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Source: *Bears: Their Biology and Management*, Vol. 8, A Selection of Papers from the Eighth International Conference on Bear Research and Management, Victoria, British Columbia, Canada, February 1989 (1990), pp. 113-123

Published by: International Association of Bear Research and Management

Stable URL: <http://www.jstor.org/stable/3872909>

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# A CASE HISTORY OF GRIZZLY BEAR MANAGEMENT IN THE SLIMS RIVER AREA, KLUANE NATIONAL PARK RESERVE, YUKON

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**Abstract:** A management planning program for Kluane National Park Reserve was completed in 1980. A major decision was made to develop a public transit system in the Slims River Area to facilitate visitor access to a large valley glacier. The transit system was not built and the valley was managed as a backcountry hiking area for an interim period. Characteristics of grizzly bear-people conflicts were monitored from 1981 to 1987. Park staff and 2,603 registered overnight backcountry users recorded 503 grizzly observations. Observations of solitary bears increased from 40% of total bear observations in 1981 to 84% in 1987. Frequency of avoidance behavior by grizzlies decreased whereas apparent neutral and approach behaviors increased. Incidents defined as serious were infrequent from 1981 to 1984 ( $n = 3$ ). Serious incidents sharply increased in 1985 ( $n = 10$ ) and continued to be relatively frequent in 1986 ( $n = 6$ ) and 1987 ( $n = 9$ ). Serious incidents were categorized as close approach or charge ( $n = 10$ ), pack robbing ( $n = 8$ ), food cache robbing ( $n = 2$ ) and disturbance of tent camps ( $n = 4$ ), facilities ( $n = 3$ ) and vehicles ( $n = 1$ ). Management actions resulted in the death of 5 grizzlies, relocation of 5 grizzlies and area closures. Our analysis of relevant documents from 3 national park planning and management processes indicated that grizzly bears were not adequately treated in plans and environmental assessments for the Slims River Area because of emphasis on the proposed public transit system. The relationship between habituation of grizzlies to people and food conditioning was not recognized in management of the Slims River Area as a wilderness hiking area. We considered national park management processes to be valid tools for grizzly management provided they are implemented by trained, knowledgeable staff that apply adequate information before making decisions.

*Int. Conf. Bear Res. and Manage. 8:113-123*

In 1980 a Park Management Plan was approved for Kluane National Park Reserve, a large wilderness area in the Yukon (Parks Canada 1980). The primary objective of the plan was to preserve the wilderness character of Kluane. Preservation of a wilderness population of grizzly bears (*Ursus arctos*) in Kluane implied minimizing habituation to people, preventing conditioning to people's food and wastes and thus eliminating the need for certain types of management actions. Kluane represented a unique opportunity to manage a park for use by people and preservation of bears without the effects of historical development and management practices as confounding variables. Managers were able to view management of Kluane's grizzlies from the perspective of preserving a wilderness population rather than from the perspective of restoring wilderness attributes to an impacted population.

The Canadian Parks Service applies 3 processes to assist in attaining orderly, rational and approved planning and management for each national park: the Planning Process for National Parks, the Natural Resource Management Process and the Environmental Assessment and Review Process. The successful coordination and implementation of these 3 planning and management processes is of paramount importance in carrying out national park objectives for the preservation of natural resources. For Kluane the challenge was considerable because the Park Management Plan (1980) had proposed a public transit system for the Slims River Area to facilitate visitor access to a large valley glacier.

In this paper we review the management of grizzly bears in the Slims River Area of Kluane from 1981 to

1987. Our objectives were to: 1) document the behavioral changes of a wilderness grizzly population after exposure to visitor use; 2) assess 3 National Park planning and management processes for their effectiveness in preserving a wilderness population of grizzlies; and 3) make recommendations on management of grizzlies in Canadian wilderness parks.

We thank the following individuals for their contribution in collecting data in the Slims River Area: K. McLaughlin, B. Sundbo, D. Burles, T. Hoggins, T. Hurd, L. Freese, R. Chambers, A. Lawrence, J. Sias and M. Flumerfelt. Reviews by 3 anonymous referees greatly improved the manuscript.

## STUDY AREA

The study area was a 650-km<sup>2</sup> portion of Kluane National Park Reserve, a 22,000-km<sup>2</sup> wilderness area located in the southwest corner of the Yukon Territory (Fig. 1). The landscape of the Slims River Area is continually being altered by active geomorphic processes related to past and present glacial activity. The area lies in the rain shadow of the St. Elias Mountains and is typified by a dry, continental climate with persistent glacial winds. The Slims River Area is dominated by the Slims River, which carries meltwater from the Kaskawulsh Glacier.

