454 (318)	391 (463)	1273 (1377)
TOTAL	1349 (1352)	2028 (2170)	1087 (811)	1276 (1126)	5740 (5449)

*Some of these losses may have been caused by domestic dogs.
Based on 1209 returns in 1987, 1128 in 1986. Approximately 2000 ranchers belong to the B.C.C.A.
(Source: Beef in B.C., Sept/Oct 1988)

survey for this study (see Table 5.3). This pattern is probably attributable, in part, to variations in livestock and predator densities, but as Hatler (1981) observes, there is no simple one-to-one relationship between predator numbers and the number of livestock losses. For reasons that are not well understood, some predators develop an appetite for domestic livestock while others do not. Consequently, two ranchers

both operating in regions of high predator densities and employing similar husbandry practices may have vastly different experiences with predators. One may encounter few difficulties, the other, chronic problems. Hatler also points out that variations in management practices may play a far more important role in determining the number of predation losses than predator numbers.

TABLE 5.2
SPATIAL DISTRIBUTION OF PREDATION LOSSES IN 1986 - 1987

Region	1986	1987
Coast*	6	1
Thompson-Okanagan	104	116
Kootenay	8	8
Cariboo	310	204
Central**	63	92
Peace River	69	80
TOTAL	560	501

*Vancouver Island and Lower Mainland

**Vanderhoof/Prince George/Bulkley Valley

Source: Beef in B.C. Sept/Oct 1988

Temporal Distribution of Livestock Predation

Temporally, livestock predation is more likely to occur in spring or in summer, although it does occur throughout the year (Tompa, 1983b). This seasonal variation correlates with the seasonal distribution of livestock and predators. During

fall and winter, most stock are quartered near farm buildings in fenced pastures or winter feedlots. In spring, most are turned out to pasture, many grazing on remote sections of private or leased land, forest grazing permit areas, and community pastures, where surveillance may be less frequent and predator numbers greater.

TABLE 5.3
SPATIAL DISTRIBUTION OF PREDATION LOSSES 1989

Region	Species				Total
	Wolf	Coyote	Bear	Other	
Coast*	0	28	2	2	32
Thompson-Okanagan	17	71	11	20	119
Kootenay	0	45	6	3	54
Cariboo	70	14	20	20	124
Central**	2	5	1	1	9
Peace River	30	10	8	1	49
TOTAL	119	173	48	47	387

*Vancouver Island and Lower Mainland

**Vanderhoof/Prince George/Bulkley Valley

NOTE: Does not include reported losses for which respondent did not report location of cattle operation.

Source: This study

Species Distribution of Livestock Predation

Although ranchers surveyed in this study indicated that coyotes were responsible for the greatest number of livestock losses in 1989, data on *confirmed* losses for the years 1985 to

1990 supplied by the B.C. Wildlife Branch suggest that generally wolves are responsible for more livestock losses than coyotes. The mean for wolves for the six-year period was 166.8; the mean for coyotes 133.5 (see Table 5.4).

TABLE 5.4
CONFIRMED LIVESTOCK LOSSES BY PREDATOR SPECIES 1985 - 1990*

Species	1985	1986	1987	1988	1989	1990	Total	Mean
Black Bear	56	48	42	42	20	18	226	37.6
Grizzly Bear	2	11	2	10	12	8	45	7.5
Bears (Total)	58	59	44	52	32	26	271	45.0
Cougar	112	119	30	52	34	35	382	63.6
Coyote	135	100	119	150	131	166	801	133.5
Wolf	189	145	293	166	104	104	1001	166.8
TOTAL	494	423	486	420	301	331	2455	409.2

*Major livestock killed and mauled (poultry and rabbits excluded).

Source: B.C. Wildlife Branch

There is also some evidence that certain raptors may occasionally attack newborn calves. A few respondents to the survey claimed that they have had problems with ravens and eagles.[1] A cattle owner provided *Country Life* (July 1983; 31)

[1]According to Wade and Bowns (1983) both bald eagles and golden eagles have been known to prey on domestic livestock, but usually golden eagles are responsible. O'Gara (1978) documents heavy predation on sheep near Dillon, Montana where 44 lambs were killed by golden eagles near the end of the lambing season in 1974.

with the following graphic account of a raven attack on two newborn calves:

> When [the cow] was in labour, the ravens attacked and killed the first calf by pulling out its tongue and pecking out its eyes. The cow tried to protect the first calf and the same procedure was repeated with the second calf. When we reached the area, an estimated 20 to 30 of the birds were driving the cow frantic.

Livestock predation by eagles or ravens is, however, believed to be quite rare (Saunders, 1991).

The Economic Impacts of Livestock Predation

Although the precise economic impact of livestock predation on the B.C. cattle industry is difficult to gauge, it is quite clear that it is greatly overshadowed by other problems. Ranchers surveyed by the B.C. Cattlemen's Association reported that sickness and accidents took far more livestock than predators in 1986 and 1987 (see Table 5.1). It is also worth noting that approximately 34 percent of the ranchers responding to the survey for this study indicated that they had *never* had cattle killed, injured or harassed by predators.

The losses attributed to predators in the BCCA survey accounted for 8.7 percent of the total losses in 1987 and 10.3 percent in 1986. If these figures are reasonably accurate, predation contributed a total of $250,500 in losses in 1987 to

the 1,209 ranchers responding to the survey.[2] Extrapolating these figures to the (approximately) 6000 cattle farms in the Province, in total, ranchers lost 2486 cattle to predators in that year.[3] This represents financial losses slightly in excess of $1.24 million, approximately 0.7 percent of the 1987 provincial cash receipts ($186 million) for beef cattle. However, similar calculations for sickness and accidents yield losses in excess of $8.27 million for 1987, with these two factors accounting for 58.1 percent of the losses in that year.

Calculations based on livestock losses confirmed by the provincial Wildlife Branch yield even smaller and undoubtedly very conservative estimates (see Table 5.4). With confirmed predation mortality of 486 livestock in 1987, independently verified financial losses were approximately $243,000. However, this figure is certainly too low. In a study of cattle mortality in northwestern Alberta, Bjorge (1983) reports that cattle killed or dying from predation are more difficult to discover than cattle killed or dying from other causes, because predators, particularly wolves, often completely consume the carcasses. Therefore, some of the cattle that go missing each year and whose remains are never

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[2]This figure is based on a nominal price of $500 per animal suggested by Lorne Leach, Secretary-Manger, B.C. Cattlemen's Association in a personal communication.

[3]Extrapolating from data is always precarious, so these estimates must be treated with extreme caution.

discovered have undoubtedly been killed by predators. In addition, many ranchers prefer to handle their own predator problems by trapping and hunting (Saunders, 1991). In fact, more than 55 percent of the ranchers surveyed in this study who indicated that they have had problems with predators stated that they had never contacted the Wildlife Branch for assistance with predators. This suggests that more than half the suspected cases of livestock harassment or predation go unreported to the provincial agency. Moreover, many predator complaints certainly involved the loss of more than one animal. Information supplied by the B.C. Wildlife Branch indicates that from 1985 to 1990, confirmed livestock losses were, on average, 57 percent higher than the number of complaints. In general then, actual losses are probably at least twice as high as those confirmed by the Wildlife Branch and may be reasonably close to the figures reported by ranchers themselves in the BCCA survey. Even so, predation losses are clearly less significant than many other causes of livestock mortality.

In spite of the uncertainty over the precise economic impact that predation has on the cattle industry in British Columbia, there is no evidence to indicate that it poses a serious threat to its survival (Saunders, 1991). Nevertheless, it can take a severe toll on individual livestock producers (Tompa, 1983b). For example, losses in the neighbourhood of 40 animals per year have been reported (Kamloops News, Aug.

12, 1985). Two of the ranchers surveyed in this study reported losing 20 animals in 1989, and one reported losing 23. (Predation losses in 1989 reported by ranchers surveyed in this study are displayed in Table 5.5.) One rancher living in the Williams Lake area wrote describing chronic problems with predators:

> We gave up crown range two years ago due to loss of cattle to wolves and bears. Since 1968, the predators have increased along with our losses. 1968 to 1970 we lost 3-4 cows and 5-6 calves per year. 1970 onward losses started to increase to devastation in 1977 with the loss of 31 cows and yearling heifers and no accurate count on calf losses. From 1980-88 losses averaged 8-10 cows and yearlings and 10 calves per year. A rough total since 1968 would be approximately 200 cows and yearlings and 300 calves. . . . We had to give up our range and pasture our cows on our hay fields; thus we have no hay to put up for winter feeding; therefore we have to buy over 150 tons of hay making our operation less feasible and very costly all due to predator problems.

Losses of these magnitudes can be very serious for ranchers, particularly those with small herds and relatively small incomes. In fact, according to Tompa (1983b), most predation losses attributed to wolves occur on the margins of agricultural regions and tend to affect livestock owners with low to moderate farm incomes. Tompa attributes this tendency to the fact that ranchers with high incomes tend to be better situated and are able to hire riders and employ other preventative measures, e.g. electric fencing, guard dogs, and adequate feed supply, thereby reducing predation losses.

TABLE 5.5
CATTLE LOSSES BY PREDATION IN 1989*

No. of Livestock	Absolute Frequency	Relative Frequency
0	227	71.0%
1	24	7.4%
2	33	10.2%
3	12	3.7%
4	5	1.6%
5	4	1.2%
6	3	.9%
7	1	.3%
8	3	.9%
10	2	.6%
13	1	.3%
14	1	.3%
15	1	.3%
16	1	.3%
20	2	.6%
23	1	.3%

*Includes pretest data.

The comments of the Select Standing Committee on Agriculture (1979) provide a convenient summary of the economic impact of livestock predation in the province:

> Predators do not place effective limits on [cattle] production in the Province. In most . . . cases, although predation may cause highly visible losses and engender strong emotional reactions, it does not impose real limits to production.

A similar assessment was offered by a spokesperson for the B.C. Federation of Agriculture:

> Though the numbers of cattle or sheep killed are small when compared to total provincial livestock numbers they are unacceptably high in relation to individual operators (*Country Life*, Aug, 1983).

The use of rancher surveys and anecdotal data supplied by livestock owners to estimate predation losses raises an issue that has been the focus of considerable debate. There appears to be widespread reluctance to place any credence in stock producers' quantitative estimates of predation mortality (O'Gara, 1982). For example, Amory (1974: 348) writes:

> . . . any man who would swear under oath that he had lost three hundred sheep or goats to coyotes in one year was a man to whom, at the very least, I'd like to address a few questions. The first of these is how many sets of books he keeps. I presume, like some ranchers, he keeps one for himself and another for the coyotes.

Amory's accusation might be dismissed as the ravings of a radical animal rights activist, but even the prestigious Cain Committee, commissioned by the Secretary of the Interior in 1971 to review the predator control program conducted by the U.S. Fish and Wildlife Service (Wade, 1981), rejected the results of Reynolds and Gustad's (1971) study, a study based on questionnaires sent to a random sample of ranchers. Reynolds and Gustad concluded that annual predation losses averaged approximately 5 percent of the total sheep inventory in the American West. Commenting on this study, Cain *et al.* (1972: 25) stated that:

> . . . similar and even more inflated figures have been arrived at in calculations by the National Wool Growers Association. While there is no basis for accepting these figures, there is no accurate

source of information on which to make an objective evaluation.

However, several field studies have shown that, with normal levels of predator control in effect, minimum livestock losses range from 3.36 to 5.8 percent (Shelton, 1972; Klebenow and McAdoo, 1976; Taylor *et al.*, 1979) These studies suggest that, on the whole, ranchers do not grossly exaggerate their losses to predators. So while there is no doubt that some ranchers occasionally inflate their losses to predators, either out of ignorance or in a deliberate attempt to persuade government agencies to increase the level of predator control, there appears to be no compelling evidence that this is typical of ranchers. Indeed, the 1273 animals reported lost to unknown causes by members of the BCCA in 1987 (see Table 5.1) indicates that unexplained losses are not routinely ascribed to predators.

Perceptions of the Predator Threat

Although there is no convincing evidence that ranchers systematically inflate *numerical* estimates of predation losses, their *subjective* assessments of the seriousness of the predator threat are frequently difficult to reconcile with the view that predators do not impose significant limitations on cattle production in the province. Yet this is true, but to a lesser extent, of the general public as well.

Data from the questionnaire surveys indicated that ranchers were more likely than the general public to consider

predators (i.e. wolves, coyotes, and bears) moderate or serious threats to the cattle industry (see Table 5.6). Assessments of the threat that predators pose to individual cattle producers exhibited a similar pattern (see Table 5.7), although, in this case, ranchers' assessments more accurately reflect the real economic impact of predation on individual livestock producers than do the assessments provided by the general public.

TABLE 5.6
ASSESSMENTS OF THE PREDATOR THREAT TO THE CATTLE INDUSTRY

	General Public			Ranchers		
	Bears	Coyotes	Wolves	Bears	Coyotes	Wolves
No Threat	58.9%	44.7%	36.8%	32.4%	28.4%	15.4%
Slight Threat	7.9%	15.9%	24.0%	34.4%	37.6%	28.6%
Moderate Threat	1.6%	4.0%	7.0%	17.6%	17.3%	25.4%
Serious Threat	0.4%	1.3%	3.2%	3.6%	5.9%	19.3%
Don't Know	31.3%	34.1%	29.0%	12.1%	10.8%	11.3%

NOTE: Each of the differences in proportions between ranchers and the general public for each species and for the moderate and serious levels of threat is significant at $p < .002$ (two-tailed tests).

Mean assessments of the threat that wolves pose to the cattle industry as a whole varied significantly amongst the groups sampled independently of attitudes towards wolves (see Tables 4.9, 4.12). These results are consistent with the

availability and law-of-small-numbers hypotheses set out in Chapter 2.

Ranchers' assessments of the threat that wolves pose to the cattle industry were found to be positively related to their perceptions of the threat they pose to their own cattle operations and to their attitudes towards wolves.[4] These results are also consistent with the heuristics hypotheses noted above.

TABLE 5.7
ASSESSMENTS OF THE PREDATOR THREAT TO INDIVIDUAL RANCHERS

	General Public			Ranchers		
	Bears	Coyotes	Wolves	Bears	Coyotes	Wolves
No Threat	48.9%	23.0%	11.3%	17.8%	18.8%	8.9%
Slight Threat	16.4%	29.5%	37.4%	41.7%	38.0%	20.0%
Moderate Threat	3.6%	11.2%	20.2%	22.3%	24.6%	26.7%
Serious Threat	0.3%	1.9%	2.7%	9.7%	11.8%	36.2%
Don't Know	30.9%	34.5%	28.5%	8.4%	6.7%	8.3%

NOTE: With one exception each of the differences in proportions between ranchers and the general public for each species and for the moderate and serious levels of threat is significant at $p < .0005$. The difference in proportions for wolves at the serious level of threat is significant at $p = .017$. (P-values based on two-tailed tests.)

[4]Attitudes towards wolves was also found to be a reliable predictor of perceptions of the threat that wolves pose to individual livestock producers for all sample groups.

As expected, ranchers' assessments of the threat that predators pose to their own cattle operations exhibited significant spatial variation. A score for the overall predator threat, determined by summing the scores for each predator species, was calculated for each region (see Table 5.8).

