

Bear report issued

YELLOWSTONE NATIONAL PARK — A draft environmental impact statement on a management program of the Yellowstone grizzly bear has been published.

The National Park Service said the statement follows by two months the completion of a special study on the population dynamics of the grizzly bears by a committee of the National Academy of Science.

The committee found no evidence that the Yellowstone grizzly is approaching extinction, according to the park service.

The program proposed by the service is

directed towards encouraging the bears to return to a wild, free-ranging existence. As the first move towards this goal of discouraging human feeding, the park service in 1970 closed garbage dumps within the park.

The draft statement will be submitted to 13 federal and state government agencies and more than 20 conservation, environmental and citizen's groups for review and comment before final preparation of the final statement.

Copies will also be sent to libraries, colleges and universities throughout the Rocky Mountain region.

national park service

For Release

October 13, 1974

Jim Harpster (303) 234-3095

Tom Wilson (202) 343-7394

NATIONAL PARK SERVICE ISSUES ENVIRONMENTAL STATEMENT
ON YELLOWSTONE NATIONAL PARK GRIZZLY BEAR MANAGEMENT PROGRAM

The National Park Service of the Department of the Interior today announced the publication of a draft environmental impact statement on its proposal to continue a management program designed to perpetuate a wild, free-ranging grizzly bear population in Yellowstone National Park, Wyoming.

The statement follows by two months the completion of a special study of the population dynamics of grizzly bears in Yellowstone by a committee of the National Academy of Science. The committee found no convincing evidence that the Yellowstone grizzly was in immediate danger of extinction.

no one has stated this
Director Ronald H. Walker of the National Park Service said the environmental statement addresses the likely impact of continuing the grizzly bear management program. This program, he said, centers principally on efforts to reduce feeding of bears by humans and to regulate visitor distribution in Yellowstone National Park.

*This was never a problem with grizzlies
Rapid closure of dumps created a problem*
The National Park Service closed garbage dumps within the park in 1970 as a major step in encouraging grizzly bears to return to their natural free-ranging environment and in minimizing the opportunities for bear-human contact.

This action increased bear-human contact
The agency estimates there are between 250 and 300 grizzly bears within Yellowstone National Park, approximately the same number as when the dumps were closed four years ago. *NAS Committee estimates possibly 158 in 1974*

Walker said four basic elements comprise the Park Service's on-going management program. They are: strict sanitation standards in all campgrounds, picnic areas, park roads and other areas of visitor concentration; visitor-use restrictions and warnings to visitors about the presence of bears in the park; the controlling of problem bears, with emphasis on trapping and relocating such animals; and a continued program of bear research and monitoring with cooperative assistance from State and Federal resource agencies.

The monitoring program will include the development of improved census techniques that will provide realistic estimates of both black and grizzly bear populations within and adjacent to the park.

Hopefully more realistic than past P.S. estimates & techniques.

restore to what time & condition?

What is natural distribution

How obscure?

"The objective of the management program," says the environmental statement, "is to restore and maintain the natural integrity, distribution, abundance, and behavior of an endemic grizzly bear population; provide for the safety of park visitors; and provide opportunities for visitors to understand, observe and appreciate the grizzly bear as a significant member of America's wildlife heritage."

The statement discusses a number of possible alternatives, including further restrictions on visitor use of the park, elimination of grizzly bears from the park, and increasing the grizzly bear population by artificial methods.

How? Why reduce & then increase?

The draft environmental statement will be submitted to 13 Federal and State government agencies and more than 20 conservation, environmental and citizens' groups for review and comment before preparation of the final statement.

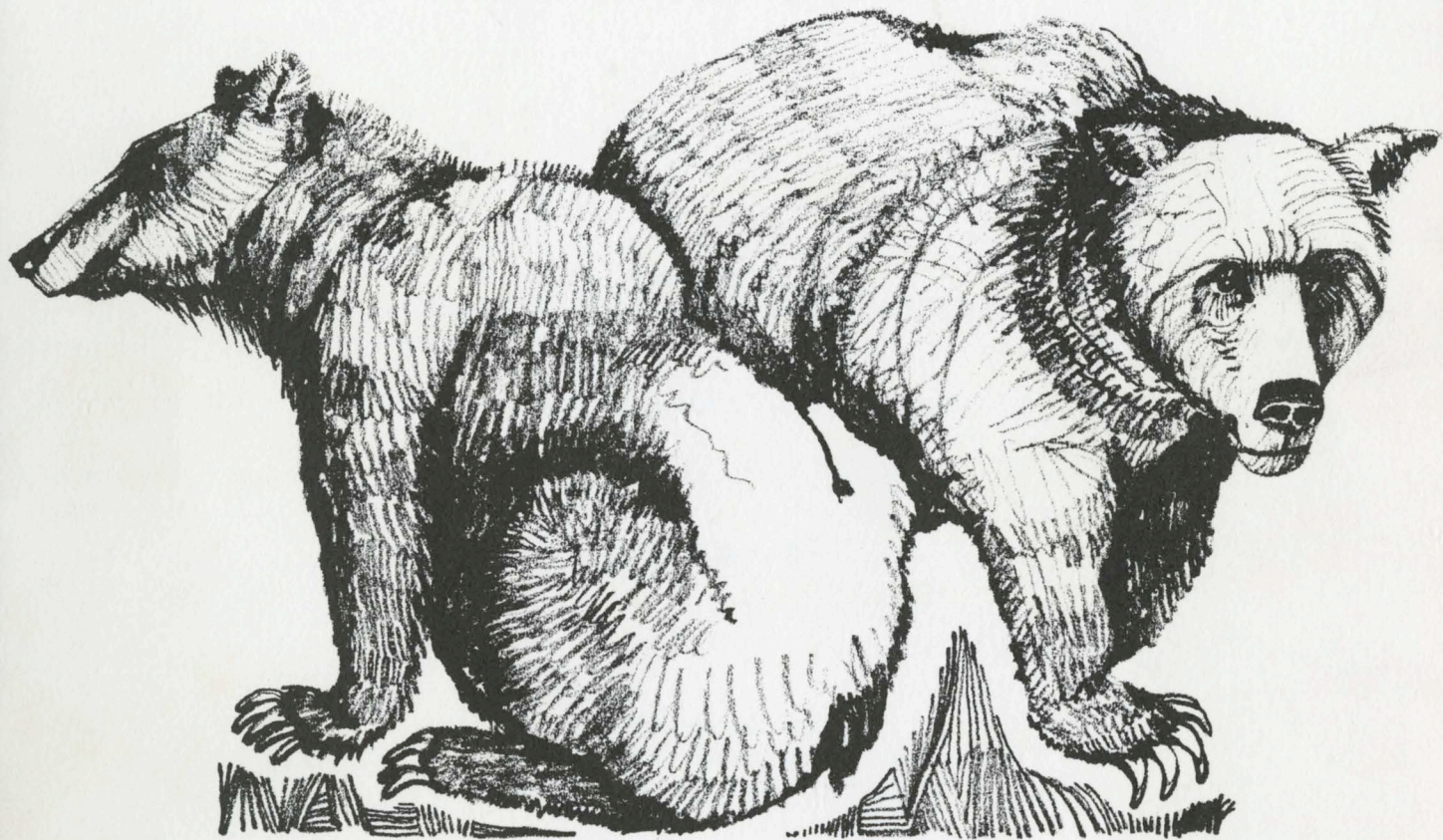
Copies of the document will be distributed to Federal and State government agencies, libraries and to colleges and universities throughout the Rocky Mountain Region.

✓ Additional copies are available for review at Yellowstone National Park; at the Rocky Mountain Regional Office of the National Park Service, 655 Parfet Street, Denver, Colorado 80225; and at the National Park Service headquarters, Department of the Interior building, Washington, D.C. 20240. Comments on the draft environmental impact statement should be submitted to the Regional Director, National Park Service, at the above Denver address not later than December 2, 1974.

-NPS-

✓ F. Crawford

ENVIRONMENTAL STATEMENT
preliminary draft



Grizzly Bear
Management Program
yellowstone national park . wyoming, montana, idaho

DEPARTMENT OF THE INTERIOR

DRAFT

ENVIRONMENTAL STATEMENT

PROPOSED
GRIZZLY BEAR MANAGEMENT PROGRAM

Yellowstone National Park, Wyoming

DES 74 - 87

Prepared by
National Park Service
Department of the Interior

Acting Regional Director, Rocky Mountain Region

SEP 18 1974

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Summary

(X) Draft () Final Environmental Impact Statement

Department of the Interior, National Park Service, Yellowstone National Park, Wyoming

1. Type of Action: (X) Administrative () Legislative

2. Brief Description of Action: The National Park Service proposes to continue to implement an on-going grizzly bear management program the purpose of which is to perpetuate a wild, free-ranging grizzly bear population in Yellowstone National Park and minimize conflicts between humans in the park and grizzly bears by reducing man-generated food sources and by regulating visitor distribution in the park.