The valley is a classic outwash-filled valley occupied by a braided stream frequently intercepted by large alluvial fans formed by tributary streams. Three biogeoclimatic zones are present. A montane zone is limited to valley bottoms and lower slopes below 1,100 m. The

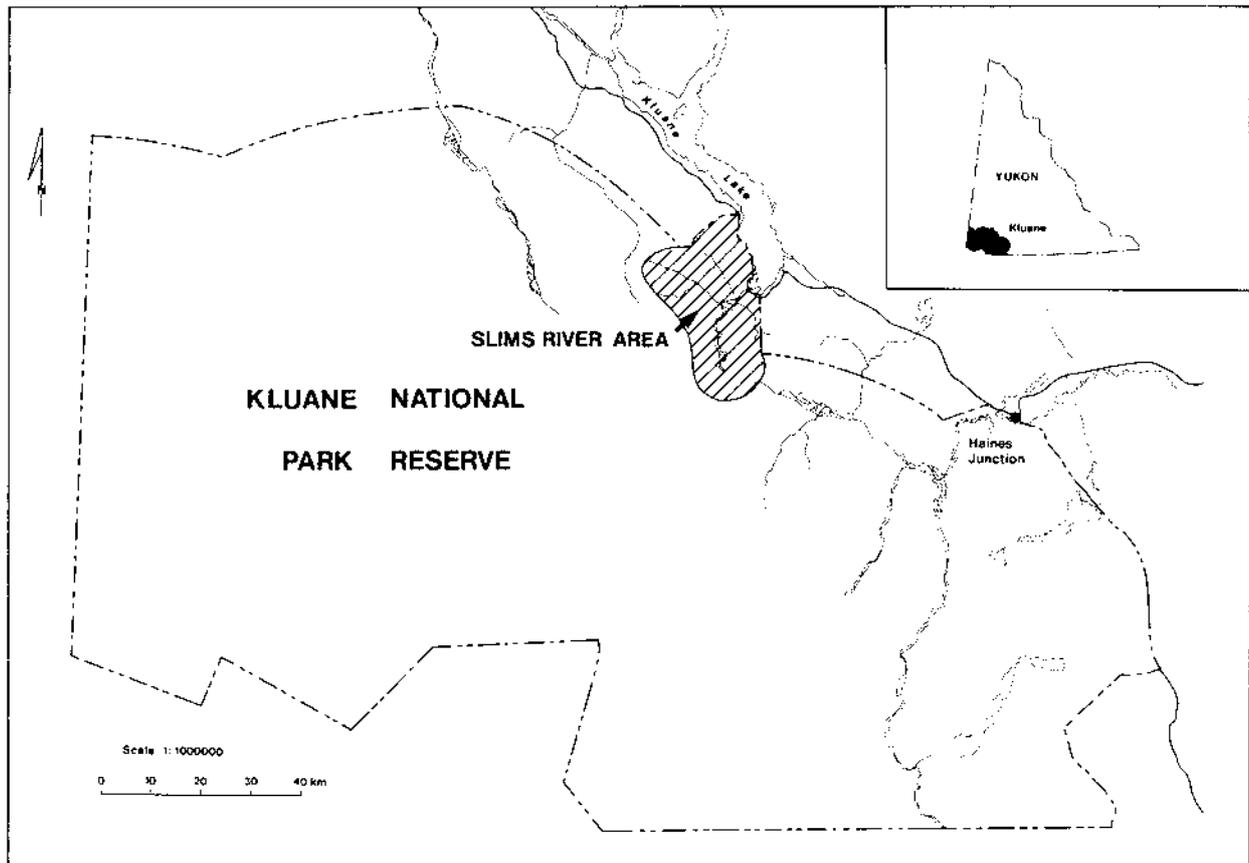


Fig. 1. Location of Slims River Area and Kluge National Park Reserve.

distribution of forest cover (*Picea glauca*) is limited by the effects of a number of geomorphic processes. A sub-alpine zone extends from 1,100 m to 1,500 m and is dominated by tall shrubs (*Salix glauca* and *Betula glandulosa*). An alpine zone, characterized by prostrate shrubs and *Dryas* communities, extends from 1,500 m to 2,100 m. Grizzly bear foods in the study area included: *Shepherdia canadensis* berries found principally in *Populus balsamifera*-*Shepherdia* and *Picea*-*Shepherdia* associations; *Equisetum* growing in wetter, treeless areas of alluvial fans; roots of *Hedysarum* found in recently disturbed parts of alluvial fans and alpine areas; *Arctostaphylos* spp. found in a variety of plant communities; and arctic ground squirrels (*Spermophilus parryi*). The Sheep-Bullion Plateau area is particularly important to grizzlies because bear foods were relatively abundant on expanses of subalpine and alpine vegetation on moderate south-facing slopes. A population of several hundred Dall's sheep (*Ovis dalli*) in the Sheep Mountain area had the potential to provide an occasional source of carrion or prey.

Pearson (1975) studied grizzly bears in the Alesk River valley area of the park, 50 km from the Slims River Area. He reported a relatively high density of 1 bear per 23-27 km<sup>2</sup> but determined that reproductive potential was low with a mean litter size of 1.6, a minimum interval between litters of 3 years, and earliest age of first reproduction of females at 6.5 years. Only 2 black bears (*Ursus americanus*) have been reported in the Slims River Area since 1972.