TABLE 5.8
REGIONAL VARIATIONS IN PERCEPTIONS OF THE PREDATOR THREAT

Region	Means (Standard Deviations)			
	Wolves	Coyotes	Bears	Composite Score
Coast	1.12 (.55)	1.82 (1.07)	1.18 (.68)	4.12 (1.59)
Thompson-Okanagan	1.28 (.73)	1.88 (.97)	1.53 (.81)	4.69 (1.84)
Kootenay	1.63 (1.05)	2.17 (1.14)	1.62 (.88)	5.42 (2.37)
Cariboo	2.50 (1.28)	1.80 (.93)	2.09 (1.12)	6.39 (2.71)
Central	2.26 (.80)	1.90 (1.07)	1.84 (.95)	6.00 (2.49)
Peace River	2.56 (1.32)	1.68 (.90)	1.97 (1.05)	6.21 (2.90)

Based on the composite score, means for the Cariboo and the Peace River regions were significantly different from the means for the Coast and the Thompson-Okanagan regions. There were no significant regional differences in assessments of the coyote threat. Mean assessments of the bear threat for the Cariboo and Peace River regions were significantly

different from that of the Coast; assessments for the Cariboo and Thompson-Okanagan were also significantly different. Significant differences in the wolf threat are displayed in Table 5.9.[5] Wolves were considered to be a serious threat in five regions: Thompson-Okanagan (by 2 percent of the region's respondents), Cariboo (29.1 percent), Central (5.3 percent), and Peace River (39 percent). Coyotes were perceived to be a serious threat in all regions: Coast (by 21.4 percent); Thompson-Okanagan (8.2 percent); Kootenay (21.1 percent); Cariboo (5.[illegible] percent); Central (5.3 percent); and Peace River (5.3%). Bears were viewed as a serious threat in four regions: Coast (2.4 percent); Thompson-Okanagan (1 percent); Cariboo (13.2 percent); and Peace River (13.2 percent).

TABLE 5.9
SIGNIFICANT DIFFERENCES IN PERSONAL WOLF THREAT

	Coast	Thompson-Okanagan	Kootenay
Cariboo	*	*	*
Central	*	*	-
Peace River	*	*	*

*An asterisk indicates a significant difference in means based on Scheffé method of multiple comparisons with overall alpha = .05.

[5]The analyses noted above involved exploratory ANOVAs followed by pairwise comparisons using the Scheffé method of multiple comparisons, with an overall alpha level of .05. The ANOVA for coyotes did not reach significance. The ANOVAs for bears and wolves reached significance ($p < .00005$ in both cases). [$F(5, 271)$ for bears = 7.14; $F(5, 269)$ for wolves = 9.29]

Presumably, ranchers' assessments of the threat that predators pose to their own operations were based largely on evaluations of the risk of livestock death or injury, but several researchers (e.g. Hatler, 1981; Andelt, 1987) have suggested that harassment of livestock by predators may result in reduced weight gain and subsequent reductions in market value. Although the question has yet to be studied in a systematic way, many ranchers agree with the speculations advanced by Hatler and Andelt. Of the ranchers indicating that predators were a problem for them, approximately 64 percent believed the productivity of their livestock had been reduced by predator harassment. If there is, indeed, a relationship between weight reduction and harassment, conventional estimates of the economic impact of predation losses will need to be revised upwards.

In a much broader context, ranchers generally viewed predators as less important than a number of other problems they frequently encounter (see Table 5.10). Indeed, only two problems -- crop damage by wildlife, and losing cattle through accidents -- were rated by fewer ranchers as important or extremely important. A similar picture emerges from the analysis of *Country Life* and *Beef in B.C.* If one assumes that the amount of space devoted to a topic provides a (crude) measure of its importance, it is clear that predator problems are less important than other issues (see Tables 5.11 and

5.12). This seems to be true of farmers, in general, and ranchers, in particular.

TABLE 5.10
PROBLEM IMPORTANCE*

Problem	Proportion
Losing cattle to disease	91.3%
Loss of prime agricultural land to development	77.3%
Nonpoisonous weed infestations	77.3%
Theft of livestock	71.1%
Hunters and other recreationists trespassing on private land	71.0%
Drought	70.5%
Groundwater contamination	70.2%
Poisonous Plants	60.5%
Predators	57.1%
Losing cattle through accidents	56.2%
Crops damaged by wildlife	38.9%

*Proportion of respondents indicating that the problem was important or extremely important.

One additional matter related to ranchers' perceptions of the predator threat should be mentioned. Seventy-one percent of the ranchers responding to the question indicated that effective predator control was necessary for the survival of the cattle industry, whereas 48 percent stated that it was essential for the survival of their own livestock operations. It is difficult to assess the accuracy of these perceptions, but the tendency for ranchers to view predator control as more

important in general than for their own cattle operations may indicate that ranchers place more importance on predator control that the circumstances warrant.

TABLE 5.11
SPACE DEVOTED TO ENVIRONMENTALLY RELATED ISSUES IN *COUNTRY LIFE*

Topic	Proportion of Space Devoted to Issue*
Agricultural Land Reserve	22.6%
Pest Control	17.2%
Water Mgt./Water Pollution	9.1%
Weeds/Weed Control	7.5%
Soil Conservation	6.2%
Predators/Predator Control	4.9%
Problem Wildlife (Other than predators)	4.7%
Waste Management	4.6%
Forestry	3.1%
Range Management	3.0%
Organic Farming	3.0%
Energy Conservation/Policy	1.9%
Air Pollution/Acid Rain	1.8%
Sustainable Development	1.3%
Global Warming	1.3%
Multiple Use	1.1%
Other	6.7%

*Percentages based on the total space devoted to environmentally related issues.

TABLE 5.12
SPACE DEVOTED TO ENVIRONMENTALLY RELATED ISSUES IN *BEEF IN B.C.*

Topic	Proportion of Space Devoted to Issue*
Forestry	16.8%
Impact of ranching on the environment	16.2%
Weeds/Weed Control	15.3%
Energy Conservation	7.0%
Waste Management	6.5%
Predators/Predator Control	6.4%
Multiple Use	6.2%
Problem Wildlife (Other than predators)	5.8%
Water Management	4.6%
Outdoor Recreation	4.1%
Agricultural Land Reserve	2.3%
Other	4.3%

*Percentages based on total space devoted to environmentally related issues.

Ranchers' beliefs in the importance of control for the industry as a whole may derive from their awareness of severe losses incurred by some producers (Hatler, 1981). This is certainly consistent with the heuristics hypotheses. However, it may also stem from the marginal economic status of many cattle farms in the province, coupled with the uncertainties of the predator threat (Hoffos, 1987). For reasons that are not clearly understood, livestock predation does occasionally increase dramatically from one year to the next (Saunders, 1991). This may generate fears that, left

unchecked, predator numbers and hence predation may escalate out of control. At any rate, these data concerning the perceived importance of predator control certainly go a long way towards explaining livestock producers' responses to the (1978) moratorium on the use of compound 1080 (sodium monoflouroacetate) for predator control and the (apparent) widespread support for predator population control programs (see below for a more detailed discussion).

Attitudes Towards Wolves

As noted in the previous section, perceptions of the threat that wolves pose to the cattle industry and to individual ranchers were significantly and independently related to attitudes toward wolves. Several details concerning this particular variable merit further discussion.

During the past 65 years, there has been a marked increase in the attention paid to wolves in the media. This is evidenced by the number of newspaper items (i.e. articles, editorials, letters to the editor) that have appeared in the Victoria Colonist, the Vancouver Sun, and the Vancouver Province in recent decades. Table 5.13 displays the total number of wolf-related items that appeared during the period 1920 - 1985. Correlating the rank order of the number of items appearing each year since 1960 with the rank order of the dates gives a trend coefficient of .89 (Spearman's rho), indicating a strong overall trend from 1960-85 in the number

of wolf-related items. And there is little doubt that this trend has been accompanied by a shift in these attitudes.

TABLE 5.13
WOLF-RELATED NEWSPAPER ITEMS 1920 - 85:
VANCOUVER SUN, VANCOUVER PROVINCE, AND VICTORIA COLONIST

Time Period	Number of Items
1920-24	2
1925-29	2
1930-34	3
1935-39	23
1940-44	26
1945-49	25
1950-54	5
1955-59	8
1960-64	2
1965-69	17
1970-74	53
1975-79	115
1980-84	306
1985	42

This shift is reflected in the changing descriptions of wolves encountered in the Vancouver Sun. Prior to the 1960s, terms like "savage beasts," "ravenous beasts," "timber savages," "varmints," "bad men of the range" were commonly employed to describe wolves. In public discourse, there has been a marked tendency to replace these pejorative descriptions with expressions that either describe wolves in

relatively neutral terms -- e.g. "predators," "carnivores," "wild animals" -- or extol the animal's perceived virtues -- e.g. "beautiful," "friendly," "magnificent," "intelligent," "noble."

From 1920 through 1959, 72 percent of the descriptions encountered in the Vancouver Sun were clearly negative in character, none were unambiguously positive or neutral. About 28 percent of the references were difficult to classify. For example the term "beast," which occurred frequently, can refer to any animal other than a human being. Yet the word is often employed to refer to the perceived savage or brutal characteristics of the animals. Descriptions of the wolf since 1960 were easier to classify. Twenty percent were clearly negative, 40 percent clearly positive, and the balance neutral. The neutral category includes terms such as "predator," "wild animal," and "wild carnivore."

It is particularly noteworthy that references to wolves in *Country Life* since 1978 and *Beef In B.C.* since it began publication contained none of the pejorative expressions frequently encountered in the past. While this probably represents a determined effort to avoid controversy, it may also reflect changing attitudes in the agricultural community.

In this study, mean scores on the Wolf Attitude scale were 40.8, 34.4 and 28.38 (scale ranges from 11 to 45) for the NWWPS, the general public and ranchers respectively. Whilst nonranchers scored significantly higher than ranchers, 81.4

percent of ranchers exhibited positive or very positive attitudes towards wolves (see Table 5.14).

TABLE 5.14
ATTITUDES TOWARDS WOLVES EXPRESSED AS PERCENTAGES

	General Public	Ranchers	NWWPS
Very Positive*	87.5%	50.2%	100%
Positive	10.5%	31.2%	Nil
Negative	1.2%	13.0%	Nil
Very Negative	0.9%	5.7%	Nil

*Categories were determined by dividing possible scores on the scale into quartiles. Percentages are based on the complete wolf attitude scale.

However, there appears to be some reluctance to grant that the attitudinal shifts evident in the general population have also occurred in the ranching community. For example, in an otherwise thoughtful and provocative book, Berman (1989: 94) writes:

> . . . ranchers embody the anti-ecological thrust of the whole of modern, and especially recent history. They loathe coyotes, eagles, and bears, and favor extermination of all animals regarded as predators. The coyote is hated because it can outwit human beings, the eagle because of its power of flight, the bear for its elusiveness.

There is certainly some truth in Berman's observations. For example, 27.5 percent of the ranchers surveyed in this study indicated that they dislike or strongly dislike wolves; and 27.9 percent expressed similar feelings about coyotes (see Table 5.15). Kellert (1985) reports that approximately 58 percent of the cattle producers he surveyed indicated that

they slightly disliked, disliked, or strongly disliked wolves. And one of the ranchers surveyed in this study writes:

> There is not enough room for man and wolf. We protect the criminal in the animal society like we protect the criminal in our own society. There is little protection for gentle wildlife, and in our society there is little protection for gentleness and honesty.

Certainly strong antiwolf sentiment survives.

TABLE 5.15
RANCHERS' ANIMAL PREFERENCES: PREDATORS

	Wolf	Coyote	Black Bear	Grizzly Bear	Cougar
Strongly Dislike	11.7%	9.5%	6.3%	9.6%	4.8%
Dislike	15.8%	18.0%	11.0%	12.2%	15.8%
Neutral	31.1%	26.1%	28.3%	27.3%	26.5%
Like	26.4%	32.0%	35.7%	31.0%	33.1%
Strongly Like	15.0%	14.0%	18.8%	19.9%	19.9%

Percentages are based on item #13 in the wolf attitude scale. See Appendix B.

Unfortunately, Berman's comments obscure the fact that many ranchers *do* exhibit very positive feelings about predators. Forty-one percent of the ranchers surveyed in this study stated that they like or strongly like wolves; and 46 percent expressed similar feelings about coyotes. Kellert (1985) reports that about 30 percent of the ranchers he surveyed indicated that they slightly liked, liked, or strongly liked wolves.

TABLE 5.16
ANIMAL PREFERENCES EXPRESSED AS MEANS[1]

	General Public	Ranchers	NWWPS
Bat	4.6	4.6	4.7
Beaver	4.4	4.0	4.6
Black Bear	4.0	3.5	4.5
Caribou	4.3	4.3	4.6
Cougar	4.0	3.5	4.6
Coyote	3.6	3.2	4.3
Deer	4.6	4.6	4.7
Eagle	4.6	4.2	4.7
Elk	4.4	4.3	4.6
Gopher	3.7	2.8	4.3
Grizzly Bear	3.9	3.4	4.5
Muskrat	3.9	3.8	4.3
Otter	4.3	4.1	4.6
Rattlesnake	2.6	2.3	3.5
Squirrel	4.5	4.3	4.5
Wolf	3.8	3.2	4.6
Composite Score: Animal Preference Scale[2]	63.78 (s = 9.53)	58.47 (s = 10.68)	70.80 (s = 9.38)

[1]Based on a 5-point scale: 1 = Strongly dislike, 2 = Dislike, 3 = Neither like nor dislike, 4 = Like, 5 = Strongly Like.

[2]Following an ANOVA [$F(2, 786) = 68.02$, $p < .00005$] pairwise comparisons of the mean Animal Preference scores for the three groups were performed employing Scheffé's method of multiple comparisons with an overall alpha level of .01. Each of the comparisons reached significance.

The data collected in this study strongly suggest that ranchers' attitudes towards predators, and indeed all wildlife, rather than being monolithic, exhibit considerable

variation (see Tables 5.15 and 5.16). In light of these data, Bennett's (1969) observations appear to present a more accurate picture of ranchers' attitudes towards wildlife in British Columbia. Commenting on the attitudes of Jasper ranchers, he states:

> To the rancher, wild animals are . . . objects of sentimentality and nostalgia. The rancher is proud of the antelope that eat from his haystacks in the winter -- although he may complain to the game wardens if they eat too much! The rancher loves the howl of the coyote, but will not hesitate to shoot one if it steals chickens. Ranchers tolerate wild animals so long as they do not get out of hand (p. 93).

Attitudes towards wolves were independently related to ecological orientation and group membership, with members of the NWWPS exhibiting the most positive and ranchers the least positive attitudes. For ranchers, attitudes towards wolves were also independently related to their perceptions of the threat wolves pose to their own cattle operations. These results are consistent with the view that variations in self-interest and cultural heritage contribute to differences in attitudes towards wolves. Attitudes towards wolves were also related to a number of other variables, but these relationships will be examined below in the discussion dealing with adjustments to the hazard. Before turning to that task, however, a more detailed examination of ecological orientation which proved to be a reliable predictor of attitudes towards wolves is in order.

Ecological Orientation

A rancher from New Mexico poignantly expresses his feelings about the environment in these words:

> I am a rancher . . . and an environmentalist. There are groups within the environmental community that would consider those two designations a contradiction. However, I am concerned about the quality of water that I drink, and the safety of the foods that my family consumes. I am concerned about the quality of the air I breathe, as well as for the habitat that is impacted by my activities. As a rancher, my main source of income depends upon the quality and quantity of grass. It is a renewable resource that must feed my cows this year and into the foreseeable future (Jackson, 1989: 843).

These comments were made in the context of a debate over grazing on public lands in the United States, but they probably represent the views of many ranchers throughout North America, who frequently find themselves in conflict with environmental groups over the management and use of natural resources. In the United States, for example, a number of environmental groups are endeavouring to eliminate grazing from public lands, because it is, they claim, damaging range ecosystems. In British Columbia, conflicts have also emerged over the use of public lands. Recently, the Okanagan Green Party, supported by the Sierra Club, has attempted to prevent cattle grazing on crown lands near Penticton because, they believe, grazing activity is polluting the public water supply (*BIBC* May/June, 1990). These are but a few of the environmental conflicts in which ranchers are now embroiled.