3. Summary of Environmental Impact and Adverse Environmental Effects: The principal impacts are: (1) the entire grizzly bear population in Yellowstone National Park will become wild and free-ranging and an integral part of the Yellowstone ecosystem as it was in the past by reestablishing natural food source feeding habits and by eliminating opportunities to establish and/or maintain unnatural relationships with man. (2) The grizzly bear population will experience temporary disturbance associated with readaptation to natural food sources. (3) Hazardous contacts and confrontations between humans and grizzly bears will be minimized, thus reducing the potential for personal injuries occurring to humans in the park. (4) Since the program emphasizes the principle of the regulation of man (except where unavoidable necessity exists to regulate intractable bears), humans in the park (visitors to and residents) will experience restrictions of their behavior, inconveniences, and constant reminders of the dangers of their environment - all of which may detract from the enjoyment of the park.

4. Alternatives Considered:

- No Action.
- Eliminate Grizzly Bears from the Yellowstone National Park.
- Further Restrict Visitor Use.
- Increase Grizzly Bear Population by Artificial Methods.
- Alternative Actions Outside the Direct Authority of the National Park Service.

5. Comments Have Been Requested From the Following: (see attached)

6. Date Draft Statement Made Available to CEQ and the Public: SEP 18 1974

?
how about
outside of
Park, they
have apparently
increased.

Federal Agencies

U.S. Department of the Interior
Bureau of Land Management
Bureau of Outdoor Recreation
U.S. Fish and Wildlife Service

Environmental Protection Agency
Bureau of Solid Waste Management

Advisory Council on Historic Preservation

U.S. Department of Agriculture
Forest Service

U.S. Department of Health, Education and Welfare
Public Health Service

State Agencies

Idaho State Clearinghouse
Idaho State Historic Preservation Office
Montana State Clearinghouse
Montana State Historic Preservation Office
Wyoming State Clearinghouse
Wyoming State Historic Preservation Office

Private Organizations and Citizens Groups

Conservation Foundation
Defenders of Wildlife
Friends of Animals, Inc.
Friends of the Earth
Fund for Animals, Inc.
Idaho Chapter, The Nature Conservancy
Idaho Environmental Council
Idaho Recreation and Park Society
Idaho Wildlife Federation
Idaho Wildlife, Inc.
International Association of Game, Fish and Conservation
Commissioners, Grizzly Bear Committee
Izaak Walton League
Montana Division Izaak Walton League of America
Montana Wildlife Federation
National Academy of Sciences
National Parks and Conservation Association
National Wildlife Federation
Sierra Club
The Wilderness Society
Wyoming Outdoor Council, Inc.

I. DESCRIPTION OF THE PROPOSAL

A. The National Park Service proposes to continue to implement an on-going grizzly bear management program initiated in the 1960's and designed with the purpose of perpetuating a wild, free-ranging grizzly bear population in Yellowstone National Park, Wyoming-Montana-Idaho, and to minimizing conflicts between humans in the park and grizzly bears.

Yellowstone National Park (Figure 1), in the establishment act of March 1, 1872 (17 Stat. 32), was "dedicated and set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people" and "for the preservation, from injury or spoilation, of all timber, mineral deposits, natural curiosities, or wonders . . . and their retention in their natural condition."

In carrying out the above purpose, the objective is to restore and maintain the natural integrity, distribution, abundance, and behavior of an endemic grizzly bear population; provide for the safety of park visitors; and provide opportunities for visitors to understand, observe and appreciate the grizzly bear as a significant member of America's wildlife heritage.

The program is designed to maintain the natural ecosystems in Yellowstone National Park with the grizzly bear as an integral part. It is further designed to regulate those activities of man that tend to attract bears to developed areas of the park and which often result in individual bears becoming habitual users of cultural and therefore artificial food sources. Thus, the program is concerned with preventing the causes of man-bear conflicts rather than treating the symptoms.

Although the program is directed specifically to actions involving the grizzly bear, it applies equally to the black bear because of similarity in behavior traits and associated problems.

The on-going grizzly bear management program consists of the following four basic elements: (1) to implement and enforce strict sanitation standards; (2) to implement and enforce visitor use restrictions; (3) to control problem bears; and (4) to continue a multifaceted research program on the ecology of grizzly bears within the park. Its specific provisions are as follows:

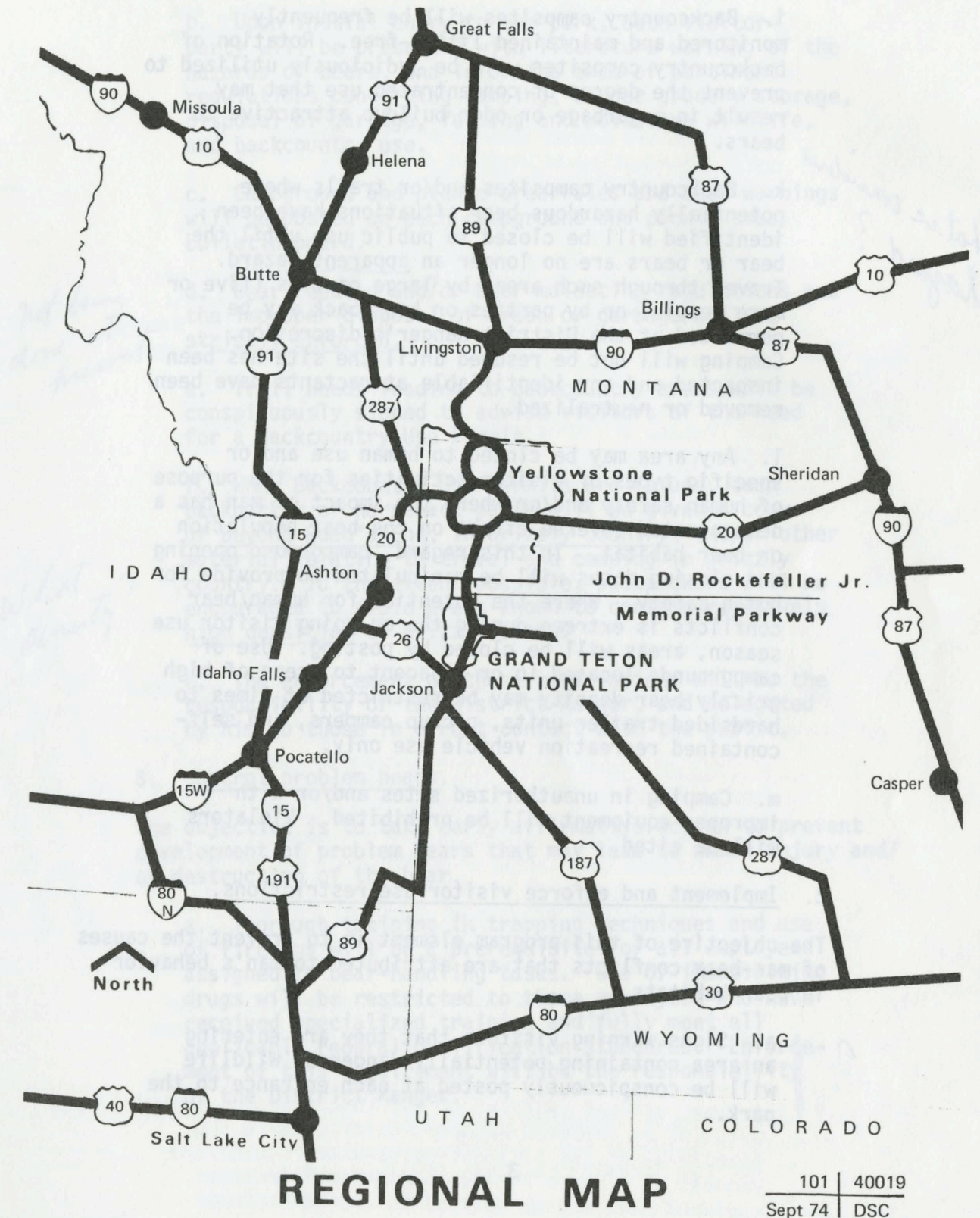
1. Implement and enforce strict sanitation standards.

The objective is the total elimination of artificial food sources for the grizzly bear, and the regulation of food storage and garbage disposal practices by visitors that may increase hazards of bears to man. Strict sanitation

standards will be maintained in all campgrounds, picnic areas, park roads, and other areas of visitor concentration.