#### NATIONAL PARK PLANNING AND MANAGEMENT PROCESSES

The 3 national park planning and management processes are designed to be applied in a coordinated way to ensure a logical, sequential approach to management and protection of a park's resources. Figure 2 shows the sequence of implementation of the processes in Kluge and their interrelationships. When the processes are implemented, documents such as plans, or study, inven-

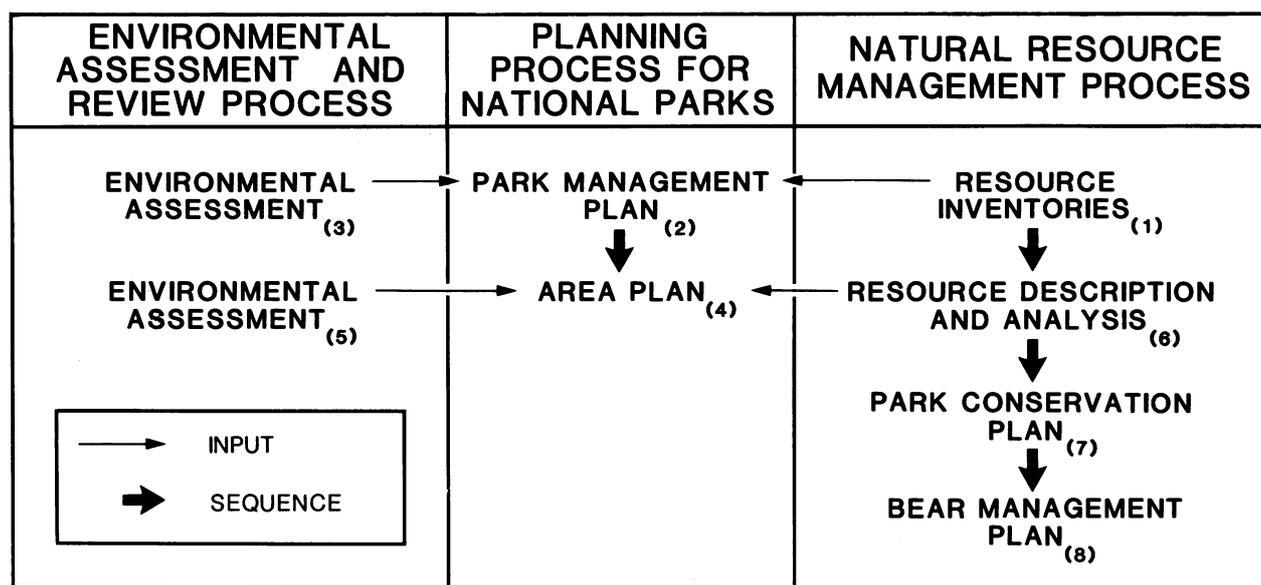


Fig. 2. Application of national park planning and management processes in Kluane National Park Reserve. Numbers in parentheses indicate temporal order of completion of process documents.

tory or environmental assessment reports are produced. This section describes: 1) the 3 processes and their associated documents and 2) the implementation of the processes in Kluane National Park Reserve.

The Planning Process for National Parks is particularly important because it results in the preparation of a Park Management Plan, which provides the approved direction for management of a park for 10 to 15 years. A Park Management Plan describes a park's role in the national park system, the scope and direction of its land use and the intent of various programs such as public education and conservation of resources. When a specific proposal for part of a park requires a more detailed, planned approach, an Area Plan is required. Both Park Management Plans and Area Plans require formal review and approval before implementation.

Management of the resources of a park is done under the Natural Resource Management Process, which is designed to be applied in coordination with the Planning Process for National Parks. The intent of the Natural Resource Management Process is to provide a sequential, integrated approach to the inventory, description, analysis and management of a park's natural resources. This process evolved from an extensive system-wide inventory of natural resources of national parks that took place in the 1970's.

The Environmental Assessment and Review Process is a federal process used to ensure that all projects or proposals involving federal money or land have the

environmental impacts understood before making decisions. In Canadian national parks this process is applied at all levels of planning and management and is used as a tool to protect resources.

All 3 processes were applied in Kluane (Fig. 2), although their coordination was hampered because 2 processes were relatively new and staff were inexperienced in their use. Resource inventories, emphasizing wildlife, soils, vegetation and geomorphology, were conducted during the 1970's (Douglas 1974, Blood and Associates 1975, Rampton 1975, Ballard and Otchere-Boateng 1977, and others). Pearson's (1975) work on grizzlies of the Alsek River area of Kluane was the main source of information on bears.

After an extensive public consultation program and analysis of the inventory data, the Park Management Plan for Kluane was approved (Parks Canada 1980). The plan's primary goal was to preserve the wilderness character of the park. The plan detailed the direction that would be applied to the park concerning the development of opportunities and facilities for visitors, its zoning for use and preservation, and the basic intention of programs for interpretation and conservation.

A major decision of the Park Management Plan was to facilitate visitor access to a large valley glacier. The Slims River Valley was chosen as an access corridor to provide a public transportation system to the Kaskawulsh glacier. The east side of the Slims River was believed to be the route that would suffer the least environmental

degradation if a transportation system was built. The plan alternatives and later the final plan were subjected to an environmental assessment under the Environmental Assessment and Review Process (Mathers 1980).

An Area Plan was prepared for the Slims River access project to ensure that the complexity of the public access proposal was properly considered (Parks Canada 1982). The final area plan received a thorough environmental assessment with recommendations for study and monitoring (Gray 1983). A description and analysis of the natural resources of the area was conducted concurrently with this exercise (Lopoukhine 1983).

A Park Conservation Plan was prepared to facilitate management of the Kluane's resources (Parks Canada 1984). The plan identified and set priorities for 20 discrete projects and 71 project tasks for the protection and management of Kluane's resources. Preparation and implementation of a Bear Management Plan was given high priority and was completed the following year (Frey 1985).

## METHODS

We evaluated the effectiveness of the 3 national park planning and management processes by examining the content of associated reports, plans and environmental assessments and files to determine how grizzly bears were considered.