But many ranchers appear to be genuinely bewildered by this conflict. Recently, the General Manager of the Canadian Cattlemen's Association expressed it this way:

> We are surprised to find ourselves coming under attack from a number of groups on environmental issues. The cattle producer has considered him or herself as a leader in the environmental field. Through their organizations they have participated in many processes to ensure policies are in place to conserve our soils, our grasslands, wildlife habitat, the purity of our water supply, and the careful management of waste. Individually they are working to apply these practices to their own operations (Laycraft, 1990: 2).

The degree to which ranchers actually conform to the portrait painted by Laycraft cannot be determined on the basis of available information. But the views about the environment expressed by both Laycraft and Jackson are certainly consistent with the data compiled in this study. It is true that, of the three groups sampled in this study, ranchers scored lowest on the NEP scale. The mean scores for ranchers, the general public, and the NWWPS were 36.36, 39.47 and 43.53 respectively.[6] However, these scores represent acceptance of the NEP for each of the groups. Indeed, only 2.3 percent of the NWWPS, 4.2 percent of the general public, and 15.7 percent of ranchers rejected the NEP.

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[6]The means are significantly different ($p < .00025$; $\eta^2 = .168$). With 12 items on the scale, possible scores range from 12 to 48. A score of 30 or less indicates rejection of the NEP, a score greater than 30 indicates acceptance.

A similar pattern emerged for the NEP sub-scales (see Table 5.17. Whilst the general public scores for each sub-scale were significantly greater than those for ranchers, ranchers' scores indicate an acceptance of the NEP for each dimension of the scale. Scores for both groups were highest for the "Balance of Nature" sub-scale and lowest for "Humanity Over Nature," indicating, perhaps, some utilitarian tendencies in both groups.

TABLE 5.17
ACCEPTANCE OF NEP SUBSCALES

Subscale	General Public	Ranchers	t	P-value
Balance of Nature	13.96 (s = 1.84)	12.99 (s = 2.23)	5 80 (df = 458)	<.0005
Limits to Growth	13.04 (s = 2.23)	11.91 (s = 2.69)	5.54 (df = 444)	<.0005
Humanity Over Nature	12.76 (s = 2.26)	11.79 (s = 2.34)	5.11 (df = 622)	<.0005

Table 5.18 compares the overall mean NEP scores for each of the three groups sampled in this study with those of commercial fishermen, Greenpeace members and the general public in British Columbia (Edgell and Nowell, 1989), an environmental group and the general public in Washington (Dunlap and Van Liere, 1978), and farmers and urban dwellers in Iowa (Albrecht *et al.*, 1982). These studies show a remarkably high degree of support for the NEP by the general

public. It is also worth noting that ranchers compare very favourably with farmers in the Iowa study and the general public in the Washington study. However, both of these studies were conducted over ten years ago; so it is possible that environmental attitudes in Washington and Iowa have changed significantly in the interim.

TABLE 5.18
MEAN NEP SCORES OF SAMPLE GROUPS

Study	Sample Group	Mean
British Columbia (This study)	NWWPS (N = 129)	43.5
	General Public (N = 413	39.4
	Ranchers (N = 259)	36.0
British Columbia (Edgell and Nowell, 1989)	Greenpeace (N = 64)	44.4
	General Public (N = 306)	39.6
	Commercial Fishermen (N = 190)	25.2
Washington (Dunlap and Van Liere, 1978)	Environmental Group (N = 407)	44.4
	General Public (N = 806)	36.0
Iowa (Albrecht et al., 1982)	Urban Dwellers (N = 407)	38.4
	Farmers (N = 348)	34.8

Adjustments to the Hazard

Several of the cognitive variables discussed above -- e.g. attitudes towards wolves, ecological orientation, and perceptions of the wolf threat -- were found to be directly or indirectly related to the perceived acceptability or use of various adjustments to the predator hazard. The examination of these relationships that follows will be divided into two

major sections: one dealing with individual adjustments, the other with institutional adjustments. In each case, the discussion will begin with a review of the theoretical, practical, and actual range of choice, with considerable emphasis being placed on the effectiveness of the alternatives. This review will be followed by an examination of a number of cognitive aspects of predator control and livestock predation prevention.

Individual Adjustments to the Predator Hazard

Numerous management options are available to ranchers who raise livestock in areas where predators pose a potential threat. These measures may be classified as lethal or nonlethal.

Lethal Procedures

Several lethal measures may be taken to control predators. Provincial legislation permits livestock owners to shoot wildlife caught in the act of attacking their animals (1979 Wildlife Act).[7] Permits may also be issued to ranchers to destroy certain predators that have previously been caught in the act of attacking livestock on private or leased land. However, these permits are valid only for the site of a

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[7]The policies of the Provincial government concerning measures that may be taken by the individual livestock owner are based on the B.C. Procedure Manual for the Management of Problem Predators.

confirmed livestock kill or injury and for a limited time, a time deemed appropriate to the resolution of the local problem. Such permits are not issued for grizzly bears, cougars, or any threatened species, although cougars and grizzly bears -- as well as black bears, coyotes, and wolves -- may be harvested as game animals in certain regions of the province. Ranchers must adhere to bag limits for these species set out in the Provincial hunting and trapping regulations. Several respondents to the survey indicated that they occasionally alert hunters and trappers to the location of previous predator sightings as well. Aside from population reductions that may occur through the elimination of "problem" animals and by hunting and trapping under provincial regulations, livestock owners are not permitted to engage in predator population reduction programs. And finally, ranchers may call on the Wildlife Branch for assistance when their livestock have been harassed, injured, or killed by predators.[8]

Nonlethal Procedures

In addition to the lethal procedures outlined above, a number of nonlethal prevention measures may be utilized by the livestock owner (Tompa, 1983b). These include the proper disposal of animal carcasses that may attract predators;

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[8]The procedures followed by the Wildlife Branch, as well as several other institutional alternatives, are discussed below.

locating calving grounds near buildings and away from remote areas; and adequate surveillance, particularly on the open range. Many of these measures are considered responsible animal husbandry practices under any conditions, but take on greater importance where predation may be a problem.

Hatler (1981) indicates that several other husbandry-related practices -- malnutrition of stock, early turn-cut on summer ranges following de-horning and castration, and the aggressiveness of certain cattle breeds -- may have an influence on predation losses. Hatler believes very strongly that early turn-out of newborns and calving on remote summer ranges are faulty practices and comments that ". . . rather than considering such 'expected' calves as losses when they do not show up in the fall, they should be considered bonuses, if they do" (p. 60). Cows in the act of giving birth are particularly vulnerable to predator attack, as are newly or partially born calves. Calving on the range can be prevented by conducting pregnancy tests prior to turn-out in the spring and delaying turn-out of calves until they are more robust (Tompa, 1983b).

Several studies indicate that electric fences significantly reduce *coyote* predation (see e.g., deCalesta and Cropsey, 1978; Gates *et al.*, 1978; Thompson, 1979; Wade, 1982). However, fences can be costly to erect and maintain, and predators can gain access to pastures by digging under or jumping over fences or going through damaged or malfunctioning

fences (Andelt, 1987). In spite of these difficulties, studies by deCalesta and Cropsey (1978), Dorrance and Bourne (1980), and Linhart *et al.* (1982) indicate that electric fences can be a cost-effective means of preventing coyote predation.

The effectiveness of electric fencing for preventing predation by other animals has apparently not been studied in a systematic way. Nevertheless, Gipson (1983) states that electric and netwire fences offer some protection against wolves; and Boddicker (1983) claims that heavy woven wire fences are effective against black bears, whilst electric fences also offer some protection.

Numerous studies (see e.g. McGrew and Blaskey, 1982; Pfeifer and Goos, 1982; Green *et al.*, 1984; Black and Green, 1985) have shown that livestock guardian dogs provide effective protection against coyotes. For example, in a survey of 36 dog owners in North Dakota, Pfeifer and Goos (1982) found that guard dogs reduced predation by 93 percent. Green *et al.* (1984), reporting on a survey of 40 dog owners, noted that guard dogs saved an average of 68 head of sheep per owner, valued at an average of $3,836 annually. Taking into account purchase and maintenance costs, Green *et al.* (1984) concluded that guard dogs are a cost-effective means of reducing coyote predation. There is, however, no convincing scientific evidence of their effectiveness against larger predators such as bears and wolves. However, a study

sponsored by the Ministry of the Environment is now under way in British Columbia, which may provide some answers in this regard (Archibald, 1991).

There is also some evidence that aggressive livestock such as llamas, burros, donkeys, and billy goats may provide some protection against coyote predation (Green, 1982), although their effectiveness has not been demonstrated in controlled field research (Andelt, 1987).

Several frightening devices have been successfully employed to reduce or prevent coyote predation. Portable battery-operated strobe-lights and siren devices have been developed and tested by the U.S. Fish and Wildlife Service and have been found effective in reducing coyote predation in relatively small pasture areas. The principal disadvantage of the devices is that coyotes eventually become habituated to the noise and lights, although by emitting a varying and irregular sequence of light and sound from different directions the period of repellency is prolonged (Linhart, 1984). In ten trials, the original prototype devices provided an average of 53 nights of protection, while newer models protected pastured animals for an average of 91 nights (Andelt, 1987).

Another device, called the gas exploder, has also been used to temporarily deter coyotes from attacking domestic stock (Andelt, 1987). This portable device produces loud explosions, similar to rifle or shotgun blasts, that frighten

coyotes from the vicinity. Gas exploders deterred coyotes from preying on domestic sheep for an average of 31 days on 30 ranches in North Dakota (Pfeifer and Goos, 1982).

Strobe-lights, sirens, and gas exploders are useful in deterring predation around lambing or calving operations. They also give ranchers or wildlife officials additional time to locate offending coyotes thereby increasing the effectiveness of ground-control techniques such as trapping, hunting, and poison baiting (Ibid.).

In summary, a wide variety of measures designed to reduce or prevent livestock predation are theoretically available to the cattle producer. However, there is very little controlled scientific research to prove that any of them provide effective protection against bear, cougar, and wolf predation. This is due, no doubt, to the fact that most of the research, by far, has been conducted in the United States where the major concern is coyote predation. Nevertheless, it is widely accepted that practices such as the proper disposal of animal carcasses, surveillance on the range, and locating lambing and calving grounds away from remote areas significantly reduce predation. The matter is well summed up by Tompa's (1983b: 116) comments concerning animal husbandry and wolf predation:

> More research is required to clarify the role of animal husbandry practices in wolf-related stock mortality, but it seems common sense to conclude on the basis of available information that preventive husbandry practices may go a long way toward reducing stock losses to wolves as well as to other mortality factors.

Indeed, Hatler (1981) believes that it is possible for ranchers to build herds that are nearly predator-proof; whether this would be economically feasible for all ranchers is another question.

Responses to the questionnaire survey provided some interesting data with respect to individual adjustments to the predator hazard. Of those ranchers who stated that they have had problems with predators, approximately 44 percent indicated that they had contacted the B.C. Wildlife Branch for assistance in dealing with predators. In addition, ranchers listed over 20 different measures that they believe could be effectively employed to reduce livestock predation (see Table 5.19).[9] Ranchers clearly showed a greater awareness of lethal control measures, which are also utilized to a greater degree than nonlethal techniques. This emphasis on lethal control is no doubt due, in part, to the fact that historically the preferred method of dealing with livestock predation has been to destroy predators. But it may also reflect ignorance of some the effective nonlethal techniques or a lack of confidence in their effectiveness. However, it should be noted that these figures may well provide a conservative estimate of the degree to which these

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[9]Recall that ranchers were asked in the questionnaire survey to indicate whether they were aware of any effective techniques that ranchers had used to protect their livestock from predators and, if so, whether they utilized any of them in their own cattle operations.

TABLE 5.19
INDIVIDUAL ADJUSTMENTS TO THE PREDATOR HAZARD

Procedure	Aware*	Utilize**
Lethal Measures		
Shoot/Hunt	52.7%	52.0%
Trap	13.1%	10.1%
Poison	11.8%	10.1%
Destroy Predators (Method Not Specified)	5.1%	4.2%
Hire Trappers/Hunters	3.4%	3.4%
Snares	2.5%	2.5%
Notify Hunters/Trappers of Predator Locations	1.7%	1.7%
Post Bounties	0.8%	0.0%
Nonlethal Measures		
Patrolling/Supervision	16.5%	14.8%
Guard Dogs	12.7%	8.9%
Proper Disposal of Animal Carcasses	10.5%	9.3%
Fencing	4.6%	2.5%
Avoid Problem Areas	3.0%	1.7%
Avoid Early Turn-out of Calves	2.1%	2.1%
Maintain Healthy Herd/Don't Turn Out Sick Animals	1.7%	1.7%
Pen Animals at Night	1.7%	1.7%
Raise Aggressive Cattle	1.3%	1.3%
Prey Habitat Enhancement	1.3%	1.3%
Shoot to Frighten	0.8%	0.8%
Proper Husbandry (Methods Not Specified)	0.8%	0.8%
Other* **		
Hang Up Raven Carcasses	0.8%	0.8%
Participate on Wildlife Committee	0.4%	0.4%

*Proportion of ranchers who listed these measures as effective. Proportions are based on the number of ranchers who indicated that predators are a problem for them (N = 237; includes pretest data).

**Proportion of ranchers who indicated that they personally employed these procedures.

***Can not be unambiguously defined as lethal or nonlethal.

measures are employed, since they probably reflect a "top-of-the-head" response to the question posed in the survey. Given additional time to reflect, more ranchers may have listed some of the less commonly employed techniques.

The number of ranchers who indicated that they have used poisons (24 or 10.1 percent) is intriguing, given the fact that livestock producers are not legally permitted to use poisons to eliminate problem animals in British Columbia (Archibald, 1989). On the face of it, these responses appear to be (commendably) honest confessions of the illegal use of chemical predacides. However, it is possible that some ranchers are referring to the use of poisons in years past -- during the late 1940s strychnine and cyanide were actually made available to ranchers by the government (Hatler, 1981) -- or the use of poison by government personnel in response to ranchers' complaints. It would, therefore, be a mistake to draw any conclusions on the basis of these particular survey data. However, it is not unlikely that ranchers who live in remote areas where government assistance is difficult to obtain might feel compelled to use poisons, should they experience serious predation problems.

Cognitive Aspects of Individual Adjustments

Although the data clearly indicate that ranchers generally favour the use of lethal over nonlethal procedures,

there is evidence that some ranchers avoid lethal measures whenever possible and deliberately employ nonlethal measures because of their concern for wildlife and nature in general. For example, one rancher writes:

> Our solution [to predation] has been fencing, keeping our operation to a size we can handle and keeping watch dogs to warn of predators. We have had predation of our chickens by raccoons. Our reaction was to improve the housing and the management of these chickens -- no further problem. We felt that we were responsible for either 1.) protecting our birds from the native predator, 2.) accepting some losses due to our mis-management, or 3.) not raising chickens. We chose option 1. We handle deer with fences and watch dogs and accept some losses of fruit and vegetables.

Another writes:

> We have always had lots of wildlife on our property, wolves, bears, coyotes, deer, pheasants, etc. We have lost livestock due to predators, but very few. I strongly believe that we should leave our wildlife alone if at all possible. We have encroached on their domain far too much.

And another:

> It is often unwise to kill coyotes or bears that are not harming our wildlife as by doing so, these animals will often be replaced by others which will attack and kill livestock. Our motto, and most ranchers', is not to kill any animals unless they are maiming or killing livestock. We probably enjoy wildlife more than most people, as we live in contact with it everyday and know the benefits of having wildlife.