- a. All outdoor trash cans will be of a bear-resistant design and equipped with a removable plastic liner.
- b. All trash cans that are not of the bear-resistant design, whether located at employee residences, administrative offices, concessioner food services, stores, lodges, cabins, or other concessioner facilities, will be located inside the building served.
- c. Trash pickups will be scheduled to prevent overflows of cans and the overnight storage of garbage in campgrounds and other visitor use areas that may be frequented by bears.
- d. When loaded, trash collection vehicles will proceed directly to the appropriate disposal facility, except that during hours when incinerators or sanitary landfills are not in operation trash will be stored on the collection vehicle within a bear-resistant campground.
- e. Trash disposal facilities will be designed, updated, and operated to meet applicable Environmental Protection Agency and Public Health Service standards, and in addition will be protected by chainlink fencing reinforced by non-lethal electric fencing (to be operated as needed) and barbed wire to prevent entry by bears.
- f. Sanitary landfills and incinerator sites will be closed to public access. Entry by anyone is permitted only by authorization of the District Ranger. Violators will be cited.
- g. Roadsides, campgrounds, and all other areas of concentrated visitor use will be maintained litter-free.
- h. Daily patrols of campgrounds by Park Rangers will be conducted to insure that camper food supplies are properly stored, and that all campers fully understand and are in compliance with the provisions of Special Regulation S 7-13(g)(3).

FIGURE 1. THE REGION



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i. Backcountry campsites will be frequently monitored and maintained litter-free. Rotation of backcountry campsites will be judiciously utilized to prevent the degree of concentrated use that may result in a garbage or odor buildup attractive to bears.

k. Backcountry campsites and/or trails where potentially hazardous bear situations have been identified will be closed to public use until the bear or bears are no longer an apparent hazard. Travel through such areas by large parties (five or more people) or by parties on horseback may be permitted at the District Ranger's discretion. Camping will not be resumed until the site has been inspected and any identifiable attractants have been removed or neutralized.

l. Any area may be closed to human use and/or specific types of visitor activities for the purpose of human safety and/or where the impact of man has a demonstrated adverse effect on the bear population or bear habitat. In this regard, campground opening and closing dates will be manipulated to provide for human safety. Where the potential for human/bear conflicts is extreme during the on-going visitor use season, areas will be closed by posting. Use of campgrounds located in or adjacent to areas of high grizzly bear density may be restricted at times to hardsided trailer units, pickup campers, and self-contained recreation vehicle use only.

m. Camping in unauthorized sites and/or with improper equipment will be prohibited. Violators will be cited.

2. Implement and enforce visitor use restrictions.

The objective of this program element is to prevent the causes of man-bear conflicts that are attributed to man's behavior in bear habitats.

a. Signs warning visitors that they are entering an area containing potentially dangerous wildlife will be conspicuously posted at each entrance to the park.

b. Upon initial entry to the park, each visitor-party will be presented with literature warning of the hazards of bears, and informing them of pertinent regulations concerning camping, camper grocery storage, disposal of garbage, feeding and molesting wildlife, and backcountry use.

c. Campground and picnic area rules and bear warnings will be posted on each campground and picnic area bulletin board.

d. Bear feeding and/or bear molesting regulations and the improper disposal of trash or garbage will be strictly enforced.

e. Trail heads leading to backcountry areas will be conspicuously signed to advise visitors of the need for a Backcountry Use Permit.

f. When Backcountry Use Permits are issued, each backpacker or horseback party will be given a copy of Beyond Road's End, In Grizzly Country, and/or other material relating to travel and camping in grizzly country. To the extent possible, backpackers will be encouraged to avoid areas known to contain relatively high densities of grizzly bears.

g. The enforcement of these restrictions will be the responsibility of the District Ranger, and delegated by him to those in direct contact with the public.

3. Control problem bears.

The objective is to take early affirmative action to prevent development of problem bears that may lead to human injury and/or destruction of the bear.

a. Thorough training in trapping techniques and use of firearms will be a prerequisite for all employees assigned to bear-handling tasks. Use of immobilizing drugs will be restricted to those employees who have received specialized training and fully meet all applicable Federal qualification standards. Enforcement of this requirement will be the responsibility of the District Ranger.

b. Necessity for bear capture, trapping hours, and procedure will be determined by the District Ranger. Traps will not be baited or set in any area unless an offending bear is known to be present. No bear will be captured or destroyed in a backcountry area unless it has become unnaturally aggressive and other alternative methods of providing for human safety cannot be employed.

c. Baited traps will be identified by conspicuous warning signs, and set traps shall not be left unattended in public use areas during busy, daylight hours. Only personnel with specific assignments on control action teams will be present at the site during capture and handling of bears. No bystander will be permitted.

d. Trapped or immobilized bears will be removed from campgrounds or other public use areas as soon as possible after capture in order to minimize the possibility of human injury or the feeding and/or harassment of captured bears.

e. The hazards associated with "black bear jams" will be minimized by the prompt removal of habitual roadside bears; special attention will be given to the prevention of roadside bear problems along sections of the park road with limited sight distance where parked vehicles constitute a particular traffic hazard.

f. Grizzly bears that are captured by the use of immobilizing drugs will be tagged with eartags. Except as may be required to facilitate approved research projects, grizzly bears trapped in conventional bear traps will not be subjected to the additional stress of immobilizing drugs or to handling for the purpose of affixing eartags. No other marks or tags will be permitted without the expressed approval of the Superintendent.

g. Trapped bears will not be released outside the sub-district in which they were trapped without the District Ranger's approval. They will not be released outside the district in which they were trapped without approval of the Chief Ranger. Bears will not be released adjacent to or outside the boundaries of the national park, except that, upon request of a State Fish and Game Department, a captured bear may be donated to the state for restocking purposes.

h. Except in emergency situations involving a critical and immediate hazard to human safety, the decision to destroy a bear will be made by the Superintendent and based on a thorough staff review of the situation, including the individual bear's known history and the particular circumstances.

i. Bears that must be removed from the population may be donated to public zoos or given to any requesting state for reestablishment of populations. If there are no requests for live specimens, or if it is impractical at the time to fill the request, the bear may be destroyed.

j. Any incident of a grizzly being either intentionally or accidentally killed in the park will be reported by telephone as soon as possible to the Superintendent's office.

k. The carcass of any black or grizzly bear killed in the park shall be immediately sent to the Montana State Fish and Game Laboratory at Bozeman for testing and processing as a scientific specimen.

l. No bear is to be destroyed or moved in retaliation for exhibiting its natural behavior--such as the defense of natural food sources or its young.

4. Continue bear research and monitoring.

Research and monitoring are integral parts of the proposed action. The objective of this program is to provide management with comprehensive factual knowledge of bear distribution, population dynamics, behavior, ecology of human-bear interrelations, and to evaluate the effectiveness of management programs affecting or affected by the grizzly bear population.

A vigorous integrated research program will be continued, including:

a. The development of census techniques that will provide realistic population estimates of wild, free-ranging black bear and grizzly bear within and adjacent to the national park.

b. Determining population dynamics, seasonal and annual distribution patterns, and movement of grizzly bears within national park and adjacent national forest lands.

Has this been done from 1968 to present?

If not reported by hunter or park personnel will violator be cited?

What is natural behavior?

attack due to surprise or feeling threatened approaching too close?

wild?

Why? Visitor, Scientist, reporter

No bears now & none in future Is this desirable?

What additional stress?

Have any bears been removed outside of park in the past without request or approval of State?

Does the marking policy apply in all parks to all animals?

c. Determining habitat requirements and the ecological relationships of the grizzly bear to other fauna and to plants of the national park and adjacent national forest ecosystems.

d. Determining immediate and probable long-term stresses and impacts on bears caused by various land use practices within and adjacent to the park. This will include an evaluation of the various types and intensities of visitor use activities, resource use, land development, and other management actions.

e. In carrying out the above general research objectives, the efforts of National Park Service scientists and the Interagency Grizzly Bear Study Team will be supplemented by encouraging outside scientists from the diverse disciplines of physical, biological, and behavioral sciences to undertake studies within the national park and to contribute to the understanding of park ecosystems. Such additional research efforts will, of course, be coordinated and regulated under a permit system.

f. A research project to test and evaluate various bear-averse techniques and devices and physical and chemical repellents will continue. The operational use of any such technique, device, and product, however, will not be permitted until the implications of its use on human safety and bear behavior and well-being are fully understood.

The bear monitoring program will require the following:

a. All incidents involving bears and people and/or their property shall be investigated and a factual and detailed bear incident report (YELL 371, Revised 3/13/69) shall be submitted to the Superintendent's office. In incidents where injury and/or property damage have occurred, the investigating officer's report will be supplemented when possible by the statements of witnesses to the incident.

b. All management actions involving bears will be reported by telephone to the Resources Management Office.

Does this mean control? If so they should be a written report.

c. All grizzly bear sighting will be recorded in the station log and telephoned daily to the biologist's office. Information shall include observer, date, location, time, number, activity, and, if possible, sex, age class, and individual description.