Data on bear observations were collected from visitors from 1981 to 1987. All visitors wishing to travel overnight in the Slims River Area were required to register and obtain a permit. A modified recreational trailer at the foot of Sheep Mountain was used as a reception center to register visitors and provide information on the resources and hiking routes in the area. Visitors were given information on how to minimize conflicts with bears. Upon their return, visitors who reported seeing grizzly bears completed a bear observation form. Details included the number, distance from and location of bears, a physical description of the bears, behavior of the bears when first observed and subsequent behavior, and actions of people when bears were observed. Ample space was given on the form for a narrative account.

Many visitors were interviewed to assess the reliability of information on completed bear observation forms. Park staff spent time hiking in the area and we included their observations to assess reliability of visitor observations. When a bear-people incident was reported, staff investigated as soon as possible, recorded details of the encounter, and applied an appropriate management action for the situation.

Observations of grizzly bears were classed as either

distant or close. Close observations were defined as situations where a bear reacted to human presence with 1 of 3 behaviors: approach (movement toward), apparent neutral (aware of people but no movement) and avoidance (movement away). In some cases bears reacted with more than 1 behavior. The results of an observation were classed as either no incident or serious incident. We defined a serious incident as one where a bear made contact with people, equipment, food, or a facility, or charged or approached people closely enough to have posed an immediate threat. There appeared to be little confusion in the visitor's mind between a bear observation at close range and an incident that was immediately threatening.

## RESULTS

### Treatment of Bears in Planning and Management Processes

All plans, assessments and reports required by the 3 national park planning and management processes were prepared, although some steps were out of synchrony. Table 1 summarizes the content of the various process documents that dealt with grizzly bears in the Slims River Area. The emphasis of the various plans and assessments centered around the establishment of the multi-million dollar access system to the glacier. However, the Slims River Area developed a reputation and a tradition as a wilderness hiking area. Its attractions were reasonable access to a valley glacier, proximity to alpine areas and presence of interesting wildlife, vegetation and geomorphology. The presence of grizzlies and the high probability of seeing one may also have contributed to the use of the area. Because hiking in the valley was not emphasized in approved plans, no funds were available to manage the area for a wilderness hiking experience. Major budget cuts precluded funding solely from federal sources for the public access system in the Slims River Area. Nonetheless the project remained viable and attempts were made to gain interest from the private sector. From 1981-1987, staff were required to manage the Slims River Area as a wilderness hiking area on an interim basis without adequate resources or objectives. As Table 1 demonstrates, the bulk of the plans, assessments and other work dealt with the proposal to provide public transit to Kaskawulsh glacier and had little to do with management of grizzly bears.

The Bear Management Plan was an important document that described and allocated the type of bear management that was to be conducted in various areas of the park. A decision was made to conduct bear habitat

**Table 1. Treatment of grizzly bears of the Slims River Area in key documents from 3 National Park Planning and Management Processes.**

Document	Completion date	General emphasis	Treatment of Slims River area grizzly bears
Resource Inventory	1970's	Park-wide soil, vegetation, landform inventory Assessment of suitability of 5 possible access corridors from environmental perspective	– mapped 2 broad classes of grizzly bear habitat
Park Management Plan	1980	Commitment made to preservation of wilderness. Detailed development plans for parts of park (e.g., Slims River Access), land use zoning	– emphasized grizzly bear as important species to preserve in park
Environmental Assessment of Park Management Plan	1980	Trails should avoid bear habitat. Garbage control at campsites. Slims River Access screened in general sense	–specific mention of high density of grizzlies on the Sheep-Bullion Plateau part of the Slims River Area – caution made to develop slowly and monitor impacts
Slims River Area Plan	1982	Type of public transit system and route and facility placement	– need for food and garbage control – avoid grizzly habitat with route and facility placement
Description and Analysis of Resources of the Slims River Area	1983	An ecological land classification of the area with emphasis on important controlling factors and processes characteristic of various land units. Evaluation of resource importance and limitations	– mapped 2 broad classes of grizzly bear habitat (from 1970's maps) – recommended that people be directed away from bear habitat
Environmental Assessment of Slims River Area Plan	1983	Detailed screening of the major environmental impacts with mitigating measures and identification of residual impacts for the routes and facilities needed for a public transit system	– identified the possibility that the grizzly population could be impacted by the increased activity and noise in valley – recommended a careful assessment of the nature and extent of cumulative impact on the grizzly population
Park Conservation Plan	1984	A broad multi-resource conservation strategy for the park's natural resources	– identified need for a more comprehensive bear management plan
Bear Management Plan	1985	A 5-year strategy to protect bears and visitors	– prepare summary report on Slims River Area grizzlies using data from 1980-84 – report to recommend monitoring program for Slims for implementation after public transit decision is made – most work on grizzlies to take place in another park area (evaluate trail routing, campsite options, and collect data on bear diet, seasonal habitat use).

evaluations using an acceptable method (Herrero et al. 1986) in another area of the park where the Park Management Plan had indicated a system of hiking trails would be developed. Bear habitat evaluations would not be done in the Slims River Area because: 1) a public access system would soon reduce visitors' desire to hike in the area, and 2) most hiking in the Slims River Area did not occur in good grizzly habitat and the open terrain minimized probability of sudden encounters with grizzlies.

### Visitor Use

Registered overnight visitor use in the Slims River Area varied little from 1981 to 1987 (Table 2). Notable exceptions were the increased number of visitors that registered in 1982 and the smaller mean party size in 1983, which had the effect of increasing the total number of party days for these years. Use of area closures for management purposes may have reduced visitor use during 1985, 1986 and 1987. Approximately 75% of

Table 2. Registered overnight visitor use in the Slims River Area, Kluane National Park Reserve, 1981-1987.