In addition to the anecdotal evidence noted above, an analysis of the survey data suggests that some ranchers employ nonlethal measures, in part, not simply because they believe them to be effective but because they are concerned about the integrity of natural ecosystems. Ranchers who reported using

nonlethal techniques scored significantly higher on ecological orientation (mean = 37.55) than non-users (mean = 34.43).

When asked if they were aware of any techniques, in addition to those listed in the questionnaire, which might be used to protect livestock from *wolves*, the general public and members of the NWWPS listed a number of alternatives that could theoretically be employed by ranchers (see Tables 5.20 and 5.21). Respondents were also asked to indicate if they would endorse the use of any of the procedures that they identified.

TABLE 5.20
INDIVIDUAL ADJUSTMENTS TO THE PREDATOR HAZARD: AWARENESS AND ENDORSEMENT - GENERAL PUBLIC

Procedure	Aware	Endorse
Fencing	28*	26
Guard Dogs	14	14
Patrolling/Supervision	11	10
Avoid Problem Areas	10	10
Enhance Prey Populations	9	9
Aversive Scenting	5	5
Aggressive Animals (Bulls, Donkeys)	2	2
Proper Disposal of Animal Carcasses	2	2
High Frequency Noises	2	2
Don't Raise Cattle	2	2
Better Husbandry (Methods Not Specified)	1	1
Feedlots	1	1
Snares	1	1
Conibear Trap	1	1

*Absolute values are given here since with a total sample of N = 441 most percentages are very small.

TABLE 5.21
INDIVIDUAL ADJUSTMENTS TO THE PREDATOR HAZARD: AWARENESS AND ENDORSEMENT - NWWPS

Procedure	Aware	Endorse
Guard Dogs	52.6%	51.9%
Avoid Problem Areas	14.3%	14.3%
Fencing	12.8%	12.8%
Aggressive Animals (Bulls, Donkeys)	5.6%	5.6%
Better Husbandry (Methods Not Specified)	3.0%	3.0%
Aversive Scenting	3.0%	3.0%
Penning at Night	3.0%	3.0%
Enhance Prey Populations	2.2%	2.2%
High Frequency Noise	0.8%	0.8%
Snares	0.8%	0.8%

Worthy of note is the number of respondents from the NWWPS who listed livestock guardian dogs. This comparatively high level of awareness and endorsement of guard dogs is due, no doubt, to the fact that a special Earth Day (1990) issue of the *Northwest Wildlife Focus*, a publication of the NWWPS, was devoted largely to the livestock guardian dog. Although no scientific studies were cited, the article left the distinct impression that guard dogs offered significant protection from wolf predation.

Whilst the general public clearly supported the use of nonlethal predator control or preventative measures, 70 percent agreed that livestock producers should have the right to kill wild animals that have killed livestock on their property (reactive control). Not surprisingly, 99.1 percent of ranchers agreed that they should have this right, whilst

only 34.6 percent of the NWWPS agreed. However, when asked whether farmers should have the right to kill other animals of the same type if a wild animal kills domestic stock on their property (proactive control), only 14.4 percent of the general public and none of the members of the NWWPS agreed. Forty-nine percent of ranchers agreed. Apparently, then, there is a general reluctance to grant farmers the right to engage in the proactive control of predators.

These results are consistent with respondents' opinions concerning a related issue. Eighty-nine percent of the NWWPS, 77.6 percent of the general public, and 30.3 percent of ranchers agreed that predator populations and other wildlife would be seriously threatened if predator control were left in the hands of livestock owners. In each sample group, there was a significant negative relationship between support for proactive control by livestock producers and beliefs about the consequences of placing predator control entirely in their hands (see Table 5.22).

TABLE 5.22
CORRELATIONS BETWEEN SUPPORT FOR PROACTIVE CONTROL BY RANCHERS AND CONSEQUENCES OF PLACING PREDATOR CONTROL IN RANCHERS' HANDS

Group	Pearson's r	Prob-value
General Public	-.37	< .0005
Ranchers	-.33	< .005
NWWPS	-.29	.001

Whilst ranchers clearly have a wide variety of techniques available to them to protect their livestock from predators,

many do not appear to have a great deal of faith in their ability to exercise control over predation. Only 2.1 percent of the ranchers who indicated that livestock predation posed a potential problem for them stated that they were able to exercise complete control over predation; 21.4 percent indicated that they were able to exercise a considerable amount of control; 30.9 percent, a moderate amount; 35.8 percent, little control; and 9.9 percent, no control. However, less than half of the ranchers surveyed (44.7 percent) agreed that the ability of ranchers to protect their livestock from predators had been adversely affected by government policy. Although there was a statistically significant negative relationship been ranchers' assessments of control and perceptions that government policy had reduced their ability to protect their livestock from predators (r = -.14; p = .033), the relationship was very weak indeed and therefore of little or no practical significance. It would seem that the ability of ranchers to exercise control over predation is largely determined by factors other than present predator control policy. Therefore, the data provide no evidence that current government restrictions on predator control place significant pressure on ranchers to employ illegal measures to protect their cattle.

Moreover, the data suggest that, as individuals, ranchers feel relatively powerless in influencing government policy concerning predator control. Just over 86 percent indicated

that they had "a little influence" or "no influence" over government policies in this regard. However, ranchers who belong to the BCCA believe that it possesses somewhat greater influence in this connection. Approximately 5 percent indicated that the BCCA exerted "very much" influence over government policies; and 40 percent that it exerted a "moderate amount."

Institutional Adjustments

Under existing legislation, the lethal control of predators for the purpose of livestock protection is carefully circumscribed. The 1979 Wildlife Act permits livestock owners to remove problem predators by ground shooting or trapping (ss. 2(3) and 27(2)). However, the 1979 Pesticide Control Act limits the placing of poison baits to certified government personnel. At the present time, the only poison authorized for use against wolves and coyotes is compound 1080 (sodium monofluoroacetate). It is the poison of choice because of its greater selectivity for canids (Gunson, 1983). It therefore presents fewer dangers to other wildlife and humans than do cyanide and strychnine (Tompa, 1983a).

According to the Procedure Manual for the Management of Problem Predators (PMMPP), predator control for agricultural purposes in the province is limited to the destruction or relocation of wild animals that have actually harassed, injured, or killed domestic livestock (reactive control).

When livestock owners request assistance from the Wildlife Branch, the investigative officer attempts to determine if the problem is related to faulty husbandry practices (e.g. carcasses left around, remote and uncontrolled lambing or calving grounds, obvious malnutrition of livestock). If such practices are implicated in the livestock losses, injury, or harassment, the attending officer may deny control until the situation is corrected.

Where it is determined that some control action is necessary, control is directed to individual problem predators or packs. Relocation is the preferred method of controlling problem grizzly bears and cougars. However, problem bears and cougars may be shot by authorized personnel if it is reasonably certain that these animals are responsible for the problem. Where they can be effectively employed, aerial shooting, ground shooting, and trapping are preferred to the use of poisons. But only Ministry of Environment personnel are permitted to shoot predators from an aircraft or any other vehicle.

In cases where the decision is taken to destroy wolves or coyotes, poison (compound 1080) is frequently chosen simply because other methods are likely to be ineffective or too expensive. Ground shooting usually depends on a chance encounter between the predator and a hunter -- a rare occurrence (Tompa, 1983a). Aerial shooting is expensive, up to $2000 per animal in the case of wolves, and the probability

of killing animals not directly implicated in livestock losses is high (Ibid.).[10] And trapping has tended to be ineffective because of the shortage of trained trappers in the province (Ibid.). Data compiled by the provincial Wildlife Branch indicate that an average of 215.7 wild animals of various species were destroyed or relocated during 1985-1990 because of predator/livestock conflicts (see Table 5.23).

TABLE 5.23
PREDATOR/LIVESTOCK CONFLICTS:
ESTIMATED NUMBER OF PREDATORS REMOVED*

Species	Estimated Number Removed Per Year					
	1985	1986	1987	1988	1989	1990
Black Bear	22	52	45	27	20	14
Grizzly Bear	2	6	6	2	7	5
Cougar	20	39	32	10	12	6
Coyote	99	50	48	87	78	77
Wolf	125	59	47	117	124	56
TOTAL	268	206	178	243	241	158

*Destroyed or relocated

Source: B.C. Wildlife Branch

There is limited evidence that reactive, site-specific predator control is effective in reducing livestock losses, although this evidence is not based on controlled field investigations. In an evaluation of the reactive wolf control program in British Columbia during 1978-1980, Tompa (1983b) reported that shooting, trapping, and poison (strychnine and

[10]Current costs are undoubtedly higher.

compound 1080) effectively reduced predation (see Table 5.24). Control effectiveness was rated high, moderate, or low when no further loss was recorded for one year, six months, or three months respectively. In the United States, individual case histories indicate that sheep producers who suffer high losses can benefit from the selective removal of problem predators (Robinson and Bolen, 1989). Nevertheless, there is no evidence that reactive control is more cost-effective than simply paying livestock owners the full market value for losses confirmed by government personnel.

TABLE 5.24
REACTIVE WOLF CONTROL EFFECTIVENESS 1978-80
(Relative Effectiveness of wolf control in relation to methods applied)

Method	Effectiveness				N
	High	Moderate	Low	Nil	
Strychnine Baits	9	4	2	5	20
Compound 1080 Baits	12	8	8	11	39
Shooting and Trapping	14	8	7	12	41
TOTAL	35	20	17	28	100

Source: Tompa 1983b

In spite of the uncertainties surrounding it, support for reactive control by government appears to be high. Approximately 71 percent of the general public, 87 percent of ranchers, and 42 percent of the NWWPS agreed that authorized government personnel should be permitted to destroy a wild animal if it kills a farmer's livestock on his/her property.

If the government should choose to engage in proactive (lethal) control, a variety of options is available: aerial shooting, ground shooting, trapping, hunting, snaring, denning,[11] and poison baits. Each of these methods can be effective in destroying predators (Andelt, 1987; Robinson and Bolen, 1989), but, short of the total extermination of predators, their effectiveness in significantly reducing livestock predation is in some doubt. In an evaluation of predator control effectiveness in northwestern British Columbia, Hatler (1981: 84) writes concerning predator population control programs:

> Some people still oppose predator control because they are against killing generally, or because they do not understand. Others, of which I am one, simply wish to put an end to the lie -- that we *know how* to conduct effective protection for livestock within the constraints set by society, that is, short of predator extermination.

Wagner (1972: cited in Robinson and Bolen, 1989) compared total sheep losses during a 10-year period (1940-49) before the application of compound 1080 with those that occurred during 1950-70, a period when 1080 was used widely. He found no detectable differences in total losses as a result of the use of compound 1080 for coyote control. Total annual losses averaged about 9.5 percent of all sheep deaths, whether or not coyote control was in place. This suggests that other forms of mortality compensate for coyote predation.

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[11]Involves locating the dens of wolves or coyotes and eliminating the pups and/or adults.

However, there is some evidence that population control may effectively reduce predation losses in certain circumstances. Bjorge and Gunson (1985) report that in a controlled field investigation cattle mortality from wolf and bear predation declined significantly after the application of strychnine. They noted, however, that wolves rapidly repopulated vacant territories, suggesting that the longterm protection of livestock would require continuous control action. Robinson (1948) reported reductions in predator losses of 75-100 percent following the use of toxic bait stations. Andelt (1987) reports an inverse relationship between the number of toxic bait stations and the number of livestock lost to predators from 1960 to 1972 in national forests in the western United States.

The Acceptability of Various Institutional Alternatives

Generally speaking, support for proactive control (predator population reduction) was weak. Sixteen percent of the general public, 53.4 percent of ranchers, and only 1.5 percent of the NWWPS agreed that authorized government personnel should be permitted to kill other animals of the same type if a wild animal killed a farmer's livestock on his/her property. Since these responses relate specifically to livestock killed on farmers' property, opinion concerning control on crown range may be different. If anything, one would expect support for lethal predator control, amongst the

general public at least, to be weaker where predation occurs on crown land, because it could be argued that, as far as possible, livestock producers, rather than wildlife, ought to bear the costs of grazing on public lands.

The mixed support for proactive control exhibited amongst ranchers is particularly interesting, in light of the fact that the B.C. Cattlemen's Association has publicly announced its support for such a program. For example, a resolution prepared by the BCCA and presented to the Ministry of Environment in 1985 included these comments (*Country Life* Apr. 1985: C5):

> In every area of the Province where problem wolves present a threat to the livestock industry, the only real solution is population control based on a long term plan.

Although the wolf kill program (1983-84) in the Muskwa region of the province was designed simply to increase wild ungulate numbers, not to protect livestock, it was officially endorsed by the BCCA:

> Your Executive Committee freely supported the provincial government's wolf kill program. This is something for which the cattlemen must give the government full support. It is not an extermination program but monitored control and something we have asked for, for twenty years (*Country Life* June 1984: C6).

Yet the survey data from this study suggest that ranchers are almost evenly divided on the issue. This indicates that ranchers may not be as supportive of predator population control as the official position of the Cattlemen's Association appears to indicate.

Each of the questions (four in total) dealing with reactive and proactive control made no references to particular control techniques. In order to gauge how support for predator control might vary according to the specific methods employed, survey respondents were asked to rate eight wolf control measures: aerial shooting, ground shooting, quick-acting poisons ("poisons that kill in less than a minute"), slow-acting poisons ("poisons that kill in a few hours"), regular leghold trap, denning, relocation, and aversive conditioning.

The mean level of acceptability for each lethal method was, as one would expect, higher for ranchers than non-ranchers (See Table 5.25). Ground shooting was rated the most highly acceptable of the lethal control measures, whilst slow acting poisons and the leghold trap were rated the least acceptable by each of the groups. Aversive conditioning and relocation were given the highest ratings by the general public and the NWWPS. The results presented in Tables 5.25 and 5.26 strongly suggest that generally the public prefers nonlethal methods of wolf control over lethal methods.

Table 5.26 displays significant differences in acceptability ratings between the sample groups for each of the control methods. The comparisons are based on the Scheffé method of multiple comparisons.

TABLE 5.25
THE ACCEPTABILITY OF WOLF CONTROL TECHNIQUES EXPRESSED AS MEANS*

Ranchers	General Public	NWWPS
		1.05 Slow Poisons
		1.09 Leghold Trap
		1.20 Aerial Shooting
	1.22 Leghold Trap	
	1.27 Slow Poisons	
		1.28 Denning
		1.52 Quick Poisons
1.77 Slow Poisons		
		1.78 Ground Shooting
	1.82 Denning	
	1.84 Aerial Shooting	
	2.27 Quick Poisons	
2.28 Leghold Trap		
2.47 Relocation	2.47 Ground Shooting	
2.49 Denning	2.49 Aversive Conditioning	
		2.54 Aversive Conditioning
2.64 Aversive Conditioning		
2.67 Quick Poisons		
2.80 Aerial Shooting		
		3.15 Relocation
3.37 Ground Shooting		
	3.43 Relocation	

*Mean acceptability based on a 4-point scale with 1 = low acceptability and 4 = high acceptability.

Means for each group are ranked in ascending order.

Note: Modest (or weak) correlations between ground shooting and aerial shooting (r = .58 for general public; .53 for ranchers; .47 for NWWPS) and between slow poisons and quick poisons (r = .30 for general public; .55 for ranchers; .26 for NWWPS) suggests that respondents view the two types of shooting and the two types of poison quite differently.

TABLE 5.26
SIGNIFICANT DIFFERENCES BETWEEN ACCEPTABILITY RATINGS FOR WOLF CONTROL TECHNIQUES

Method	*F*	Ranchers vs. G. Public	Ranchers vs. NWWPS	G. Public vs. NWWPS
Slow poisons	(2, 748) 40.43	*	*	*
Quick poisons	(2, 758) 46.05	*	*	*
Leghold trap	(2, 757) 169.00	*	*	
Aerial shooting	(2, 749) 127.60	*	*	*
Ground shooting	(2, 763) 127.86	*	*	*
Denning	(2, 762) 67.36	*	*	*
Aversive Conditioning	(2, 453) .71			
Relocation	(2, 730) 72.46	*	*	*

*Indicates significant differences using Scheffé method of multiple comparisons with overall alpha = .01.