B. Interrelationships with Other Programs

1. Solid waste management in the Yellowstone National Park region.

While the grizzly bear management program is concerned primarily with perpetuating a wild, free-ranging population of grizzly bears within Yellowstone National Park, it is directly related to a number of programs of other Federal and state agencies and to public and private activities outside the park boundaries.

The inseparability of bear management and solid waste management is a situation common to gateway towns, private citizens, and land-management agencies. Problems involved are long-standing, and have not been created by recent, past, or proposed actions within the park. Open pit dumps have been or will be shortly replaced by sanitary landfill facilities. Through 1971, the Gardiner Dump, located inside the park and operated on a special use permit, was in use by the town of Gardiner. The West Yellowstone Dump was also in operation. Dumps were in use at Cooke City, Montana and at Flagg Ranch outside the south gate.

In 1972, the West Yellowstone Dump was replaced by a fenced sanitary landfill. The Flagg Ranch, Cooke City, and Gardiner open-pit dumps remained in operation and are in use today. Exact figures on the amount of garbage disposed of in these dumps are not presently available. Use is comparatively light, however, and bears are seen infrequently at these sites.

While the density of bears in the portions of adjacent national forests that receive heavy public use does not appear to be as high as in some public use areas within the park (Knight 1974), the U.S. Forest Service has begun a program to replace open trash cans with bear-resistant models within campgrounds and other public-use areas. In addition, the U.S. Forest Service is

increasing its emphasis on maintaining high standards of sanitation in connection with recreation home sites and on other leased lands within the national forests.

Since closure of the open-pit garbage dumps within Yellowstone National Park, a great deal of public attention has been directed to the number of grizzly bears harvested by hunters and killed whether illegally or for control purposes on lands surrounding the national park.

Detailed and accurate records were not kept of grizzly bears mortality outside the boundaries prior to garbage dump closure inside the park, but there is little to suggest that dump closure within the park has increased bear mortality outside except in 1970-71. During those 2 years the removals were 53 and 48 respectively. However, the second largest known mortality was in 1967 and was primarily due to hunter kill (24) in Wyoming (Cowan et al. 1974). Some of the bears removed by the state of Montana in conjunction with the closure of the West Yellowstone Dump in 1971, may have formerly used both the West Yellowstone Dump and dumps inside the park, or may have moved from park dumps to the dumps outside the park boundary. During the period 1970-73, a total of 55 grizzly bears were reported killed, for other than control purposes, adjacent to Yellowstone National Park. The low proportion of these animals (7) that bore ear tags, indicating they had been marked in Yellowstone National Park prior to or since 1970 (Cole 1974), suggests, however, that locally resident bears make up the bulk of man-caused bear mortalities outside of the park.

2. U.S. Fish and Wildlife Service studies on status of the grizzly bear.

The U.S. Fish and Wildlife Service is currently reviewing the status of the grizzly bear in the lower 48 states of the United States to determine if it should be placed on the Endangered Species List under the provisions of the 1973 Endangered Species Act (Petition filed with the Fish and Wildlife Service, February 14, 1974). The findings and conclusions of this review are not available at this time. Should the grizzly bear be placed on the Endangered Species List, the Yellowstone National Park grizzly bear management program would be modified appropriately and a reevaluation of the impacts of the program would be made at that time.

Regardless of the outcome of the Fish and Wildlife Service study, the intent of the Act is pertinent. For example: subsection (3)(e), "The Secretary may, by regulation, and to the extent he deems advisable, treat any species as an endangered species or threatened species even though it is not listed pursuant to Section 4 of this Act if he finds that--(c) such treatment of an unlisted species will substantially facilitate the enforcement and further the policy of this Act." . . . (Section 2, (a), (5), ". . . and to better safeguarding for the benefit of all citizens, the Nation's heritage in fish and wildlife." Indeed, under the current grizzly bear management program, the prime objective is to ensure the population stability of this regionally uncommon--if not threatened--species.

3. Interagency Grizzly Bear Study Team.

Under a recent agreement of five agencies concerned with the status of the grizzly bear population in the Yellowstone ecosystem, an Interagency Grizzly Bear Study Team has been established consisting of research biologists from the National Park Service, the Fish and Wildlife Service, the U.S. Forest Service, and the states of Wyoming, Montana, and Idaho. Field investigations are carried out in the Yellowstone ecosystem under the supervision of the National Park Service biologist who also coordinates the team's efforts with state biologists. The team's primary objective is to carry out an investigation into the ecology of the grizzly bear in order to provide data to the five management jurisdictions involved that are concerned with the preservation and enhancement of the grizzly bear population in the Rocky Mountain Region. While the study is in progress, all research and monitoring of the grizzly bear population conducted by the park staff will be fully integrated into the team's investigation. Specific objectives for the team have been outlined by representatives of the three Federal agencies involved at a meeting in Washington, D.C., on December 14, 1973, as follows:

a. Habitat considerations

- (1). Evaluation and analysis of habitat
- (2). Extent
- (3). Land use impacts (Recreation, livestock management, timber management, non-recreational development, weather modification, wildlife and fishery management, agriculture, fire management.

already done

b. Population considerations

- (1). Population numbers
- (2). Distribution
- (3). Population trends natality, sex; age structure; and both natural and unnatural causes of mortality.
- (4). Behavior (migrations, movements, and social behavior).

c. Trophic ecology

- (1). Food habits
- (2). Food chain relationships and nutrient cycling.
- (3). Interspecific competition
- (4). Intraspecific competition

d. Parasites and disease

While the team's investigation is in progress, all research on grizzly bear ecology by the park staff will be integrated with this work to the maximal degree possible.

The National Academy of Sciences Committee on the Yellowstone Grizzlies (Cowan 1974) has recommended that the interagency research approach be reevaluated and that coordination of the research effort be assumed by a nongovernmental body. This recommendation is being given consideration but exceeds the specific purposes of this grizzly bear management proposal.

II. DESCRIPTION OF THE ENVIRONMENT

A. Park Development

The majority of development is concentrated in ten locations in three districts of the park (Figure 2).

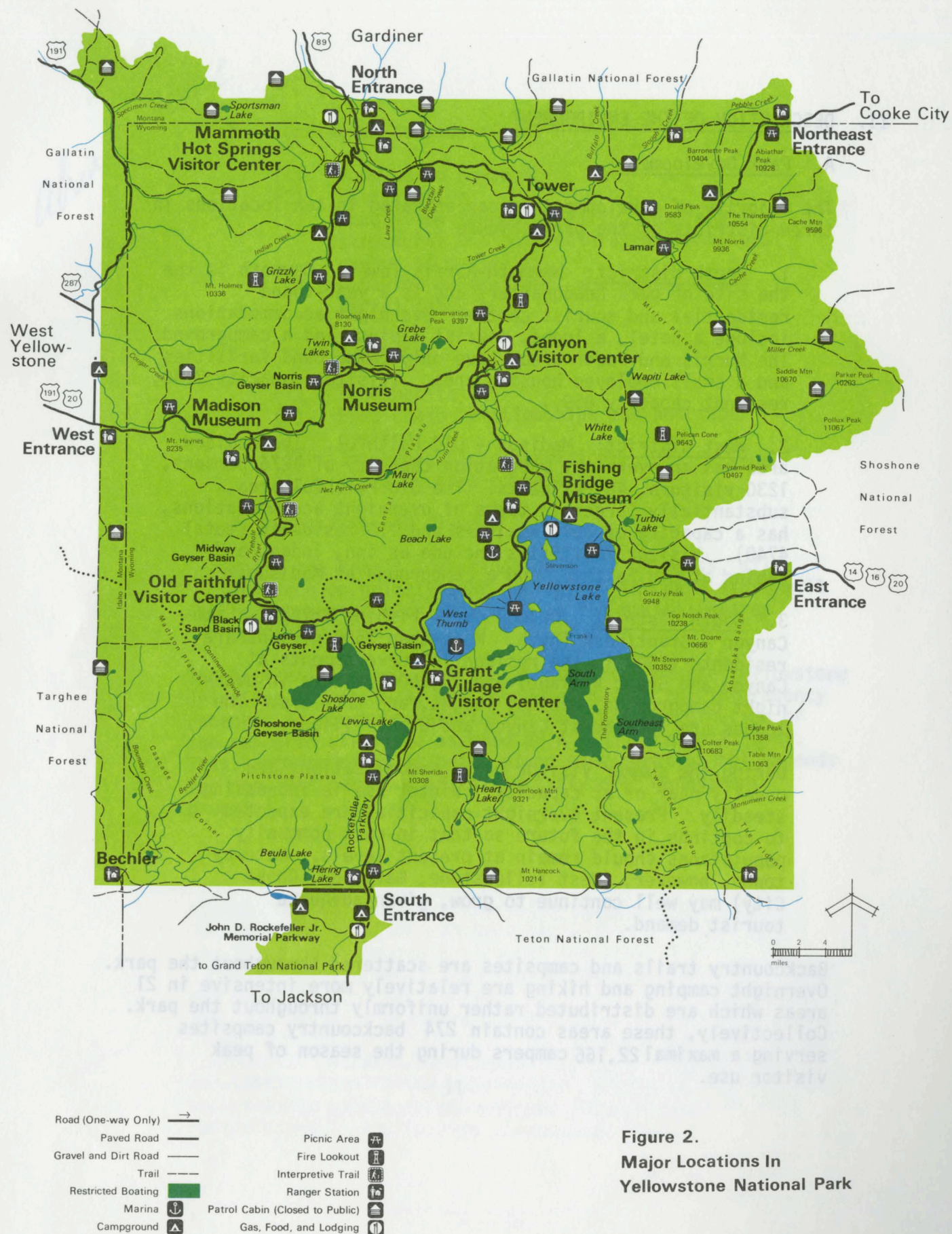
1. North district: Mammoth-Norris-Tower. Mammoth is the site of park headquarters and is a year-round residential and tourist center. Overnight accommodations include a hotel, a lodge, tourist cabins, and a campground. The Norris and Tower areas have only campground facilities and a small employee housing area. (Visitor capacity 2140; resident capacity 859.)