Year	No. of parties	Mean party size	Mean party stay (days)	No. of persons	Visitor days <sup>a</sup>	Party days <sup>b</sup>
1981	117	2.2	5.0	254	1268	585
1982	232	2.3	3.9	539	2120	905
1983	238	1.5	3.9	359	1384	928
1984	161	2.7	3.2	436	1381	515
1985	138	2.3	3.6	322	1175	497
1986	199	1.7	3.6	341	1229	716
1987	157	2.2	3.3	352	1172	518

<sup>a</sup> No. of persons x no. of days

<sup>b</sup> No. of parties x mean party stay

registered overnight use occurred during July and August, with the balance distributed among May, June and September. The annual mean number of parties registered was 177, resulting in approximately 2.2 parties/day using the Slims River Area during July and August, the peak months of visitor use. This amounted to a density of about 1 party/300 km<sup>2</sup>/day in the 650-km<sup>2</sup> study area. Hiking was not random throughout the area, but occurred predominantly on the Sheep-Bullion Plateau and the east and west routes along the Slims River to the Kaskawulsh Glacier.

### Grizzly Bear Observations

From 1981 to 1987, 2,603 visitors reported 340 observations of grizzly bears. Indices of the frequency of grizzly observations indicated that 1982 was the only year in which visitors and staff saw fewer bears (Table 3). In 1983 visitors saw fewer bears per party, but staff recorded 24 bears, similar to the annual mean of 23 bears. The relatively high number of bears observed by park staff suggested that visitors may have missed many bears, but the data were reliable for among-year comparisons.

The number of solitary grizzly bears reported from 1981 to 1987 increased from 40% to 84% of total observations (Fig. 3). Three hundred and twelve (62%) of the 503 observations made by visitors and staff were classified as distant and involved no apparent reaction to human activities. Most of these were observations of bears that were feeding, resting or travelling. The remaining 191 (38%) observations were classified as close and were typified by  $\geq 1$  responses of grizzlies to the observers. Figure 4 depicts these behaviors in 3 categories: avoidance, apparent neutral and approach. From 1981 to 1984 there appeared to be a decrease in avoidance

Table 3. Grizzly observations in the Slims River Area, Kluane National Park Reserve, 1981-1987.

Year	No. of bear observations		Bear obs. per 100 visitors	Bear obs. per 1,000 visitor days	Bear obs. per party
	Visitors	Staff			
1981	40	28	15.7	31.5	0.34
1982	37	13	6.9	17.5	0.16
1983	36	24	10.0	26.0	0.15
1984	57	22	13.1	41.3	0.35
1985	60	20	18.6	51.1	0.43
1986	65	33	19.1	52.9	0.33
1987	45	23	12.8	38.4	0.29

behaviors and a slight increase in the apparent neutral and approach categories. From 1985 to 1987, grizzlies tended to approach people more often.

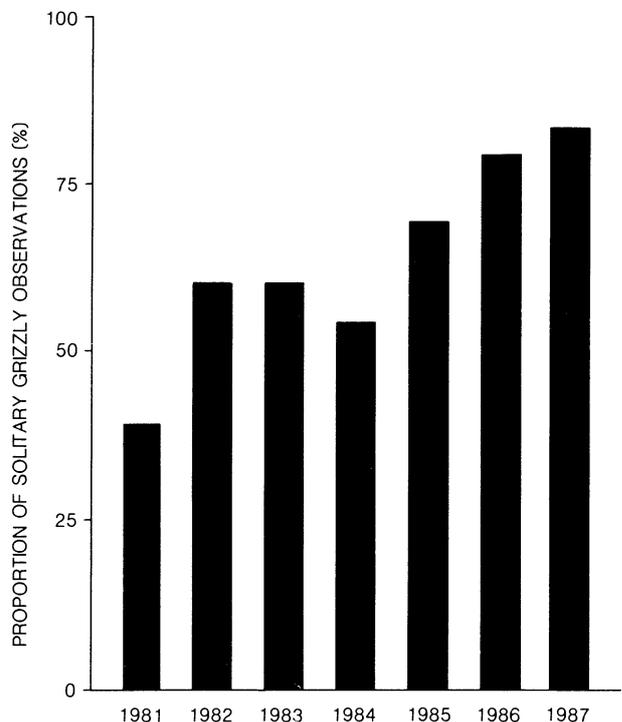


Fig. 3. Observations of solitary grizzly bears in the Slims River Area, Kluane National Park Reserve, 1981-1987.