Several details warrant additional discussion. The comparatively low rating for relocation amongst ranchers may reflect some knowledge of the problems associated with this control measure (see Hoffos, 1987). First, since wolves areable to travel long distances, they must be shipped a considerable distance to prevent their return, and this could prove very costly. Second, wolves are territorial animals and will kill intruders. Therefore, moving wolves to other locations may be equivalent to lethal control. Third, it may result in the transmission of disease and parasites. Fourth,

relocation may simply transfer the problem to another area. Finally, wolves are comparatively difficult to trap. Awareness of these difficulties, particularly the latter two, may well be a factor in ranchers's acceptability ratings of relocation.

Fifty percent of the general public, 49.6 percent of ranchers, and 39.4 percent of the NWWPS selected the "Don't know" response for aversive conditioning, indicating that the technique is not well-known. But for those familiar with it, aversive conditioning appears to be a reasonably popular alternative to lethal control (Table 5.25).

The most common form of aversive conditioning is taste aversion, which involves placing mutton or beef baits laced with a strong emetic (frequently lithium chloride) on the range. Supposedly, predators ingest the baits, become ill, and develop an avoidance of sheep or cattle because they associate them with sickness (Andelt, 1987).

However, field experiments have generated mixed results. Gustavson *et al.* (1974; 1976; 1982), Ellins *et al.* (1977), and Ellins and Catalano (1980) report reductions in coyote predation after the consumption of baits laced with lithium chloride. But Griffiths *et al.* (1977), and Horn (1983) have questioned the experimental designs and conclusions of these studies. Conover *et al.* (1977), Burns (1980, 1983a, 1983b), Burns and Connolly (1980), and Horn (1983) found that coyotes did not develop avoidance of prey after feeding on baits or

carcasses treated with lithium chloride. Based on the experimental results, aversive conditioning does not appear to be a reliable technique for reducing coyote predation on livestock.

In general, acceptability ratings for slow-acting poison were low. This may explain, in part, why public opposition to the use of compound 1080, a slow-acting poison, has been so strong. Although its proponents claim that it is a humane, painless, canid-selective method of control, its critics charge that it produces great suffering for wolves and coyotes and presents a major threat to nontarget predators and other wildlife. During a public controversy in the province that erupted over the use of compound 1080 in 1978, letters to the editor published in the Victoria Daily Colonist were overwhelmingly opposed to its use. The use of the poison was variously described as "unspeakably cruel," "another instance of the depravity of human beings who condone the torture and killing of wild animals," "abhorrent," a "blood-thirsty plan," a "loathsome substance," "cruel and vicious murder." Numerous letters complained 1080 would have serious impacts on nontarget species. For example, one (self-designated) wildlife ecologist wrote: ". . . the proposed poison 1080 is unspecific: in other words, all other carnivores and raptors will be indiscriminantly affected as well" (*Daily Colonist* Dec. 5/78;5).

However, ranchers also gave slow-acting poisons a low rating, the lowest of all the techniques. Yet when Rafe Mair, Minister of the Environment at the time, announced a temporary moratorium on the use of compound 1080 for predator control in 1978 (Hoffos, 1987), the announcement was not well received by many in the agricultural community. Indeed, reports surfaced to the effect that some ranchers had begun ". . . or intensified their own private poisoning programs, using a variety of killing agents such as strychnine . . ., anti-freeze, poison hemlock, and broken glass" (Hoffos, 1987; 4). An article in *Country Life* (Beingessner, 1979: 25) labelled the moratorium "a sellout to wildlife groups." Some livestock producers complained that they could not graze their stock on open range, a situation they claimed was "crippling the industry" (Ibid.) Increases in sheep losses to coyotes reported by the Lower Mainland Sheep Producers' Association were attributed to the ban on compound 1080 (*Country Life*, May 1979), and the president of that organization argued that the future of the sheep industry in the Fraser Valley depended upon the development of an effective predator control program (*Country Life*, Oct. 1979). Hugh Shelford, then the chairman of the predator management committee of the B.C. Cattlemen's Association, argued that the moratorium was a severe blow to the cattle industry, at a time when it was beginning to climb out of a "badly depressed" market period (*Country Life*, Jan. 1979).

On the face of it, this reaction in the agricultural community is difficult to reconcile with ranchers' responses to the survey. It is possible that the publicly voiced opinions about 1080 were not indicative of ranchers as a group. But it may well be that many ranchers responding to the survey assumed that the method produced suffering simply because it was slow-acting and rejected it for that reason.[12] They may have made no connection between slow-acting poisons and compound 1080. This supposition is supported by recent research. Based on a survey of ranchers, members of the B.C. Wildlife Federation, and the Federation of B.C. Naturalists, Hoffos (1987) reports that few respondents were aware of the properties of compound 1080. This suggests that ranchers' support for its use may be based largely on a belief in its efficacy rather than on perceptions concerning its humaneness or specificity. It also suggests that the widespread public opposition to the use of 1080 (noted above) may be based more on a general aversion to the use of poisons than on a particular dislike for compound 1080.

The acceptability ratings for the wolf control techniques are consistent with the importance attached to several aspects of wolf control. Respondents were asked to indicate which of the following factors was most important to them and which second most important in judging the acceptability of a wolf

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[12]Quick-acting poisons received a much higher rating from all three groups suggesting that respondents associated speed of action with humaneness.

control technique: cost; effectiveness; humaneness; species specificity; animal specificity; and lethality (Table 5.27).

TABLE 5.27
ASPECTS OF WOLF CONTROL: FACTOR IMPORTANCE

Most Important Factor			
	Group		
Factor	General Public	Ranchers	NWWPS
Cost	6.5%	10.5%	2.4%
Effectiveness	18.6%	56.6%	4.8%
Humaneness	33.2%	12.8%	28.0%
Species Specificity*	9.7%	8.9%	12.0%
Animal Specificity**	18.6%	8.1%	11.2%
Lethality	13.3%	3.1%	41.6%
Second Most Important Factor			
	Group		
Factor	General Public	Ranchers	NWWPS
Cost	7.1%	14.6%	1.6%
Effectiveness	17.8%	14.2%	15.2%
Humaneness	18.7%	19.7%	22.4%
Species Specificity*	34.8%	30.3%	31.2%
Animal Specificity**	15.1%	16.1%	7.2%
Lethality	6.6%	5.1%	22.4%

*Potential for harming other types of wildlife

**Procedure targets only those animals that have attacked livestock.

The general public tended to rate humaneness the most important factor, ranchers, effectiveness, and the NWWPS,

lethality. All of the groups tended to rate species specificity as the second-most important criterion. Kolmogorov-Smirnov two-sample tests indicated that, for the most important factor, distributions on the factors varied significantly across the three sample groups ($p < .0005$ in each case). For the second-most important factor, only the comparison between ranchers and the NWWPS reached significance ($p = .013$).[13]

To explore these differences more fully, a series of rank correlation coefficients (Spearman's rho) was calculated. Ranks were assigned to each of the factors on the basis of the number of people that rated them as most or second-most important, and correlations between the ranks were calculated (Table 5.28).

These correlations confirm the impression left by the previous analysis: namely that, with respect to the most important factor, the three groups see the issue of wolf control in quite different terms. This is particularly true in the case of ranchers and the NWWPS. There is more agreement on the second factor, particularly between ranchers and the general public, but there is still some distance between ranchers and the NWWPS.

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[13]Because this was a *post hoc* analysis, a Bonferroni method of multiple comparisons was used to adjust for Type I error. To ensure that the overall alpha level for each set of multiple comparisons -- one for the most important factor and one for the second most important factor -- was less than .05 a prob-value of .0167 or less was required for a test to be deemed statistically significant.

TABLE 5.28
FACTOR IMPORTANCE: RANK CORRELATIONS

Most Important Factor		
	Ranchers	NWWPS
General Public	.33	.36
Ranchers	1.00	-.49
Second Most Important Factor		
	Ranchers	NWWPS
General Public	.83	.56
Ranchers	1.00	.36

The high level of importance assigned to humaneness by both the general public and the NWWPS (with mean ratings of 3.75 and 3.88 respectively on a four-point scale) is reflected in the positive correlations between the perceived humaneness of wolf control techniques and their perceived acceptability (see Table 5.29).[14] More than half of these correlations exceed .65.

The overall acceptability of *lethal* wolf control was found to be related to assessments of the overall humaneness of lethal wolf control and attitudes towards wolves. Humaneness was, by far, the more important predictor of the

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[14]Similar data were not collected for ranchers, because questionnaire space was limited and, more importantly, there was reason to believe that other factors would be more salient. This turned out to be the case, with only 12.8 percent listing it as the most important factor and 19.7 percent as the second most factor. In general, effectiveness and species specificity were far more important to ranchers.

TABLE 5.29
CORRELATIONS BETWEEN HUMANENESS AND ACCEPTABILITY OF LETHAL WOLF CONTROL

General Public		
Control Method	**Pearson's r**	**Prob-value**
Aerial Shooting	.74	< .0005
Ground Shooting	.67	< .0005
Leghold Trap	.39	< .0005
Quick-Acting Poison	.63	< .0005
Slow-Acting Poison	.37	< .0005
Denning	.72	< .0005
Relocation	.44	< .0005
Aversive Conditioning	.71	< .0005
NWWPS		
Control Method	**Pearson's r**	**Prob-value**
Aerial Shooting	.59	< .0005
Ground Shooting	.65	< .0005
Leghold Trap	.76	< .0005
Quick-Acting Poison	.77	< .0005
Slow-Acting Poison	.56	< .0005
Denning	.78	< .0005
Relocation	.79	< .0005
Aversive Conditioning	.86	< .0005
Prob-values based on one-tailed tests		

two. The overall acceptability of lethal wolf control was not significantly influenced by perceptions concerning the economic impact of wolf predation on individual ranchers or the cattle industry as a whole. And humaneness was found to

be significantly associated only with attitudes towards wolves and not, as predicted, with ecological orientation as well.

Ranchers' assessments of the overall acceptability of lethal wolf control were significantly associated with attitudes towards wolves and assessments of the threat that wolves pose to their own cattle operations. Assessment of the threat wolves pose to the cattle industry was not a reliable predictor of overall acceptability.

This discussion of institutional responses to the hazard concludes with an examination of opinions concerning a predator compensation programme, which has been advocated by several agricultural organizations in the province for a number of years.

Predator indemnity programmes are in place in several political jurisdictions in North America: Alberta, Minnesota, Ontario, and Utah (Gunson, 1983). In Alberta, for example, up to 100 percent of the commercial value of a domestic animal will be paid for a confirmed kill, up to 50 percent for a probable kill, with no compensation for missing livestock. There is a $100 per claimant annual deductible (Flath, 1990).

Both the B.C. Federation of Agriculture and the B.C. Cattlemen's Association have been lobbying the government for a similar programme in this province for a number of years (see e.g. *Country Life* Jan 1986, Jan 1989; *BIBC* Sept/Oct 1989). For instance, the following resolution was passed at the 1989 Convention of the BCCA (*BIBC* Sept/Oct 1989):

> WHEREAS There is no compensation legislation in B.C. to reimburse producers for damage or loss caused by wildlife as there is in other provinces, and
>
> WHEREAS The wildlife is considered a public resource, therefore the responsibility for damages and loss incurred by wildlife is a public responsibility,
>
> THEREFORE BE IT RESOLVED That the BCCA and the B.C. Federation of Agriculture lobby the B.C. Ministry of Environment to establish a fair compensation program in B.C. for damages and loss funded by the public, incurred by wildlife.

Thus far, the government has resolutely refused to initiate a livestock indemnity programme. Indeed, the majority of the general public appears to support the government's position. Less than half (44 percent) of the general public surveyed in this study endorsed the payment of compensation for livestock predation losses (under the appropriate circumstances).[15] Support for the programme in the ranching community appears to be high but not overwhelming. Sixty-eight percent of the ranchers in this study endorsed it. NWWPS support was surprisingly high, with 62.5 percent of the respondents endorsing the programme.

Survey respondents were given the opportunity to indicate whether their endorsement of an indemnity programme would depend upon the continuation of predator control in agricultural regions or the impact of the programme on wildlife management costs. The data in Table 5.30 show that

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[15]Respondents were asked to indicate whether they would support the payment of compensation under the appropriate circumstances. Therefore, for many respondents, the endorsement of compensation was a qualified one.

69.1 percent of the ranchers' endorsements, 40.3 percent of the general public's, and 28.1 percent of the NWWPS's were not affected by cost or predator control decisions. Sixty-seven

TABLE 5.30
QUALIFICATIONS ON THE ENDORSEMENT OF A LIVESTOCK INDEMNITY PLAN*

Conditions	General Public	Ranchers	NWWPS
No conditions: support not affected by both cost and control.	40.3%	69.1%	28.1%
Indifferent to predator control, but will not endorse if costs increase.	6.8%	2.9%	Nil
Indifferent to cost, but will endorse only if predator control is continued.	18.4%	7.4%	5.3%
Indifferent to cost, but will endorse only if predator control is discontinued.	26.8%	12.5%	64.9%
Will endorse if control continues and costs do not increase.	5.3%	4.4%	Nil
Will endorse if control discontinued and costs do not increase.	2.3%	3.7%	1.8%

*Percentages are based on the number of respondents who indicated that they would endorse a compensation programme under the appropriate circumstances.

percent of the NWWPS endorsing compensation would do so if predator control were discontinued in agricultural regions. It is probably safe to interpret this as meaning that, for many members of the NWWPS, the discontinuance of predator control is a necessary precondition for their endorsement of

the program. In other words, they may view it as a "bargaining chip," a means of eliminating predator control. Interestingly, 16.2 percent of the ranchers endorsing the programme also based their support on the discontinuance of predator control. However, these results probably ought to be interpreted differently. Based on ranchers' comments, it seems that many ranchers would prefer predator control to an indemnity plan, but some would be willing to endorse the latter only if government refused to take action against predators. An indemnity programme would then compensate ranchers in two ways: for the loss of livestock; and for the loss of predator control.

CHAPTER 6

SUMMARY AND CONCLUSIONS

Summary of Major Findings

This study was motivated in part by a concern for the complexity of the public policy issues surrounding the problem of livestock predation and a belief that the examination of some of the cognitive dimensions of the problem would clarify the nature of the recent conflicts connected with the issue.

The research was structured around a conceptual framework based largely on Rokeach's system of human beliefs, Gilbert White's decision-making model, Kates' general systems model of natural hazards, and other relevant theoretical concepts from psychology. A number of hypotheses derived from this conceptual scheme was tested with data collected in a mail questionnaire survey sent to a sample of ranchers, samples from the cities of Victoria, Kamloops, and Williams Lake, and members of the Northwest Wildlife Preservation Society. These data were supplemented by content analysis and informal interviews with a number of officials from the B.C. Wildlife Branch, the Ministry of Fisheries and Agriculture, individuals from the ranching community, and members of several wildlife interest groups. Most of the hypotheses were supported by the data.

Some of the more significant findings are noted here. A number of variables differed significantly across the three sample groups: ecological orientation (as measured by the NEP

scale); attitudes towards wolves; and perceptions of the wolf, coyote, and bear threats. Ranchers tended to rate lethal wolf control measures more acceptable than did nonranchers. Ranchers also more strongly supported both reactive and proactive predator control. Support for reactive control was strong amongst ranchers and the general public, and weak in the NWWPS. Support for proactive control amongst nonranchers was weak; support in the ranching sample was mixed. In principle, the government policy of site-specific, reactive predator control received strong support from the general public sample. They did, however, exhibit strong reservations about certain wolf control techniques: the leghold trap, slow-acting poisons, denning, and aerial shooting. There were also significant differences among the three groups in the factors identified as being most important in judging the acceptability of wolf control techniques. Ranchers tended to rate effectiveness most important, the general public, humaneness, and members of the NWWPS, nonlethality. All three groups tended to rate species specificity as second most important.