2. West district: Madison - Old Faithful. The Madison area has an overnight population capacity of 1276 persons, 1230 visitors, 46 residents. The Old Faithful area, substantially larger in terms of overnight accommodations, has a capacity of 3970 visitors and 770 residents (total 4740). Visitor facilities include an inn, lodge, and cabins at Old Faithful and a campground at Madison.

3. South district: Bridge Bay - Fishing Bridge - Lake-Canyon - Grant/West Thumb. More than 2500 persons are residents (2000 in the residential developments at Canyon and Grant Village) and 15,850 visitors in overnight campgrounds, cabins, lodges, and trailers. The lodges are located at Canyon and Grant Village.

During the summer visitor peak, accommodations are usually near or at capacity. Winter use is increasing steadily. Present overnight capacities are expected to continue in the future so that in-park community populations should remain at present levels. Gateway towns, however, (West Yellowstone, Gardiner, Cooke City) may well continue to grow, given adequate tourist demand.

Backcountry trails and campsites are scattered throughout the park. Overnight camping and hiking are relatively more intensive in 21 areas which are distributed rather uniformly throughout the park. Collectively, these areas contain 274 backcountry campsites serving a maximal 22,166 campers during the season of peak visitor use.



B. The Park's Natural Environment - A Brief Overview

Yellowstone National Park, located in the extreme northwestern corner of the state of Wyoming, occupies an area of approximately 3500 square miles (9000 km²) and is the central portion of a vast mountain-encircled, upland plateau astride the Continental Divide. This entire wildland area covering approximately 7000 square miles (20,000 km²) in Wyoming, Idaho, and Montana includes Yellowstone and Grand Teton National Parks, and portions of five adjoining national forests. Elevations in the Yellowstone area range from 5000 feet (1525 m) at Gardiner, Montana to over 11,000 feet for the highest peaks. Yellowstone National Park is characterized by several broad, forested volcanic plateaus ranging in elevation from 7000 to 9000 feet (2140 to 2750 m). These volcanic plateaus are bounded by mountains on all sides; the Absaroka Range on the east; Teton Range on the southwest; the Gallatin Range on the northeast and north; and the Snowy Range to the north outside the park boundary. The park is well-known for its many thermal features which have developed in topographically low areas, or along major fault systems.

The climate of Yellowstone National Park is characterized by long, cold winters, short cool summers, and a resultant short growing season. Frost occurs most nights at higher elevations; at lower elevations nights are always cool. The average temperature during the month of July is 62.8°F, during January, 18°F. The mean annual temperature at Mammoth (the warmest section) is 39.8°F. Summer temperatures generally range from 55°F (13°C) at night into the 70s F (22°C to 26°C) in the daytime. Freezing temperatures have been recorded at all park weather stations during all months of the year. Precipitation averages 25 inches (635 mm) per year, mostly in the form of snow. Snowfall varies with elevation in the park. Areas along the Continental Divide and in the Absaroka Range along the eastern boundary receive 200 to 400 inches (5075 to 10,250 mm) annually, while the Mammoth area at 6000 feet (1830 m) elevation receives only about 90 inches (2290 mm) annually. Lightning-caused fires are occasional and normal.

Much of the park is forested. Spruce-fir and lodgepole pine forest types predominate, followed by a smaller Douglas-fir forest. Non-forest vegetation is widely interspersed throughout the forest areas. Extensive grassland and sagebrush areas on high slopes and ridges as well as mesic meadows scattered throughout the forests on moist sites along streams and around ponds predominate in the non-forest vegetation. On the upper plateau levels and mountain slopes, subalpine meadows are found. To a limited extent, areas above about 10,000 feet support an alpine tundra.

These non-forest lands include the large, open valleys of Lamar, Pelican, Hayden, and Firehole. Dense sedge growth borders the streams and extends across the flat bottoms. Slightly higher slopes support bunchgrasses, forbs, and sagebrush, with scattered marshy swale areas. Seasonally, these valleys and their vegetation are a major feature of the grizzly bear habitat.

The highly varied vegetation mosaic supports a wide variety of plant-eating animals. Among them are an array of large ungulates--bison, mule deer, moose, pronghorn antelope, elk, and bighorn sheep. The rodent population includes pocket gophers, mice, marmots, squirrels, muskrat, and beaver. These plant eaters support a second level complex of meat eaters such as the coyotes, fox, cougar, wolf, mountain lion, black bear, and grizzly bear. Fish both natural and introduced are an important component of the fauna. A wide variety of birdlife can be found including Canada goose, trumpeter swan, white pelican, osprey, sandhill cranes, great blue herons, and kingfishers, many of which are dependent upon fish for a major portion of their diet.

In addition to the large and visible animals so important to the visitor's experience, there exists a great diversity of lesser forms which interact to form the complex food web of which the grizzly bear is a part.

C. Grizzly Bears

In February 1973, the Secretary of the Interior requested the National Academy of Sciences to undertake a study to "evaluate data on the population dynamics of the grizzly bears in Yellowstone National Park and to make recommendations concerning the scientific and technical implications of those data." The Academy's report (Cowan 1974) released to the public in August, 1974, contains a detailed summary of current information on the ecology of the grizzly bear. The below discussion includes the Academy's findings as well as certain additional information considered relevant to understanding the dynamics of the grizzly bear population in the park. Excerpts from the Academy's report are indicated by double bars at the beginning and end of the excerpt.

1. Historical distribution of the species.

//The grizzly bear of North America, Ursus arctos horribilis Ord (Rausch, 1963) is conspecific with the brown bears, Ursus arctos spp., of the Old World. In North America, grizzly bears formerly occurred

from northern Alaska and Canada southward to northern Baja California and Durango, Mexico (Hall and Kelson, 1959), and from the Pacific Coast eastward to at least Ontario, Ohio, and Kentucky (Peterson, 1965; Guidlay, 1968). The range of the grizzly bear has been shrinking for at least 10,000 years. Populations east of the Mississippi River disappeared in early post-glacial time, and by the 16th century grizzly bears were found only in western North America. Farther north, grizzlies may have inhabited the "barren-grounds" of the Ungava Peninsula in northern Labrador and Quebec, but the evidence is equivocal, and no specimens exist (Elton, 1954; Harper, 1961). In any case, the range of the "barren-ground" grizzly north and west of Hudson Bay shrank during the 19th century. Grizzlies also disappeared from the Great Plains during the last half of the 19th century and from the Pacific Coast states in the first several decades of the 20th (Allen, 1942). In the Rocky Mountains, grizzly numbers also declined during this period, but more slowly. In the 1930's, grizzlies may have persisted in small numbers in the mountains of Arizona, New Mexico, and possibly Utah, but if so, they disappeared in the next several decades (Bailey, 1931), as did populations in northern Colorado and most of Wyoming; the last grizzly was seen in northern Colorado in 1920 (R. J. Tully, unpublished data, 1970; mentioned in Armstrong, 1972, page 271).

By the 1950's grizzly bears survived in Alaska, Canada, and adjacent parts of Washington, Idaho, and Montana. In addition, small, isolated populations survived in three localities: (1) the mountains of Chihuahua, Mexico (especially the Sierra del Nido); (2) the San Juan Mountains of southwestern Colorado; and (3) the Yellowstone Plateau region of Wyoming and adjacent Idaho and Montana (Cahalane, 1964). In 1957, the number of Sierra del Nido grizzlies was estimated to be between 10 and 30 (Leopold, 1967). By 1968, that population was probably extinct (Koford, 1969). However, another small population is reported to persist in the Sierra Madre (A. S. Leopold, personal communication, 1974). Status of southwestern Colorado grizzlies is less certain, but three were killed in the two decades preceding 1970 (R. J. Tully, unpublished data, 1970, as mentioned in Armstrong, 1972, p. 271), suggesting that a few individuals may survive in more remote parts of the San Juan Mountains (R. M. Hansen, personal communication, 1974).