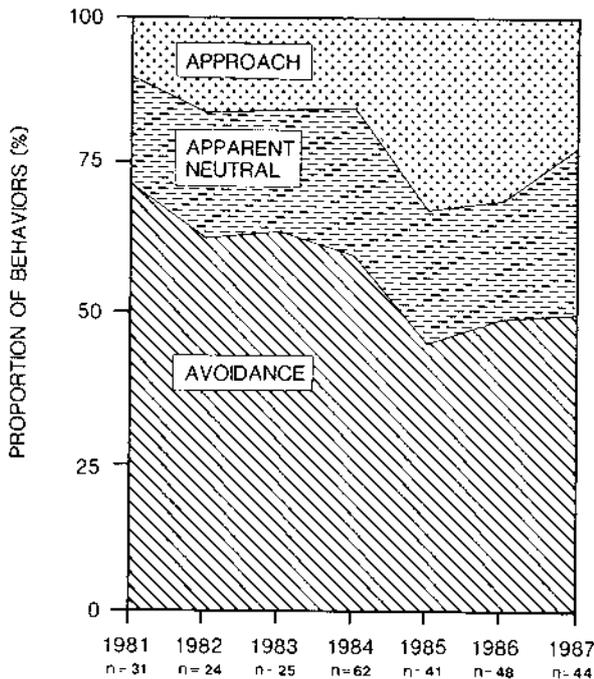


Fig. 4. Grizzly bear behaviors recorded in the Slims River Area, Kluane National Park Reserve, 1981-1987.

### Bear-People Conflict

During 1981-1984, only 3 serious incidents between bears and people occurred. Two incidents involved female grizzlies with young, 1 in a charge and 1 in a close approach. Management actions were restricted to a single area closure to deal with these defensive reactions.

In 1985 a dramatic change in the behavior of some grizzlies toward people resulted in 10 serious incidents. On 3 occasions grizzlies charged hikers when surprised at close quarters. At least 2 of these grizzlies were females accompanied by young. Four incidents involved a form of pack robbing. Typically, a solitary grizzly would follow hikers and approach to within a few meters. Hikers would drop  $\geq 1$  packs and the bear would immediately tear them open to consume food. Once a grizzly chased hikers about 10 m from their packs. Similar grizzly behavior was reported at a backcountry food cache near a tent and at 2 backcountry tent camps. All camps were occupied when the incidents occurred. In separate instances 2 grizzlies also demonstrated aggressive behavior at these camps by climbing part way up a tree after 1 hiker and chasing away another group of hikers that tried to reclaim their camp. The serious nature of the incidents created the need for immediate manage-

ment action to protect visitors. One family group, a 15-year-old female and 2 female yearlings, was killed by park staff. Two other grizzlies were immobilized and relocated to more remote areas of the park. One grizzly was captured in a culvert trap and was relocated. The Slims River Area was closed to hiking for about 30 days.

A comparatively large number of incidents also occurred in 1986. One grizzly charged hikers twice after being surprised at a distance of about 20 m. On 2 other occasions a grizzly walked toward hikers but did not rummage through the packs that were dropped. In another 2 incidents, grizzlies stalked or charged hikers to obtain packs, approaching to about 1 m. Area closures were used more frequently in an attempt to reduce the need to kill or relocate bears. The valley was closed to hiking on 3 separate occasions for a total of 24 days. One female grizzly that had obtained packs from hikers was approached by park staff and was driven from the packs by a rubber bullet fired from a 12-gauge shotgun. Two days later this bear approached park staff and was killed when it was 6 m away.

In 1987 similar incidents were reported. A grizzly stalked a lone hiker to within 5 m until he dropped his pack. The same bear charged park staff the following day. Another grizzly observed hikers, swam the Slims River, and obtained 1 pack from 3 hikers. Grizzlies entered occupied tent camps on 2 occasions and removed packs and robbed a food cache. One grizzly entered a tent camp, left, and then returned and acted more aggressively. Two hikers travelling on an open creek fan were charged by a grizzly. They dropped a foam mattress to distract the bear and left the area. One grizzly twice attempted to enter an occupied park cabin, attempted to obtain garbage from a bear-proof container and attempted to enter 2 unoccupied vehicles. To manage the situation shorter duration area closures were used more frequently; 6 different closures totaled 17 days. One male grizzly was immobilized, radio-collared and relocated. It was killed 40 days later at a mine site near the park. A female grizzly was immobilized and relocated. In another incident, park staff investigated an area where a grizzly had obtained a pack from a hiker the previous day. A non-lactating solitary adult female charged park staff and was killed at close range.

In total there were 28 serious incidents from 1981-87 (Table 4). Although 24 incidents involved hikers and placed grizzlies and people in close proximity, there were no human injuries. In only 1 case was a female with young involved in obtaining food from people; the other 4 incidents involving females with young were a result of defensive reactions to surprise encounters with people.

**Table 4. Characteristics of serious incidents caused by grizzly bears in the Slims River Area, Kluane National Park Reserve, 1981-1987.**

Year	Park facility	Vehicle	Backcountry tent camp	Backcountry food cache	Pack	Close approach or charge
1981						
1982						1
1983						
1984						2
1985			2	1	4	3
1986			1		2	3
1987	3	1	1	1	2	1

The remaining 23 incidents involved solitary grizzlies. We believe that some grizzlies repeated these behaviors to obtain food from people. Evidence from bear descriptions and the location and timing of incidents suggested that 1 bear was responsible for 4 incidents in 1985, another for 3 incidents in 1986, and 1 for 4 incidents in 1987.

From 1981 to 1983 there was <1 serious incident per 1,000 person days (Table 5). The rate showed a sharp increase in 1984 and peaked in 1985, when 7% of the parties and 3% of the people in the Slims River Area were involved in a serious incident with a grizzly bear. The rate dropped to about 50% of the 1985 levels in the subsequent 2 years.

Of the 5 bears that were relocated, only 2 could be positively linked to a previous bear-people conflict. However, all 5 bears that were killed were involved in a conflict 1 or 2 days before their death. Two of these grizzlies reacted to armed park staff with the same aggressive behavior reported by hikers.