For all three groups, significant relationships were found between ecological orientation and attitudes towards wolves; between attitudes towards wolves and perceptions of the threat wolves pose to individual cattle producers and the cattle industry as a whole; between attitudes towards wolves and the acceptability of certain lethal wolf control measures;

and, for nonranchers, between attitudes towards wolves and the humaneness of lethal wolf control, and between humaneness and lethal wolf control.

Implications

Although ranchers and nonranchers varied significantly in terms of ecological orientation and attitudes towards wolves, it should be emphasized that the variations within the groups were greater than the differences between them. A good many ranchers, for example, exhibited very strong support for the NEP, highly positive attitudes towards wolves, and very positive feelings about many types of wildlife. This suggests that considerable common ground is shared by ranchers and the general public. The data also suggest that it is unfair to ranchers in the province to characterize them as uniformly anti-wolf.

There also appears to be no grounds for asserting that ranchers generally and routinely inflate numerical estimates of predation losses. It is only when one examines their subjective evaluations of the seriousness of the predator threat and the importance of predator control that their views are difficult to reconcile with reality. However, it would be a mistake to assume that ranchers' expressed views on these matters are simply a deliberate distortion of the truth designed to influence government policy. The results of the study are consistent with the view that their perceptions

concerning predator control and the predator threat are significantly influenced by attitudes towards predators and judgmental heuristics. But these very factors are apparently at work in the general population as well.

If judgmental heuristics do in fact play an important role in determining perceptions of environmental problems, as this and other research suggests, attempts to counter the effects of incomplete or incorrect information may fail if the psychological dynamics involved in the formation of judgments and attitudes are ignored. An uninspired, dry, colourless presentation of scientific data is likely to have little impact when set beside the rather dramatic and sometimes sensationalized media accounts and interest group demonstrations one frequently encounters.

The recent television spots sponsored by the Workers' Compensation Board (WCB) in British Columbia, which are designed to dramatize the impacts of workplace accidents on family life, represent one attempt to increase public awareness of a very significant problem. These television messages depict poignant moments at a family funeral, and knowingly or unknowingly take advantage of the availability heuristic in an effort to reduce the tremendous financial, social, and emotional costs associated with workplace casualties. This is not to advocate a marriage of "Madison Avenue" and wildlife management. The approach used by the WCB has certainly engendered some criticism and may well be too

heavy-handed for wildlife management purposes. Nevertheless, all of the participants involved in environmental decision-making processes, whether they be government officials, advisory committee members, or interest-group leaders, should accept the importance of presenting information in as vivid, concrete, and dramatic a fashion as is consistent with fair and responsible presentation of data.

Moreover, decision makers should realize that their own attitudes and judgments are susceptible to the effects of judgmental heuristics. Consequently, they need to be cautious about making decisions on the basis of small samples, particularly when those samples have not been randomly selected.

Whilst there was common ground, there were some very significant differences among the groups with respect to the specifics of predator control and the dimensions of the issue that are salient for various groups. Given that attitudes are unlikely to change dramatically in the near future, it is clear that controversy over predator control will continue unless safe, highly selective, cost-effective, and humane nonlethal predator control techniques can be developed. In the interim, it appears that conflict can be minimized by continued stress on the importance of animal husbandry, the education of livestock producers in this regard, and the development of a better understanding amongst the general public of the chronic predator problems that some ranchers

face and the many factors, other than faulty husbandry practices, that contribute to their difficulties.

One frequently encounters claims by predator control proponents to the effect that anticontrol advocates simply will not listen to reason, that they have retreated into a type of blind emotionalism. Whilst it is true that emotions can interfere with rational thought, accusations of irrationalism or emotionalism are often directed at people whose arguments are entirely rational given the assumptions upon which they are based. The strong social and political support that utilitarian perspectives have traditionally received in western societies seems to have fostered a belief in some quarters that arguments based on other assumptions -- on the intrinsic value of sentient beings, for example -- are somehow irrational. Strictly speaking there is no *scientific* case to be made for predator control. Science may be used in the service of particular perspectives, but in the final analysis it cannot determine which value system it ought to serve.

A better understanding of predator-prey dynamics as they relate to livestock predation and a dissemination of these findings to the general public and the ranching community would probably contribute to the softening of antipredator sentiment. Certainly this kind of research is sorely needed. Yet the attitudes of ranchers who face chronic predator problems are not likely to change significantly until they

become convinced that predators can be effectively controlled, at reasonable cost, through nonlethal means. Consequently, if there is to be a technical solution to the problem, it is most likely to be found in the development of cost-effective nonlethal control and prevention.

The high level of support for the NEP in all three groups is very encouraging. However, several considerations caution against being overly enthusiastic. First, although the overall level of support is high, many people accepted some of the beliefs associated with the DSP and/or rejected some connected with the NEP. Moreover, Kellert (1985) observes that utilitarian and dominionistic tendencies are still evident in attitudes towards animals amongst certain population groups in the United States. Presumably similar tendencies obtain in Canada as well. Second, there is no doubt that people's beliefs and ideals often "run ahead" of their actions. This may be particularly true of beliefs associated with the NEP, many of which have what might be called a credal character. For many people, religious and political creeds are taken very seriously and have a significant influence on their behaviours. Yet many people readily assent to creeds while finding them largely irrelevant to the conduct of daily life. Many people may relate to NEP beliefs in a similar way. Most people probably do not want to be thought of, or do not wish to think of themselves, as "anti-environmental." It is, after all, quite fashionable to

consider oneself an environmentalist. Nevertheless, whilst the correlation between beliefs and actions is often weak, most people intuitively grasp the importance of beliefs. Few people would wish, for example, to elect a political candidate who advocated genocide.

The generally high level of support for the NEP raises a third issue relevant to a wide range of environmental issues. If Cotgrove (1982) is correct in arguing that the dominance of the DSP derives from the fact that it is the belief system held by the dominant groups in society, then the high level of support for the NEP exhibited in this study will have limited impact on public policy unless these beliefs are shared by those who hold the reins of power. In western democracies, there is little doubt that business leaders control a substantial portion of this power and that governments tend to focus on economic development often at the expense of social and environmental justice.

In several surveys, Milbrath (1985: 166) asked respondents to indicate on a seven-point scale "whether they would prefer to live in a society that emphasizes environmental protection over economic growth or a society that emphasizes economic growth over environmental protection." His data indicate that people in the United States chose environmental protection over economic growth by a ratio of 3 to 1. Whilst business leaders might be expected to be unanimous in the opposite direction, they tended to be

undecided when asked to choose between the two options. Since the value attached to economic growth is such an important element in the old DSP, the general ambivalence of the business community on this point suggests significant departure from the DSP in the United States. Yet it also indicates that business leaders lag behind the general population in their acceptance of the NEP. And their views undoubtedly have greater impact on the development of environmental policy in general than those of the general public. So if Cotgrove is right, a good deal more attention needs to be given to the environmental attitudes of business leaders and public officials who realize that their political fortunes are closely tied to the economic climate.

One final matter concerning the New Environmental Paradigm needs to be addressed. As noted earlier, the decision was made to use the NEP Scale developed by Dunlap and Van Liere (1978), which does not include any explicit references to technology. However, if attitudes towards technology are an important constituent of the New Environmental Paradigm, then the differences in scores on the NEP Scale for the three groups sampled in this study may not represent real differences in the complete spectrum of New Environmental Paradigm beliefs in that similar differences may not be exhibited in attitudes towards technology.

This study was predicated on the belief that "values" research is a very important component in public policy

development. Yet the research itself provides no guidance to policymakers as to how the information generated should be used. Whether they ought to develop programmes that reflect a wide variety of beliefs and interests or whether they should use "values" research to help them manipulate existing attitudes can only be determined by values not amenable to *scientific* confirmation. Should decision makers choose the latter course, Rokeach's (1973) claim that attitudes are functionally dependent upon underlying values becomes particularly relevant. If he is correct, it would be fruitless to attempt to manipulate environmental attitudes without attempting to change the more fundamental values from which they are derived.

To conclude, it would be helpful to return to a theme introduced in Chapter 1. At the turn of the century, the professional wildlife manager's job was seen to involve the resolution of an array of problems that appeared to be definable and understandable. However, the decision environment has become increasingly complex. Pressures on wildlife have escalated. Many important scientific and technical questions remain unresolved and new questions emerge almost daily. Attitudes and values have changed and have become more diverse. And numerous interest groups demand to be heard. Accordingly, it is clear that wildlife officials are being forced to confront what Rittel and Webber (1973) have termed "wicked problems."

Such problems are not "wicked" because they are somehow morally impure; "wicked" is used in the sense of "malignant," "vicious," "tricky," or "aggressive." In contrast to "tame" problems, which are definable and easily resolved, wicked problems are stubborn, intractable, and amorphous. Wicked problems share several characteristics: they are difficult to define; alternative solutions are hard to identify; it is usually impossible to determine when a genuine solution has been found, and in any case, each solution tends to produce its own set of problems; there are no generally accepted criteria for evaluating success or failure; and in spite of all these difficulties, the manager "has no right to be wrong" (Ibid.). The laboratory scientist can test a hypothesis, and usually no one is harmed if it turns out to be incorrect. For the wildlife managers, however, there is no secluded laboratory for testing ideas. The interlocking system of nature and society is their testing ground. In that world, mistakes often cause harm, and managers are held responsible for the problems they create.

Mason and Mitroff (1981) suggest that policymakers confronted by wicked problems can ease their task by: encouraging a broader participation of affected parties, directly and indirectly, in the decision-making process; and basing policy decisions on a wide spectrum of information gathered from a large number of diverse sources. Certainly the Problem Wildlife Committees and the Wolf Working Group

established by the provincial government are an important component of a public consultation process with respect to wildlife management. But data such as that reported in this study, if taken seriously, can also make an important though indirect contribution to greater public involvement. Attitudinal data can also broaden the range of information on which management decisions are made.

Admittedly, wildlife "values" research is no panacea for wicked problems. Regrettably, the search for practical solutions to environmental conflicts can be extremely elusive, since irreconcilable value differences often separate conflicting parties. But there appears to be a growing recognition that "values" research can make a valuable contribution to the taming of wicked problems by aiding in problem definition, identifying management options, understanding public preferences, and anticipating potential management problems.

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APPENDIX A

MAIL QUESTIONNAIRE SURVEYS

NONRANCHERS MAIL SURVEY QUESTIONNAIRE

WILDLIFE AND AGRICULTURE STUDY
c/o Department of Geography
University of Victoria,
Victoria, B.C.

Dear Sir or Madam:

In recent years, British Columbians have become increasingly interested in the use, management, and welfare of wildlife in our province. We are asking for your help in what we believe to be a very important research project. At the University of Victoria, we are conducting a study to determine the opinion of a wide range of British Columbians on a number of issues related to the management of wildlife in agricultural regions.

We would be very grateful if you would complete this questionnaire and return it to us as soon as possible. The questionnaire begins on the next page of this booklet. For your convenience, a return envelope with pre-paid postage is included.

Since it is not possible to survey everyone in the province, the success of our research depends very much on your willingness to complete a questionnaire. Your opinion <u>is</u> important.

Be assured that your answers will be strictly confidential. This is an independent research project. While the overall results will be presented to British Columbia wildlife officials, no personal information will be released. If you have any questions do not hesitate to write or call. My telephone number is 721-7327.

Please take the short time required to complete the questionnaire. Thank you for your assistance.

Yours sincerely,

Orland L. Wilkerson
Research Coordinator

Survey number _____

THIS QUESTIONNAIRE IS DIVIDED INTO SEVERAL SECTIONS. PLEASE ANSWER ALL THE QUESTIONS. THE FIRST SET OF QUESTIONS IS CONCERNED WITH YOUR VIEWS ON A NUMBER OF ISSUES RELATED TO WILDLIFE, WILDLIFE MANAGEMENT AND THE NATURAL ENVIRONMENT.

Q - 1. Please indicate whether or not you agree with the following statements by circling the appropriate number. This is what the numbers mean:

1 = Strongly agree 2 = Agree 3 = Disagree 4 = Strongly Disagree

1.	The balance of nature is very delicate and easily upset	1	2	3	4
2.	When humans interfere with nature it often produces disastrous consequences.	1	2	3	4
3.	Humans must live in harmony with nature in order to survive.	1	2	3	4
4.	Humankind is severely abusing the environment.	1	2	3	4
5.	We are approaching the limit of the number of people the earth can support.	1	2	3	4
6.	The earth is like a spaceship with only limited room and resources.	1	2	3	4
7.	There are limits to growth beyond which our industrialized society cannot expand.	1	2	3	4
8.	To maintain a healthy economy we will have to develop a "steady-state" economy where industrial growth is controlled.	1	2	3	4
9.	Humankind was created to rule over the rest of nature.	1	2	3	4
10.	Humans have the right to modify the natural environment to suit their needs.	1	2	3	4
11.	Plants and animals exist primarily to be used by humans.	1	2	3	4
12.	Humans need not adapt to the natural environment because they can remake it to suit their needs.	1	2	3	4
13.	The wolf is one of the few animals that kill for the pleasure of killing.	1	2	3	4
14.	Some animals like wolves are naturally cruel.	1	2	3	4

1 = Strongly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree

15.	Although I may never see a timber wolf in the wild, it is important to me to know that wolves exist.	1	2	3	4
16.	If I were to see a wolf while I was in the woods I would shoot it if I could.	1	2	3	4
17.	To me the wolf symbolizes the beauty and wonder of nature.	1	2	3	4
18.	Areas should be set aside in British Columbia where wolves are completely protected.	1	2	3	4
19.	If I saw a wolf in the woods I would be concerned that it might attack me.	1	2	3	4
20.	I would shoot a wolf if it threatened by pets or livestock.	1	2	3	4
21.	Wolves are "wasteful," frequently killing more prey than they need to sustain themselves.	1	2	3	4
22.	Provided it is properly controlled, game hunting is an acceptable practice.	1	2	3	4
23.	The British Columbia government should continue its policy of reducing wolf population numbers in certain areas of the province to protect prey populations (e.g. elk, moose, deer.).	1	2	3	4
24.	If a wild animal kills a farmer's livestock on his or her property the farmer should have the right to kill that animal.	1	2	3	4
25.	If a wild animal kills a farmer's livestock on his or her property the farmer should have the right to kill other animals of the same type to prevent future losses.	1	2	3	4
26.	If a wild animal kills a farmer's livestock on his or her property duly appointed government officials should be permitted to kill other animals of the same type to prevent future losses.	1	2	3	4
27.	If a wild animal kills a farmer's livestock on his or her property duly appointed government officials should be permitted to kill other animals of the same type to prevent future losses.	1	2	3	4

1 = Strongly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree

28. If predator control were left in the hands of livestock owners predator populations and other wildlife would be seriously threatened. 1 2 3 4

Q - 2. We are interested in finding out whether or not you feel that certain predators pose an economic threat to individual cattle owners or to the cattle industry as a whole. Please indicate your opinion by placing the appropriate number in the space provided. This is what the numbers mean:

1 = pose no economic threat
2 = pose a slight economic threat
3 = pose a moderate economic threat
4 = pose a very serious economic threat
5 = don't know

I. Do any of the following animals pose an economic threat for <u>some individual</u> cattle owners in British Columbia?

a. Bears _____ b. Wolves _____ c. Coyotes _____

II. Do any of the following animals pose an economic threat for the cattle industry <u>as a whole</u> in British Columbia?

a. Bears _____ b. Wolves _____ c. Coyotes _____

III. Do you own or raise cattle in B.C.? Yes _____ No _____

IV. If yes, do any of the following wild animals pose a threat to your livelihood?

a. Bears _____ b. Wolves _____ c. Coyotes _____

Q - 3. The following list contains names of various types of wildlife. Please indicate whether you like or dislike the animals by entering the appropriate number in the space provided. This is what the numbers mean:

1 = Strongly like 2 = Like 3 = Neither like nor dislike
4 = Dislike 5 = Strongly dislike

Deer _____	Elk _____	Cougar _____	Rattlesnake _____
Wolf _____	Beaver _____	Eagle _____	Coyote _____
Bat _____	Caribou _____	Gopher _____	Grizzly Bear _____
Squirrel _____	Muskrat _____	Otter _____	Black Bear _____

NEXT SOME QUESTIONS ABOUT PREDATOR CONTROL.