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Report

The only one of these three isolated populations that has maintained significant numbers is on the Yellowstone Plateau. The occupied area includes Yellowstone and Grand Teton National Parks and adjacent portions of the Gallatin, Shoshone, Teton, and Targhee National Forests. The system is variously estimated to comprise 14,000 km² (Cole, 1974) as the "Yellowstone ecosystem," about half (8,800 km²) of which lies within the boundaries of Yellowstone National Park (Cole, 1974).//

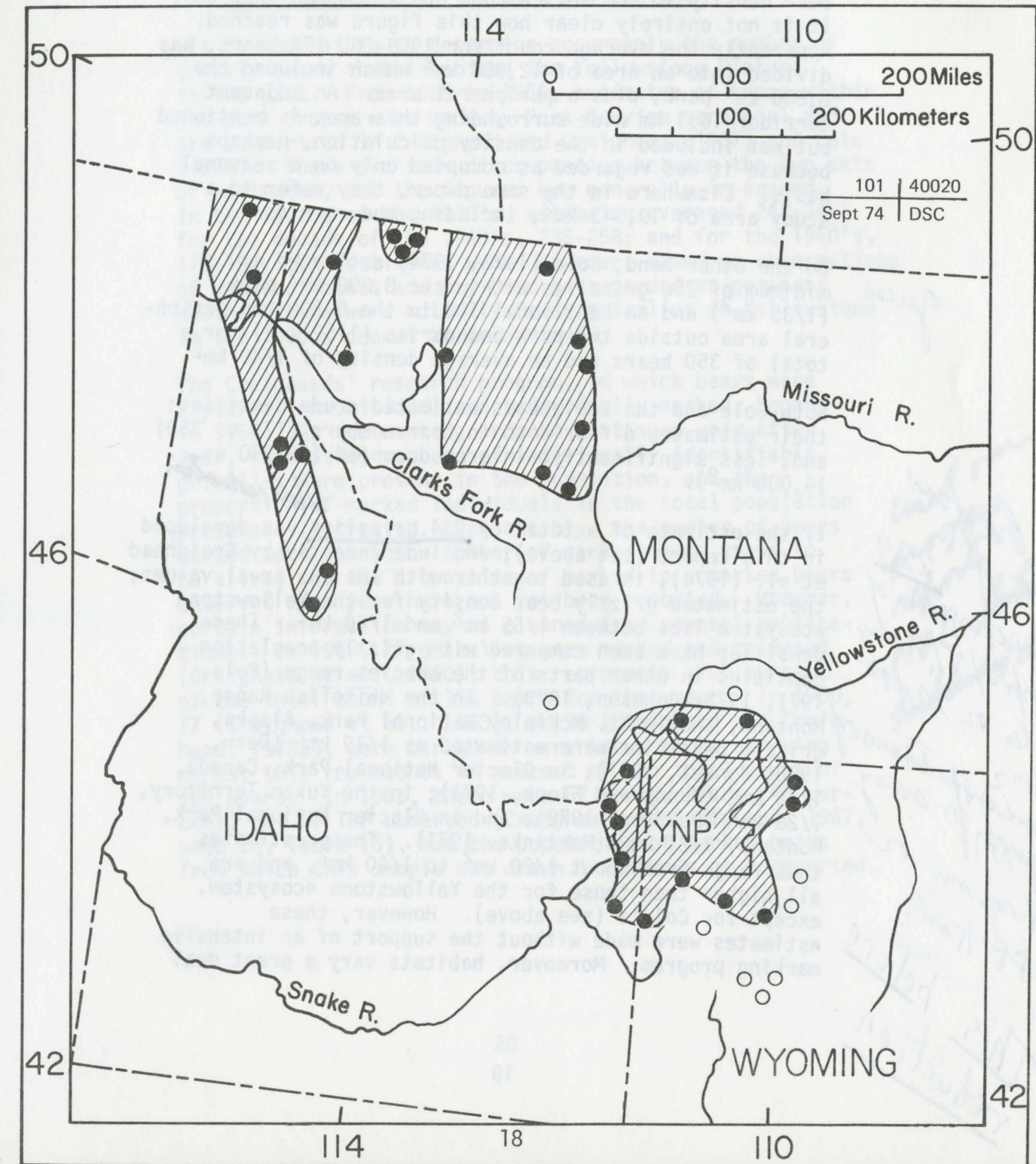
2. Present distribution of the species.

//The limits of the range of grizzly bears at the present time must be based primarily on records of specimens taken at known localities and, secondarily, on records of sightings that can be judged trustworthy. Records for the last decade that at least marginally meet these criteria are plotted on Figure 3. From this map it is apparent that the population in the Yellowstone Park region is rather closely confined to the Yellowstone Plateau and that there is a gap of about 200 km between the northeast corner of the Plateau region and the nearest population to the north, on the southeast edge of Montana's Bob Marshall Wilderness Area. The intervening area is interrupted by agricultural lowlands, which grizzlies are highly unlikely to cross. Nor are they likely to reestablish populations in the smaller mountain ranges within the gap, such as the Bridgers, Big Belts, Tobacco Roots, Highlands, or Garnets. To the west, an even greater gap exists in Idaho between grizzlies in the Centennial Mountains on the Montana-Idaho border just west of the park and the nearest populations in the Clearwater Mountains of the north-central Idaho. Along the southern edge of the Plateau, in the Teton and adjacent ranges to the south, and in the Wind River Mountains to the southeast, the present status of grizzly bears is unclear. There are persistent reports of their occurrence, especially in the Wind River Mountains, but specimens are lacking.//

3. Population density in the region and park.

//The various estimates of population density for grizzly bears in the Yellowstone ecosystem depend upon

Figure 3. Approximate present distribution of grizzly bears in the contiguous 48 states. Solid circles indicate actual specimens or reliable site records; open circles represent records considered to be beyond the normal range. The crosshatched areas delineate approximate normal ranges of grizzly bears. (Based on unpublished records supplied by D.T. Fluckiger, K. Greer, D. Houston, A.E. Nielson, J. Reese, L. Roop, and T. Russell).
From Cowan (1974)



both population size and estimates of the area occupied by bears. Furthermore, the area may be considered either as the largest bounded by the range margins of the species (crude density) or as only the area of suitable habitat (ecological density).

based on consensus
Craighead and Craighead (1971) estimated that grizzly bear density in the Yellowstone ecosystem was $1/75 \text{ km}^2$. It is not entirely clear how this figure was reached. Apparently the average count for 1959-66, 174 bears, was divided into an area of $12,950 \text{ km}^2$ which included the $8,800 \text{ km}^2$ park, plus a peripheral area. An adjacent corridor 16.1 km wide surrounding this area is mentioned but not included in the density calculation, perhaps because it was regarded as occupied only on a seasonal basis. Elsewhere in the same paper, they refer to a study area of $19,943 \text{ km}^2$, including the corridor.

guess
On the other hand, Cole (1973, 1974) estimated a minimum of 250 grizzlies within the $8,800 \text{ km}^2$ park ($1/35 \text{ km}^2$) and an additional 100 in the $5,200 \text{ km}^2$ peripheral area outside the park boundaries ($1/52 \text{ km}^2$) for a total of 350 bears and an average density of $1/40 \text{ km}^2$.

Both Cole and the Craigheads estimated crude densities; their estimates differ both in bear numbers (174 vs 350) and, less significantly, in area occupied ($12,950$ vs $14,000 \text{ km}^2$).

before reduction
If the estimate of a total of 234 grizzlies, as developed in this report (see above), and independently by Craighead et al. (1974), is used together with the two areal values, the estimated grizzly bear density for the Yellowstone ecosystem lies between $1/55 \text{ km}^2$ and $1/60 \text{ km}^2$. These densities have been compared with grizzly population densities in other parts of the species range (Cole, 1971, 1973; Johnson, 1973). In the Whitefish Range, Montana, and in Mt. McKinley National Park, Alaska, grizzly densities were estimated as $1/39 \text{ km}^2$ (Dean, 1958; Jonkel, 1967); in Glacier National Park, Canada, $1/28 \text{ km}^2$ (Mundy and Flook, 1973); in the Yukon Territory, $1/26 \text{ km}^2$ (Pearson, 1972); and in Glacier National Park, Montana, $1/21 \text{ km}^2$ (Martinka, 1971). These estimates thus range from about $1/20 \text{ km}^2$ to $1/40 \text{ km}^2$, and are all higher than those for the Yellowstone ecosystem, except for Cole's (see above). However, these estimates were made without the support of an intensive marking program. Moreover, habitats vary a great deal

between the different parts of grizzly bear range where these studies were made, and carrying capacities should also be expected to vary. Hence, to judge the population density estimate of $1/55\text{--}60 \text{ km}^2$ in the Yellowstone ecosystem as too low simply because it is below estimates for other areas is unwarranted.//

4. Population size in the park and region.

//It is impossible to determine accurately the number of grizzly bears that inhabited the Yellowstone Plateau in the past. From 1925 to 1958, estimates of those within the park proper were made by Park Service personnel and are summarized in Craighead and Craighead (1967) and Cole (1971). There are some discrepancies between the two sets of estimates, but the figures are generally in accord. In the decade of the 1930's, estimates averaged 240-245; for the decade of the 1940's, 235-258; and for the 1950's, 170-190. The estimates were, however, based on observations of unmarked bears and may best be regarded as guesses; whether there were actually fewer grizzlies in Yellowstone in the 1950's cannot be determined.