## DISCUSSION

Management actions carried out in the Slims River Area in response to increased bear-people conflicts are a classic case of treating the effects rather than the causes of a problem. In other areas this type of management has reduced grizzlies to low densities even in sanctuaries and national parks. In a wilderness park, bear management that relies upon relocations and removals to resolve bear-people conflict will soon degrade the wilderness character of a bear population. Relocations may serve to further educate bears about people (Gilbert 1989) and removals establish a harvest regime, however conservative. Clearly, the management of problem bears in the Slims River Area between 1981 and 1987 must be viewed only as a short-

term solution dictated by immediate visitor safety requirements.

There are 2 related issues to consider in the case history of grizzly bear management in the Slims River Area: the effectiveness of Canadian Parks Service planning and management processes and the biology of the bear-people problem that developed.

The process documents did not deal adequately with the Slims River Valley grizzlies. The main problem stemmed from a failure to consider grizzly bears properly because of the pre-occupation with planning the public access system. No interim plans were developed, allowing the area to be used for hiking for an indeterminate period without the perceived need or availability of resources to do required research and management of grizzly bears. From 1981 to 1987 the Slims River Area essentially remained devoid of any consistent strategy for management of grizzly bears and people despite the production of numerous planning and management documents. In addition, our analysis of the process documents indicated that there existed a lack of understanding of the type of data on the biology of Kluane's grizzlies that could be applied for management purposes. How grizzlies use their habitat and where key resources in their habitat are located (Hamer and Herrero 1983, 1987*a,b*) are basic knowledge required to manage grizzlies and people in national parks. This information was entirely lacking in process documents because a single premise, that availability of garbage was the major factor in bear-people problems, existed during planning in the 1970's and pervaded subsequent thinking.

The Canadian Parks Service spent much time and money in southern, developed parks to restrict availability of human foods to bears by closing garbage dumps and bear-proofing garbage containers (Mundy and Flook

**Table 5. Rates of grizzly bear-people conflict in the Slims River Area, Kluane National Park Reserve, 1981-1987.**

Year	Serious encounters per 100 parties	Serious encounters per 1,000 person days	Serious encounters per 100 persons
1981			
1982	0.45	0.79	0.19
1983			
1984	1.25	1.4	0.46
1985	7.0	8.5	3.1
1986	3.0	4.9	1.8
1987 <sup>a</sup>	3.15	4.3	1.4

<sup>a</sup> Does not include facility or vehicle incidents shown in Table 4.

1973, Taylor 1984). Although this is undoubtedly the most important step in reducing food conditioning of bears, it does not entirely eliminate the potential for problems because bear behavior is complex. Kluane possessed no dumps or garbage problem, so it was perceived that this park would have few problems as long as people avoided dense grizzly areas. The Canadian Parks Service clearly lacked experience in managing pristine, wilderness populations of grizzly bears. This is reflected in the content of the process documents and the subsequent development of bear-people conflict.

The Bear Management Plan was the first document to consider grizzly management in the park in reasonable detail. We believe that the decision to conduct bear habitat use studies in another portion of Kluane that was slated to be a hiking area and to depend upon the openness of the terrain in the Slims River Area to minimize grizzly-people encounters was valid considering the available people and financial resources. Data collected during 1981-84 (Tables 3,4,5) supported this decision. It appeared, at least until 1985, that hikers were receiving a prime wilderness experience highlighted by an opportunity to view unhabituated grizzly bears. Grizzly bear habitat evaluations and routing of trails in the Slims River Area may have done little to reduce the likelihood of incidents since much visitor use was already in less productive bear habitat along unvegetated stream channels of the Slims River. Establishing mandatory use of bear-proof backpacking containers in conjunction with an aversive conditioning program (Dalle-Molle and Van Horn 1989) would have been prudent measures to discourage habituation and food conditioning of these grizzlies.

The Bear Management Plan's primary shortcoming was the failure to recognize that hiking within an area inhabited by wilderness grizzlies could change bear behavior. Frequent contact with people in the absence of negative stimuli can cause habituation of bears to people (Jope 1985). Development of habituation may foster a simultaneous development of food conditioning (McCullough 1982).

Our critique of the 3 planning and management processes as applied in the Slims River Area showed they could be valid tools for rational, responsible land use management. Failure to treat bears was a human error related to the agency's perception of bear management through experiences in more developed, southern parks. The 3 processes are sound if they are operated by trained, knowledgeable staff that apply adequate information before making decisions.

Understanding the biology of the bear-people prob-

lem in the Slims River Area is of primary importance. In particular, the causes of the marked and rapid change in grizzly bear behavior toward people in the Slims River Area must be addressed if grizzly management in Kluane is to proceed toward the approved objective of preserving a wilderness grizzly bear population. Four general hypotheses that potentially address the observed changes in bear behavior are presented with their supporting and conflicting evidence.

Hypothesis 1: A fundamental relationship exists between the number of park visitors and number of management removals of grizzly bears. Martinka (1982) showed that this relationship was probable in Glacier National Park, Montana. Dalle-Molle and Van Horn (1989) documented an increase in bear-people conflicts in Denali National Park, Alaska, that was associated with increased visitation. The establishment of Kluane National Park Reserve and the subsequent public consultation program resulted in increased hiking use in the Slims River Area. This increase in human use appeared to have no repercussions until 1985, when changes in behavior led to removal of some bears. In the broadest sense, it appears that presence of people in grizzly habitat will result in bear-people conflict that is simply caused by overlap of 2 species that are not completely compatible. Although this hypothesis does not explain the immediate cause of the problems, it identifies people, even doing benign things like hiking, are a significant concern in the protection of grizzly bears.