Q - 4. Please indicate whether or not you feel the following wolf control methods are humane by circling the appropriate number.

1 = very humane
2 = humane
3 = inhumane
4 = very inhumane
5 = don't know

a.	Aerial shooting (from aircraft)	1	2	3	4	5
b.	Ground shooting (at ground level)	1	2	3	4	5
c.	Regular leghold trap	1	2	3	4	5
d.	Poisons that kill in less than a minute	1	2	3	4	5
e.	Poisons that kill in a few hours	1	2	3	4	5
f.	Relocation	1	2	3	4	5
g.	Eliminating wolf pups (denning)	1	2	3	4	5
h.	Aversive conditioning	1	2	3	4	5

Q - 5. Please indicate whether or not you would condone the use of the following wolf control methods in areas where wolves are preying on domestic livestock. Please circle the appropriate number.

1 = definitely condone
2 = probably condone
3 = probably not condone
4 = definitely not condone
5 = don't know

a.	Aerial shooting (from aircraft)	1	2	3	4	5
b.	Ground shooting (at ground level)	1	2	3	4	5
c.	Regular leghold trap	1	2	3	4	5
d.	Poisons that kill in less than a minute	1	2	3	4	5
e.	Poisons that kill in a few hours	1	2	3	4	5
f.	Relocation	1	2	3	4	5
g.	Eliminating wolf pups (denning)	1	2	3	4	5
h.	Aversive conditioning	1	2	3	4	5

Q - 6. In addition to the methods listed above are you aware of any other ways of protecting livestock from wolves?

Yes _____ No _____

If yes would you list them in the space provided below?

Would you endorse the use of any of these procedures? If so, which ones?

Q - 7. A number of factors might be considered by a person attempting to decide which procedures for protecting livestock from wolves he or she would endorse. Several of them are listed below. Please indicate how important each of these factors is to you by circling the appropriate number. This is what the numbers mean:

1 = not at all important
2 = slightly important
3 = moderately important
4 = very important

a.	Cost	1	2	3	4
b.	Effectiveness in protecting livestock	1	2	3	4
c.	Humaneness	1	2	3	4
d.	Potential harm to other kinds of wildlife	1	2	3	4
e.	Does the procedure target only those animals that have killed livestock?	1	2	3	4
f.	Are they nonlethal: that is do they attempt to protect livestock using techniques that do not involve killing wolves?	1	2	3	4

Which of the factors listed above do you consider to be the most important and the second most important? (Please put the factor letter, e.g. a, b, c, etc., in the appropriate space.)

_____ Most important factor

_____ Second most important factor

Q - 8. Some people suggest that the government should compensate livestock owners for the full market value of animals killed by predators.

Under the appropriate conditions would you support such a program?
Yes _____ No _____

If you answered "Yes," please respond to the following statements by circling the appropriate number. This is what the numbers mean:

1 = Strongly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree

I would support paying livestock owners for losses if predator control were continued in agricultural regions.	1	2	3	4
I would support paying livestock owners for losses if predator control were discontinued in agricultural regions.	1	2	3	4
I would support paying livestock owners for losses <u>even</u> if total costs to the taxpayer for wildlife management <u>increased</u> as a result.	1	2	3	4
I would support paying livestock owners for losses if total costs to the taxpayer for wildlife management declined as a result.	1	2	3	4
I would support paying livestock owners for losses if total costs to the taxpayer for wildlife management were not affected.	1	2	3	4

If you would like to make any additional comments concerning a compensation program of this nature, please use the space provided below.

Q - 9. Finally, we would like a few facts about yourself. These questions will be used for classification purposes only. Like the rest of the questionnaire, your answers will be kept strictly confidential.

1. Which of the following best describes the area you now live in?
   a. Rural _____
   b. Urban - 1,000 to 19,999 people _____
   c. Small city - 20,00 to 99,999 people _____
   d. Large city - 100,000 or more people _____

2. What is your age? _____

3. Your sex? Female _____ Male _____

4. Are you a member of an organization or group that has an interest in wildlife or wildlife management?
   Yes _____ Name of group _____
   No _____

5. Which of the following most accurately describes your formal educational background?
   a. Less than 12 years _____
   b. High school graduate _____
   c. Trade or Technical School _____
   d. Some College or University _____
   e. University Graduate (Bachelor's degree)_____
   f. Graduate Degree _____

6. Which of the following most accurately describes your annual household income?
   a. $100,000 _____
   b. More than $50,000 but less than $100,000 _____
   c. More than $20,000 but less than $50,000 _____
   d. More than $10,000 but less than $20,000 _____
   e. Less than $10,000 _____

Is there anything else you would like to say about the topics dealt with in this questionnaire? If so, please use the following space for that purpose. Use an additional sheet if necessary.

Thank you. We look forward to receiving your answers. Your contribution to this project is very much appreciated.

RANCHERS' MAIL SURVEY QUESTIONNAIRE

WILDLIFE AND AGRICULTURE STUDY

A SURVEY OF LIVESTOCK OWNERS' OPINIONS

c/o Department of Geography
University of Victoria
Victoria, B.C.
V8W 2Y2

Survey number _____

WILDLIFE AND AGRICULTURE STUDY
Department of Geography
University of Victoria

Dear Sir or Madam:

If you are a livestock owner we are very interested in your opinions concerning wildlife and agriculture in British Columbia. (If you are not, please disregard this letter, and thank you for your time.)

In recent years, British Columbians have become increasingly interested in the use and management of wildlife in our province. Ranchers, for example, have expressed concerns about the management of animals such as wolves, coyotes, and deer in livestock raising districts.

At the University of Victoria we are conducting a study that focuses on the interaction between wildlife and agriculture. We are asking for your help in what we believe is a very important research project. We are particularly interested in livestock owners' views about wildlife, and certain aspects of livestock management and wildlife management. You can assist us by completing the enclosed questionnaire and returning it to us. The questionnaire begins on the next page of this booklet. For your convenience an envelope with pre-paid postage is included.

Since it is not feasible to survey every livestock owner in the province, the success of our research depends very much on your willingness to complete a questionnaire. Your opinion <u>is</u> important.

Be assured that your answers will be completely confidential. This is an independent study. While the overall results will be forwarded to British Columbia agriculture and wildlife officials for their consideration, no personal information will be released. Our results will be presented as objectively as is humanly possible. If you have any questions, do not hesitate to write or call. My telephone number is 477-5315 or 712-7327.

Please take the short time required to complete the questionnaire. Thank you for your assistance.

Yours sincerely,

Orland L. Wilkerson
Research Coordinator

THIS QUESTIONNAIRE IS DIVIDED INTO SEVERAL SECTIONS. PLEASE ANSWER ALL THE QUESTIONS. THE FIRST FEW QUESTIONS ARE CONCERNED WITH YOUR OPINIONS ABOUT SOME PROBLEMS THAT YOU, AS A LIVESTOCK OWNER, MAY FACE.

Q - 1. Please indicate how important each of the following problems is to you by entering the appropriate number in the space provided. This is what the numbers mean:

1 = the problem is not at all important to me.
2 = the problem is slightly important to me.
3 = the problem is important to me.
4 = the problem is extremely important to me.

a. Losing cattle to sickness or disease..... _____
b. Loss of prime agricultural land to development..... _____
c. Predators (wolves, coyotes, bears, etc.)..... _____
d. Crops damaged by wildlife..... _____
e. Groundwater contamination..... _____
f. Drought..... _____
g. Non-poisonous weed infestations..... _____
h. Losing cattle through accidents (bog holes, drowning)..... _____
i. Theft of livestock..... _____
j. Poisonous plants..... _____
k. Hunters and other recreationists trespassing on private land..... _____

Which of the problems listed above is the most important to you and which is the second most important? (Please put the letter, e.g. a, b, c, etc. of the problem in the appropriate space.)

_____ Most important problem.
_____ Second most important problem.

THE FOLLOWING QUESTIONS DEAL WITH PROBLEMS RELATED SPECIFICALLY TO WILD ANIMALS AND AGRICULTURE.

Q - 2. We would like to know whether or not you feel that certain predators pose an economic threat to individual ranchers or to the cattle industry as a whole in British Columbia. Please indicate your opinion by placing the appropriate number in the space provided. This is what the numbers mean:

1 = pose no economic threat
2 = pose a slight economic threat
3 = pose a significant economic threat
4 = pose a very serious economic threat
5 = don't know

I. Do any of the following animals pose an economic threat to <u>some individual</u> ranchers in British Columbia?

a. Bears _____ b. Wolves _____ c. Coyotes _____

II. Do any of the following animals pose an economic threat to the cattle industry <u>as a whole</u> in British Columbia?

a. Bears _____ b. Wolves _____ c. Coyotes _____

III. Do any of the following animals pose an economic threat to your <u>own</u> cattle operation?

a. Bears _____ b. Wolves _____ c. Coyotes _____

Q - 3. The following questions ask you to draw on your own experience to provide some information about predator activity and your own livestock operation.

1. How many livestock did you own at the start of 1989?

   Mature cattle _____ Mature sheep _____
   Other (please specify) _____

2. During 1989, in total how many of your livestock were grazing on:

   Crown range _____ Private range _____

3. Have you ever had livestock killed, injured, or harassed by wild animals? Yes _____ (go to question 4)
   No _____ (go to question 7)

4. Were any of your livestock killed by predators in 1989?
   Yes _____ No _____
   If yes, how many were killed by:
   Wolves _____ Bears _____
   Coyotes _____ Other _____

5. In general, how did losses in 1989 compare with the previous 5 years?
   More _____ Fewer _____ About the same _____

6. Do you believe that the productivity of your livestock has been affected at times by harassment from predators?
   Yes _____ No _____

7. How much influence do you feel you, as an individual, have over predator control policies in the province of B.C.?
None _____ A little _____ A moderate amount _____
Very much _____

8. Do you belong to the British Columbia Cattlemen's Association?
Yes _____ No _____

If yes, how much influence do you feel the Association has over predator control policies in B.C.?

None _____ A little _____ A moderate amount _____
Very much _____

9. Have you ever requested help from the B.C. Wildlife Branch in order to deal with predators? Yes _____ No _____

If yes, how often have you taken this action. Please check the most appropriate response:

a. rarely _____ b. often _____ c. very often _____

10. In general, how would you rate the effectiveness of the present government predator control program in protecting livestock from predators. Please check the most appropriate response:

a. Not at all effective _____
b. Slightly effective _____
c. Moderately effective _____
d. Very effective _____

11. In general, do you feel that you have the ability to exercise some control over the number of livestock that you lose to predators each year? Please indicate the amount of control you are able to exercise by checking the appropriate response.

No control _____
A little control _____
A moderate amount of control _____
A considerable amount of control _____
Complete control _____
Not applicable - predators are not a problem for me _____

12. In addition to calling on the B.C. Wildlife Branch for help, we would like to know if ranchers have discovered effective ways of protecting their own livestock from predators.

a. Are you aware of any effective measures that livestock owners can take to protect their animals from predators?

Yes _____ No _____

If yes, would you please list them in the space provided below?

b. Have you found a need to employ any of the measures listed in question "a" in your own livestock operation?

Yes _____ No _____

If yes, which ones?

NOW SOME QUESTIONS ABOUT WILDLIFE, WILDLIFE MANAGEMENT AND THE NATURAL ENVIRONMENT.

Q - 4. Please indicate whether or not you agree with the following statements by circling the appropriate number. This is what the numbers mean:

1 = Strongly agree 2 = Agree 3 = Disagree 4 = Strongly Disagree

1.	The balance of nature is very delicate and easily upset	1	2	3	4
2.	When humans interfere with nature it often produces disastrous consequences.	1	2	3	4

1 = Strongly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree

3	Humans must live in harmony with nature in order to survive.	1	2	3	4
4.	Humankind is severely abusing the environment.	1	2	3	4
5.	We are approaching the limit of the number of people the earth can support.	1	2	3	4
6.	The earth is like a spaceship with only limited room and resources.	1	2	3	4
7.	There are limits to growth beyond which our industrialized society cannot expand.	1	2	3	4
8.	To maintain a healthy economy we will have to develop a "steady-state" economy where industrial growth is controlled.	1	2	3	4
9.	Humankind was created to rule over the rest of nature.	1	2	3	4
10.	Humans have the right to modify the natural environment to suit their needs.	1	2	3	4
11.	Plants and animals exist primarily to be used by humans.	1	2	3	4
12.	Humans need not adapt to the natural environment because they can remake it to suit their needs.	1	2	3	4
13.	The wolf is one of the few animals that kill for the pleasure of killing.	1	2	3	4
14.	Some animals like wolves are naturally cruel.	1	2	3	4
15.	Although I may never see a timber wolf in the wild, it is important to me to know that wolves exist.	1	2	3	4
16.	If I were to see a wolf while I was in the woods I would shoot it if I could.	1	2	3	4
17.	To me the wolf symbolizes the beauty and wonder of nature.	1	2	3	4
18.	Areas should be set aside in British Columbia where wolves are completely protected.	1	2	3	4
19.	If I saw a wolf in the woods I would be concerned that it might attack me.	1	2	3	4
20.	I would shoot a wolf if it threatened by pets or livestock.	1	2	3	4

1 = Strongly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree

21.	Wolves are "wasteful," frequently killing more prey than they need to sustain themselves.	1	2	3	4
22.	Provided it is properly controlled, game hunting is an acceptable practice.	1	2	3	4
23.	The British Columbia government should continue its policy of reducing wolf population numbers in certain areas of the province to protect prey populations (e.g. elk, moose, deer.).	1	2	3	4
24.	If a wild animal kills a farmer's livestock on his or her property the farmer should have the right to kill that animal.	1	2	3	4
25.	If a wild animal kills a farmer's livestock on his or her property the farmer should have the right to kill other animals of the same type to prevent future losses.	1	2	3	4
26.	If a wild animal kills a farmer's livestock on his or her property duly appointed government officials should be permitted to kill other animals of the same type to prevent future losses.	1	2	3	4
27.	If a wild animal kills a farmer's livestock on his or her property duly appointed government officials should be permitted to kill other animals of the same type to prevent future losses.	1	2	3	4
28.	If predator control were left in the hands of livestock owners predator populations and other wildlife would be seriously threatened.	1	2	3	4

Q - 5. Some people suggest that the government should compensate livestock owners for the full market value of animals killed by predators.

Under the appropriate conditions would you support such a program?
Yes _____ No _____

If you answered "Yes," please respond to the following statements by circling the appropriate number. This is what the numbers mean:

1 = Strongly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree

I would support paying livestock owners for losses if predator control were continued in agricultural regions.	1	2	3	4
I would support paying livestock owners for losses if predator control were discontinued in agricultural regions.	1	2	3	4
I would support paying livestock owners for losses <u>even</u> if total costs to the taxpayer for wildlife management <u>increased</u> as a result.	1	2	3	4
I would support paying livestock owners for losses if total costs to the taxpayer for wildlife management declined as a result.	1	2	3	4
I would support paying livestock owners for losses if total costs to the taxpayer for wildlife management were not affected.	1	2	3	4

If you would like to make any additional comments concerning a compensation program of this nature, please use the space provided below.