The Craigheads' research program, in which bears were captured, immobilized, and individually marked, began in 1959. As the marking program continued year after year, increasing numbers of individually identifiable grizzlies were present in the population, and the proportion of marked individuals in the total population presumably increased. Regrettably, the number of bears marked each year, the number of marked bears known to be alive, and the proportion of marked to unmarked bears observed each year have not yet been reported. However, certain information may be gleaned from several publications. In 1959, 27 grizzlies were marked and released (Craighead et al., 1960); this represents 17.5 percent of the total count of 154 bears for that year. In 1960, 77 (Craighead et al., 1963), or 78 (Craighead and Craighead, 1972a), were marked or were known to be carrying marks; this represents 46 percent of the total count of 169 bears. In 1965, there were 87 marked bears (45 percent) out of 187 observed (Craighead and Craighead, 1967, page 26, Table 15), but the population of marked bears from which this sample was drawn is unknown or unreported.

used on progress reports NOT latest published data

The proportion of marked to unmarked bears observed at the Trout Creek dump may be reconstructed from data in Craighead and Craighead (1967, page 41, Table 8). Of 128 bears tallied as different individuals, 66 were marked and 62 were unmarked. If the count be assumed accurate (i.e., that the unmarked bears were counted without duplication or omission), then 52 percent of the total population at Trout Creek was marked. The proportion was higher in older age classes (Table 1). Although observations were made at five other dumps, the largest numbers were observed each year at Trout Creek; an average of 65 percent of the Park totals were seen there. If marking was equally emphasized at each of the census areas and/or if marked individuals moved at random between dumps, then the proportions of marked individuals at each of the census areas would be similar. However, no data on this point are available to us.

After 12 years, a total of 264 bears had been individually marked (Craighead et al., 1974). Population size was estimated from observations of marked bears and of bears that "could be recognized individually from diagnostic natural markings" (Craighead et al., 1973). The validity of using counts of unmarked bears is subject to question, since the possibility of duplication or omission cannot be excluded. However, as the research team gained experience, these estimates of unmarked individuals probably became more reliable. Thus, population counts made later in the study are probably more accurate than those made in earlier years.

Totals were estimated to fluctuate from 154 in 1959 up to a peak of 202 in 1966 and then down to 179 in 1970 (Craighead et al., 1974). No counts of marked bears were made after 1970. Estimates of bear numbers for 1971 to 1973 (Cole, 1973, 1974) are based on hypothetical calculations and there are no data to verify them. // However, the assumptions on which the estimates are based are believed to be valid.

Cole (1974) estimated the grizzly bear population in Yellowstone National Park to be from 250-290 animals (Tables 1 and 2). Cole's estimate was based on the assumption that adult female grizzly bears have a mean 3-year reproductive cycle, and an adult male: adult female ratio of 0.85:1.00. The latter is based on other research studies (Craighead and Craighead 1967). Knight (1974) states further:

Page 15, paragraph 2, the NAS Committee state "Estimates of bear numbers for 1971 to 1973 (Cole, 1973, 1974) are based on hypothetical calculations and there are no data to verify them". The committee is saying that Cole had no population data on which to base the grizzly pop. estimates

Table 1. Estimated grizzly bear population, Yellowstone National Park (after Cole 1974). Estimates are based on different numbers of females with young (Columns I, II, III), a mean 3-year reproductive cycle for adult females, adult male:female ratios, and final adjustments for equilibrium mortality and emigrations.

Classes	Nos. in classes		
	Column I	II	III
Adult females w/cubs	15	20	25
Adult females w/yearlings	15	20	25
Other adult females	15	20	25
Adult males ¹	38	50	64
Cubs ²	27	36	45
Yearlings	27	36	45
2-year-olds	27	36	45
3-year-olds	27	36	45
4-year-olds	27	36	45
Potential N	218	290	364
Mortality and emigration ³	27	36	45
Minimum N	191	254	319
Approximate N	200	270	340

¹Calculated as 0.85 of adult females (Craighead and Craighead 1967).

²Observed 1973 ratio of 1.8 per female used from Table 5 and carried through subsequent classes to give a potential N that is adjusted by subtracting equilibrium mortality and emigrations.

³Equal to yearly production of cubs.

What assumptions

What did Cole get this 3-yr. mean?

or parameter

Table 2. Numbers and ratios of female grizzlies to young in different family groups in Yellowstone National Park (after Cole, 1974). Data are provided for the period 1959-1966¹ and for two additional years.²

Years	Numbers			Numbers		
	Females	Cubs	Ratios	Females	Yearlings	Ratios
1959-66 average	15	33	2.2	15	20	1.3
1972	11(31)	22(58)	2.0	9(25)	18(48)	2.0
1973	15(33)	27(64)	1.8	16(40)	24(50)	1.5

¹ Average female-cub figures from Craighead and Craighead (1967) with female-yearling figures calculated from a reported 39% mortality rate in a population segment that used garbage dumps.

² Figures in parentheses are the total sightings of females or young from which different family groups were distinguished. The 1973 data includes two females with cubs and two with yearlings that were 1.6 km or less outside park boundaries. Four other family groups that were seen in areas 4 to 8 km from park boundaries are not included.

"Identification of individual bears or family groups yielded a total of 157 (grizzly bears). Most of these (129) were within the boundaries of Yellowstone National Park. A number of other bears observed within the park were suspected to be different individuals but could not be positively identified. Judging from the number and distribution of sightings along with tracks and other signs, the 129 individuals probably account for 1/3 to 1/2 of the total park population."

How was this determined?

Using the more conservative estimate, the national park grizzly population may be calculated to be approximately 250-260 animals. This compares favorably with Cole's 1973 population estimate and the 1933 estimate of 260 grizzly bears reported by Wright and Thompson (1934). Since 1970, population estimates of the park's grizzly population have relied on observations of unmarked bears and bear signs.

It is recognized that such population estimates may be subject to bias from the lack of verifiable data. The above population estimates are presented, therefore, as the best possible guess based upon current knowledge. The National Academy of Sciences (Cowan 1974) was particularly concerned about the lack of reliable population data concerning the Yellowstone grizzly bear. The summary report recommends that a recognizably marked element of known size in the population should be reestablished to improve the reliability of information on the population.

An interagency grizzly bear study team was formed in 1973 to provide information on the entire wild grizzly population of both the park and adjacent areas. This team is presently investigating grizzly bear distribution within an approximate 7000 square mile (11,600 km²) land area within Yellowstone National Park and the Montana and Wyoming portion of the study area. To date, lack of manpower has precluded gathering information from the Idaho portion of the study area. Preliminary information from the first field season suggests that a minimum total area population may be 350-400 bears.

An estimated 100-150 grizzly bears form a viable resident population in the Shoshone-Teton National Forest, Wyoming, adjacent to the east and southeast boundaries of the park (Roop 1974).

How resident pop. was determined?