Hypothesis 2: A change in characteristics of the grizzly bear population occurred that increased the probability of bear-people conflict. The increased number of observations of solitary bears (Fig. 3) appeared to be related to the increased number of incidents. Young from the large number of family groups (60% of observations in 1981) may have dispersed and may have been more prone to becoming involved with people. However, there is evidence that a number of types of human activity in grizzly habitat can displace females with young (Archibald et al. 1987, Mattson et al. 1987, Gilbert 1989) thus increasing the proportion of solitary bears observed. This is supported by the decreased rate of bear observations during 1981 and 1982 when visitor use was highest. It is not generally supported by the low density of human use described in the Slims River Area. Whatever the reason, the prevalence of solitary bears seemed to be correlated with the development of problems.

Hypothesis 3: Grizzlies became habituated to visitor use in the valley and some factors led to food conditioning. Jope (1985) showed that grizzlies habituate to hikers. Before the increase in incidents in 1985 there was

only weak evidence (Fig. 4) that avoidance behavior of grizzlies in the Slims River Area may have been decreasing. Food conditioning may have been partly caused by bears having access to a dump near the park boundary during the duration of this study and making the subsequent association between garbage and food in packs. Unfortunately, we have no data on the ages, sex or movements of bears that used the dump and whether these bears used the Slims River Area. The sudden increase of incidents in 1985 suggests the possibility of an environmental trigger, such as a failure of some natural foods, which may have caused habituated bears to become more aggressive. Observations of grizzlies entering camps and not obtaining food may reflect the learning process that led to food conditioning.

Hypothesis 4: Complete protection of grizzly bears will allow more aggressive individuals to survive and interact with people. Herrero (1985, 1989) demonstrated that aggressive grizzlies that inflict injury are largely a phenomenon of national parks; in other areas they are killed. Before 1974, when Kluane received legal protection under the *National Parks Act*, placer miners and poachers likely eliminated some aggressive bears. The first generation of grizzlies born from females that experienced complete legal protection since birth would have been dispersing in the park in the mid-1980's when the incidents first occurred. This hypothesis is further supported by a recent review of behavioral plasticity and learning in grizzly bears (Gilbert 1989).

We have no evidence to reject any of the 4 hypotheses. They do illustrate how diverse the origin of the problem may be and the difficulty in establishing a management program to treat causes, rather than effects.

## CONCLUSIONS AND RECOMMENDATIONS

Managing national parks using the Planning Process for National Parks, the Natural Resource Management Process and the Environmental Assessment and Review Process could generate significant negative impacts on grizzly bears if this species is not considered during every stage of planning and management. Managers must recognize that small errors in the planning and management documents associated with these processes can cause large, serious errors resulting in grizzly bear-people conflict that reduces visitor safety and ultimately ends up in the removal of bears.

Implementation of the Planning Process for National Parks must result in Park Management Plans and Area Plans that set objectives for grizzly bear protection in an ecosystem management context. These plans should propose only those human uses that will not encourage

grizzly-bear people conflict. Application of the Environmental Assessment and Review Process must occur in early planning stages and not only identify potential impacts on grizzly bears, but specifically detail the range of mitigating measures necessary to reduce effects on bears. No plans should be approved unless adequate grizzly bear protection and management measures are identified and funded. Interim land uses not approved in plans must be dealt with in the same fashion.

The complexity of grizzly behavior necessitates a more theoretical and comprehensive approach to management than most other natural resources. Consequently, the Natural Resource Management Process must set up a framework for dealing with grizzly bears in inventories, studies, resource management plans and analyses. Grizzly bears must be considered in this process as a matter of course, not only to resolve problems.

Basic information at the inventory level must include a thorough understanding of grizzly bear habitat use and feeding ecology over a long enough time to account for natural variations in food availability and population changes. Studies of grizzly bear behavior with emphasis on learning, habituation and food conditioning should be a priority if we are to establish an equilibrium between people and grizzlies in national parks. Techniques to reduce grizzly-people conflict, such as bear-proof backpacking containers for hikers, should be incorporated into management plans. The role of aversive conditioning should be explored cautiously and, if necessary, implemented within the context of an experimental research program. Bear management plans must deal with causes of grizzly bear-people problems, rather than the effects. Monitoring programs must be developed that quantitatively describe grizzly behavior toward people and carefully assess behavioral changes in relation to time and varying human uses.

Most importantly, the implementation of the 3 national park planning and management processes must be well coordinated to ensure that adequate information on grizzly bears is available before making decisions. The general intent of these recommendations applies to other agencies that are responsible for managing wilderness grizzly populations, regardless of how their planning and management framework is applied.

Despite the best efforts to understand grizzly bear behavior and manage human use in bear habitat, serious deficiencies remain that are always resolved at the expense of the bears. Until data are available to show that people and grizzly bears can co-exist without modifying bear behavior in a way that eventually leads to removals, managers of reserves should set aside large areas that

allow grizzlies to retain the attributes of a wilderness population. Managers of Canadian national parks that contain wilderness grizzly populations should zone extensive special preservation areas that preclude, or severely restrict, all human uses.

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