Q - 6. The following list contains names of various types of wildlife. Please indicate whether you like or dislike the animals by entering the appropriate number in the space provided. This is what the numbers mean:

1 = Strongly like 2 = Like 3 = Neither like nor dislike
4 = Dislike 5 = Strongly dislike

Deer _____	Elk _____	Cougar _____	Rattlesnake _____
Wolf _____	Beaver _____	Eagle _____	Coyote _____
Bat _____	Caribou _____	Gopher _____	Grizzly Bear _____
Squirrel _____	Muskrat _____	Otter _____	Black Bear _____

NEXT SOME QUESTIONS ABOUT PREDATOR CONTROL.

Q - 7. Please indicate whether or not you would condone the use of the following wolf control methods in areas where wolves are preying on domestic livestock. Please circle the appropriate number.

1 = definitely condone
2 = probably condone
3 = probably not condone
4 = definitely not condone
5 = don't know

a.	Aerial shooting (from aircraft)	1	2	3	4	5
b.	Ground shooting (at ground level)	1	2	3	4	5
c.	Regular leghold trap	1	2	3	4	5
d	Poisons that kill in less than a minute	1	2	3	4	5
e.	Poisons that kill in a few hours	1	2	3	4	5
f.	Relocation	1	2	3	4	5
g.	Eliminating wolf pups (denning)	1	2	3	4	5
h.	Aversive conditioning	1	2	3	4	5

Q - 8. In addition to the methods listed above are you aware of any other measures that wildlife officials could take to protect livestock from wolves?

Yes _____ No _____

If yes, would you list them in the space provided below?

Would you endorse the use of any of these procedures? If so, which ones?

Q - 9. A number of factors might be considered by a person attempting to decide which procedures for protecting livestock from wolves he or she would endorse. Several of them are listed below. Please indicate how important each of these factors is to you by circling the appropriate number. This is what the numbers mean:

1 = not at all important
2 = slightly important
3 = moderately important
4 = very important

a.	Cost	1	2	3	4
b.	Effectiveness in protecting livestock	1	2	3	4
c.	Humaneness	1	2	3	4
d.	Potential harm to other kinds of wildlife	1	2	3	4
e.	Does the procedure target only those animals that have killed livestock?	1	2	3	4
f.	Are they nonlethal: that is do they attempt to protect livestock using techniques that do not involve killing wolves?	1	2	3	4

Which of the factors listed above do you consider to be the most important and the second most important? (Please put the factor letter, e.g. a, b, c, etc., in the appropriate space.)

_____ Most important factor
_____ Second most important factor

Q - 10. Finally, we would like a few facts about you. These questions will be used for classification purposes only. Like the rest of the questionnaire, your answers will be kept strictly confidential.

1. Please indicate the town or city nearest to your livestock operation. _____

2. What is your age? _____

3. Your sex? Female _____ Male _____

4. Which of the following most accurately describes your formal educational background?

   a. Less than 12 years _____
   b. High school graduate _____
   c. Trade or Technical School _____
   d. Some College or University _____
   e. University Graduate (Bachelor's degree)_____
   f. Graduate Degree _____

7. Which of the following best describes your annual household income?

   a. $100,000 or more _____
   b. $50,000 to $99,999 _____
   c. $20,000 to $49,999 _____
   d. $10,000 to $19,999 _____
   e. Less than $10,000 _____

8. What percentage of your annual household income is derived from the sale of livestock? _____

Is there anything else you would like to say about the topics dealt with in this questionnaire? If so, please use the following space for that purpose. Use an additional sheet if necessary.

Thank you. We look forward to receiving your answers. Your contribution to this project is very much appreciated.

APPENDIX B

QUESTIONNAIRE SCALES

APPENDIX B

WOLF ATTITUDE SCALE

Please indicate whether or not you agree with the following statements by circling the appropriate number.

1 = Strongly agree
2 = Agree
3 = Disagree
4 = Strongly disagree

*1. The wolf is one of the few animals that kill for the pleasure of killing. 1 2 3 4

*2. Some animals like wolves are naturally cruel. 1 2 3 4

*3. Although I may never see a timber wolf in the wild, it is important to me to know that they exist. 1 2 3 4

*4. If I were to see a wolf while I was in the woods I would shoot it if I could. 1 2 3 4

*5. To me the wolf symbolizes the beauty and wonder of nature. 1 2 3 4

6. If wolves had more monetary value I would be more concerned about protecting them. 1 2 3 4

*7. Areas should be set aside in British Columbia where wolves are completely protected. 1 2 3 4

*8. If I saw a wolf in the woods I would be concerned that it might attack me. 1 2 3 4

*9. I would shoot a wolf if it threatened by pets or livestock. 1 2 3 4

10. Killing wolves is justified only if they are a threat to human life or safety. 1 2 3 4

*11. Wolves are "wasteful," frequently killing more than they need to sustain themselves. 1 2 3 4

(Continued next page. . .)

*12. The British Columbia Government should continue its policy of reducing wolf population numbers in certain areas of the Province in order to protect prey populations (e.g. deer, elk, caribou).

1 2 3 4

*13. Please indicate whether you like or dislike wolves by circling the appropriate response.

1. Strongly like 2. Like
3. Neither like nor dislike
4. Dislike 5. Strongly dislike

(Questions 3, 4, 5, 8, and 9 were reversed scored. Questions marked with an asterisk (*) were included in the final questionnaire).

ANIMAL PREFERENCE SCALE

The following list contains names of various types of wildlife. Please indicate whether you like or dislike the animals by entering the appropriate number in the space provided. This is what the numbers mean:

1 = Strongly like
2 = Like
3 = Neither like nor dislike
4 = Dislike
5 = Strongly dislike

Deer	_____	Rattlesnake	_____	Cougar	_____
Elk	_____	Wolf	_____	Beaver	_____
Eagle	_____	Coyote	_____	Bat	_____
Caribou	_____	Gopher	_____	Eagle	_____
Squirrel	_____	Muskrat	_____	Otter	_____
Black Bear	_____	Grizzly Bear	_____		

ECOLOGICAL ORIENTATION SCALE (NEP-DSP SCALE)

Please indicate whether or not you agree with the following statements by circling the appropriate number. This is what the numbers mean:

1 = Strongly agree
2 = Agree
3 = Disagree
4 = Strongly disagree

1. More emphasis should be place on teaching children about nature than on teaching them about science and technology.
   1 2 3 4

2. Rapid economic growth often creates more problems than benefits.
   1 2 3 4

3. We can continue to raise our standard of living through the application of science and technology.
   1 2 3 4

4. In the long run, there are no limits to the extent to which we can raise our standard of living.
   1 2 3 4

5. Most problems can be solved by applying more and better technology.
   1 2 3 4

6. We cannot keep counting on science and technology to solve humankind's problems.
   1 2 3 4

7. Science and technology often do as much harm as good.
   1 2 3 4

8. Economic growth improves the quality of life of all citizens in Canada.
   1 2 3 4

9. The positive benefits of economic growth far outweigh any negative consequences.
   1 2 3 4

(Continued next page . . .)

10. The Canadian people would be better off if the nation's economy stopped growing so fast.
1 2 3 4

11. Canadians are going to have to reduce their level of consumption drastically over the next few years.
1 2 3 4

*12. We are approaching the limit of the number of people the earth can support.
1 2 3 4

*13. The balance of nature is very delicate and easily upset.
1 2 3 4

*14. Humans have the right to modify the natural environment to suit their needs.
1 2 3 4

*15. Humankind was created to rule over the rest of nature.
1 2 3 4

*16. When humans interfere with nature it often produces disastrous consequences.
1 2 3 4

*17. Plants and animals exist primarily to be used by humans.
1 2 3 4

*18. To maintain a healthy economy we will have to develop a "steady-state" economy where industrial growth is controlled.
1 2 3 4

*19. Humans must live in harmony with nature in order to survive.
1 2 3 4

*20. The earth is like a spaceship with only limited room and resources.
1 2 3 4

*21. Humans need not adapt to the natural environment because they can remake it to suit their needs.
1 2 3 4

(Continued next page . . .)

*22. There are limits to growth beyond which our industrialized society cannot expand.
1 2 3 4

*23. Humankind is severely abusing the environment.
1 2 3 4

Statements 1, 2, 6, 7, 10, 11, 12, 13, 16, 18, 19, 20, 22, and 23 were reverse scored. Statements marked with an asterisk (*) constitute the NEP scale and were included in the final questionnaire.

PREDATOR THREAT SCALE

(Note: The following question appeared in two versions -- one for non-ranchers and one for ranchers.)

We would like to know whether or not you feel that certain predators pose an economic threat to individual ranchers or to the cattle industry as a whole in British Columbia. Please indicate your opinion by placing the appropriate number in the space provided. This is what the numbers mean:

1 = Pose no economic threat
2 = Pose a slight economic threat
3 = Pose a significant economic threat
4 = Pose a very serious economic threat
5 = Don't know

I. Do any of the following animals pose an economic threat to some individual ranchers in British Columbia?

a. Bears _____ b. Wolves _____ c. Coyotes _____

II. Do any of the following animals pose an economic threat to the cattle industry as a whole in British Columbia?

a. Bears _____ b. Wolves _____ c. Coyotes _____

(For non-ranchers the questionnaire included the following questions.)

III. Do you own or raise cattle in B.C.? Yes _____
No _____

(Continued next page . . .)

IV. If yes, do any of the following wild animals pose a threat to your livelihood?

a. Bears _____ b. Wolves _____ c. Coyotes _____

(For ranchers the questionnaire included the following question.)

III. Do any of the following animals pose an economic threat to your <u>own</u> cattle operation?

a. Bears _____ b. Wolves _____ c. Coyotes _____

PREDATOR CONTROL SCALE

Please indicate whether or not you would condone the use of the following <u>wolf</u> control methods acceptable in areas where wolves are preying on domestic livestock. Please circle the appropriate number.

1 = definitely condone 2 = probably condone
3 = probably <u>not</u> condone 4 = definitely <u>not</u> condone
5 = don't know

a.	Aerial shooting	1	2	3	4	5
b.	Ground shooting	1	2	3	4	5
c.	Poisons that kill in less than a minute	1	2	3	4	5
d.	Regular leghold trap	1	2	3	4	5
e.	Aversive conditioning	1	2	3	4	5
f.	Eliminating wolf pups (denning)	1	2	3	4	5
g.	Relocation	1	2	3	4	5
h.	Poisons that kill in a few hours	1	2	3	4	5

(The first four response categories were reverse scored for purposes of statistical analysi

HUMANENESS SCALE

Please indicate whether or not you feel the following wolf control methods are humane by circling the appropriate number.

1 = very humane
2 = humane
3 = inhumane
4 = very inhumane
5 = don't know

a.	Aerial shooting	1	2	3	4	5
b.	Ground shooting	1	2	3	4	5
c.	Regular leghold trap	1	2	3	4	5
d.	Poisons that kill in less than a minute	1	2	3	4	5
e.	Poisons that kill in a few hours	1	2	3	4	5
f.	Relocation	1	2	3	4	5
g.	Eliminating wolf pups (denning)	1	2	3	4	5
h.	Aversive conditioning	1	2	3	4	5

(The first four response categories were reverse scored).

PREDATOR CONTROL METHODS: FACTOR IMPORTANCE

A number of factors might be considered by a person attempting to decide which procedures for protecting livestock from wolves from wolves he or she would endorse. Several of them are listed below. Please indicate how important each of these factors is to you by circling the appropriate number. This is what the numbers mean:

1 = not at all important
2 = slightly important
3 = moderately important
4 = very important

a.	Cost	1	2	3	4
b.	Effectiveness in protecting livestock	1	2	3	4

(Continued next page . . .)

c. Humaneness 1 2 3 4

d. Potential harm to other kinds of wildlife 1 2 3 4

e. Does the procedure target only those animals that have killed livestock? 1 2 3 4

f. Are they non-lethal; that is do they attempt to protect livestock using techniques that do not involve killing wolves? 1 2 3 4

Which of the factors listed above do you consider to be the most important and the second most important? (Please put the factor letter, e.g. a, b, c, etc. in the appropriate space.)

_____ Most important factor
_____ Second most important factor

COMPENSATION

Some people suggest that the government should compensate livestock owners for the full market value of animals killed by predators.

Under the appropriate conditions would you support such a program?

Yes _____ No _____

If you answered "Yes," please respond to the following statements by circling the appropriate number. This is what the numbers means:

1 = strongly agree 2 = agree
3 = disagree 3 = strongly disagree

I would support paying livestock owners for losses if predator control were continued in agricultural regions. 1 2 3 4

I would support paying livestock owners for losses if predator control were discontinued in agricultural regions. 1 2 3 4

I would support paying livestock owners for losses <u>even</u> if total costs to the taxpayer for wildlife management <u>increased</u> as a result. 1 2 3 4

(Continued next page . . .)

I would support paying livestock owners for losses if total costs to the taxpayer for wildlife management declined as a result. 1 2 3 4

I would support paying livestock owners for losses if total costs to the taxpayer for wildlife management were not affected. 1 2 3 4

If you would like to make any additional comments concerning a compensation program of this nature, please use the space provided below.

(All items were reverse scored.)

PROBLEM IMPORTANCE SCALE (Ranchers only)

Please indicate how important each of the following problems is to you by entering the appropriate number in the space provided. This is what the numbers mean:

1 = the problem is <u>not at all important</u> to me
2 = the problem is <u>slightly important</u> to me
3 = the problem is <u>important</u> to me
4 = the problem is <u>extremely important</u> to me

a. Losing cattle to sickness or disease....._____

b. Loss of prime agricultural land to development..._____

c. Predators (wolves, coyotes, bears, etc.) ....._____

d. Crops damaged by wildlife ....._____

e. Groundwater contamination ....._____

f. Drought ....._____

g. Non-poisonous weed infestations ....._____

h. Losing cattle through accidents (bog holes, drowning)..... _____

i. Theft of livestock ....._____

j. Poisonous plants ....._____

(Continued next page . . .)

k. Hunters and other recreationists trespassing on private land ....._____

Which of the problems listed above is the most important to you and which is the second most important? (Please put the letter, e.g. a, b, b, etc., of the problem in the appropriate space.)

_____ Most important problem
_____ Second most important problem

CONTROL AND INFLUENCE

a. How much influence do you feel you, as a individual, have over predator control policies in the province of B.C.?

None _____ A little _____ A moderate amount _____

Very much _____

b. Do you belong to the British Columbia Cattlemen's Association?

Yes _____ No _____

If yes, how much influence do you feel the Association has over predator control policies in B.C.?

None _____ A little _____ A moderate amount _____

Very much _____

c. In general, do feel that you have the ability to exercise control over the number of livestock that you lose to predators each year? Please indicate that amount of control you are able to exercise by checking the appropriate response.

No control _____ A little control _____

A moderate amount of control _____

A considerable amount of control _____

Complete control _____

Not applicable: predators are not a problem for me ____

INDIVIDUAL ADJUSTMENTS (Ranchers Only)

In addition to calling on the B.C. Wildlife Branch for help, we would like to know if ranchers have discovered effective ways of protecting their own livestock from predators.

a. Are you aware of any <u>effective</u> measures that livestock owners can take to protect their animals from predators?

Yes _____ No _____

If yes, would you please list them in the space provided below?

b. Have you found a need to employ any of the measures listed in question (a) in your own livestock operation?

Yes _____ No _____

If yes, which ones?