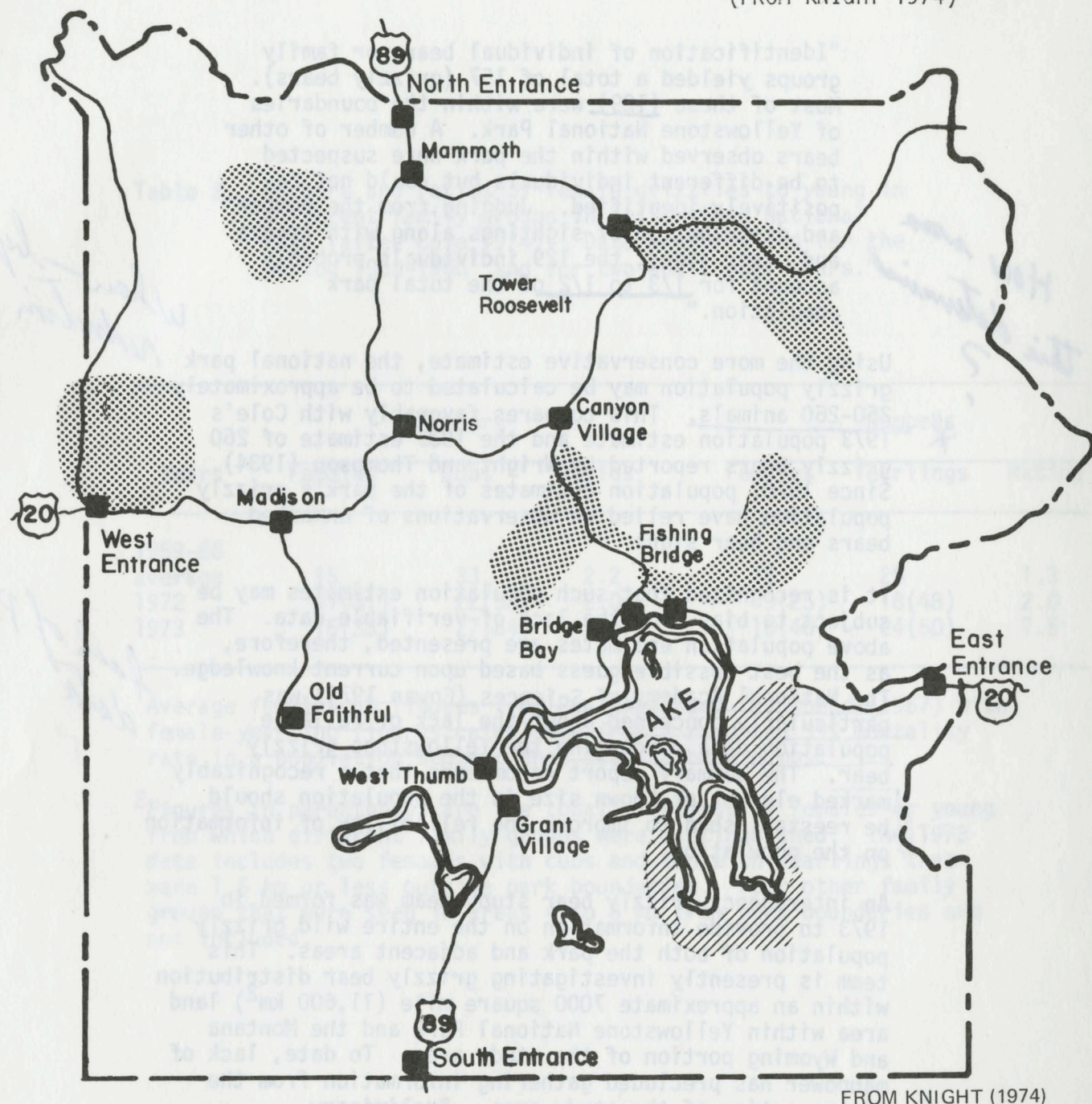
*Have not seen this
* Roop - no data to support statement like this*

many of these are so-called park bears

when before reduction

lack of P.S. data

FIGURE 4. DISTRIBUTION OF GRIZZLY BEARS IN YELLOWSTONE NATIONAL PARK
(FROM KNIGHT 1974)



FROM KNIGHT (1974)

DISTRIBUTION OF GRIZZLY BEARS

High Density Suspected High Density

YELLOWSTONE NATIONAL PARK

0 5 10

101 40017
Sept 74 DSC

Knight (1974) has provided information on the density of grizzly bears within the park and has mapped areas of known or suspected high bear density (Figure 4). Knight reports that:

"Areas of relatively high population density were computed from unduplicated sightings of identifiable bears or groups of bears. Densities ranged from 1 bear/3 square miles (7.8 km^2) in the Cougar Creek-West Yellowstone area to 1 bear/4 square miles (10.3 km^2) in the Hayden-Pelican and Lamar Valley areas to 1 bear/7 square miles (18.1 km^2) in the Fawn Pass-Quadrant Mountain area. Most of the sightings coincided with open areas where bears were relatively easily seen. The Bechler Meadows in the southwestern corner of the park was the only extensive open area where grizzly bears were not observed.

The area around Yellowstone Lake where a high bear population was suspected was defined largely by amounts of bear sign. Tributary streams of Yellowstone Lake which support spawning runs of cutthroat trout appeared to be attractive to grizzly bears. Grizzly bear tracks, scats, and partially eaten fish were common along such streams that were investigated. There appears to be a large number of small permanent streams running into the lake that are now shown on available maps and which could furnish a mid-summer forage base for a substantial bear population. Although not investigated by team members, conversations with park personnel indicate that there are similar concentrations of grizzly bear signs on the northwest shore of the lake. During the 1974 field season, special efforts will be made to inventory small spawning streams and investigate their use by grizzly bears.

It is apparent that grizzly bears were fairly well distributed throughout Yellowstone Park during 1973. Most of the areas where bears were not observed were timber covered, making

density at any one time depends on bear movement
give glamsch
Brayton 1974
Range movement
We got 1 bear to .02 sq. mi. or .05 km².
44 bears/sq. mi. summer at Trout Creek.

observation difficult. Further effort with improved techniques may result in finding a greater distribution within timbered areas."

5. Park management programs directly affecting the grizzly bear population.

a. Solid waste management

(1). Statement of the problem: bears and garbage.

//Since early in the history of the Yellowstone National Park (Skinner, 1925), black and grizzly bears have been accustomed to utilizing garbage as a supplementary food resource, a practice that encouraged concentrations of bears at garbage dumps in and around the Park. The most obvious consequences were: to habituate the bears to the presence of people; to teach them to identify and use the foods associated with man; to provide a readily available "spectacle" for tourist viewing (until the practice was abandoned about 1942); and to accustom people to relatively close contact with bears and thereby increase the likelihood of those foolhardy acts that lead to personal injury and property damage.

In 1968, the National Park authorities decided that garbage-habitation of bears was indeed unnatural, that it reflected a poor image to public viewers, and that it constituted a substantial and avoidable threat to people using the Park campgrounds. A policy decision was made, therefore, to deny garbage as a food source and to restrict the grizzlies to natural foods.

A controversy soon developed as to the technique that should be adopted. One group supported gradual phase-out of garbage dumps, in the hope that the number of bears gathering at dumps would likewise decline and that after several years all bears would have learned to exist entirely on natural foods. The alternative approach was to close the garbage dumps within, at most, two or three years, beginning with those closest to the campgrounds. This latter policy, it was argued, would shorten

the adjustment period and minimize the time during which emergency measures would have to be taken to prevent injuries to people (and damage to camps and vehicles) by hungry bears seeking the food to which they were accustomed. Those espousing gradual phase-out feared that the more rapid closure would require the removal or killing of more bears than would the gradual approach and might well endanger the population *and visitors - 1 possibly 2 killed*

Proponents of both viewpoints realized that there were very likely to be difficulties. To minimize these, the National Park Service undertook an intensive program that included bear-proofing of all garbage containers; special patrols of campgrounds at night; closing of campgrounds where the danger was regarded as serious; closing of trails where contact with bears was most likely to occur; transporting of incorrigible bears to wilderness areas far removed from the trouble area; and, when dealing with intractable bears, removing them to zoos, or, as an extreme measure, killing them.

After seeking the advice of the Natural Sciences Advisory Committee, Park authorities chose the management technique that invoked quick closure. The amount of garbage in open dumps was sharply decreased beginning in 1968, and dumps within the Park were closed during the 1970-71 period. Control actions increased, and a large number of bears were removed from the Park or killed. //

(2). Historical changes in solid waste management

The historical changes in the park, solid waste management programs provide necessary background for understanding subsequent effects on the park's grizzly population.

Through 1968, the Mammoth, Lake, and Grant Village incinerators and the Tower, Rabbit Creek, and Trout Creek dumps were in operation. Burnable materials were separated from Canyon, Lake, and

Fishing Bridge garbage during the summer season and were taken to the Lake incinerator. Wet garbage from these areas, a total of 5162 cans, was taken to the Trout Creek Dump. In the spring and fall, an additional 2908 cans of unseparated garbage were taken from these areas to the Trout Creek Dump. Rabbit Creek Dump was in use during 1968 and previously, but volume figures are unavailable. The Tower Dump was used for the last time during this season, receiving only light use. In 1969, the same facilities and procedures were in use, except for the Tower Dump which was closed and covered during the summer. There were 7992 cans of wet garbage and 1758 cans of unseparated garbage dumped at Trout Creek. Rabbit Creek received 43,000 cans of unseparated garbage from Old Faithful and Madison Junction. This was the last season of use for the Rabbit Creek Dump. It was closed and covered in the fall.

In 1970, the U.S. Public Health Service issued a report entitled Solid Waste Disposal in Yellowstone National Park (Little 1970), which stated that "... the solid waste treatment and disposal facilities and practices in Yellowstone National Park are in violation of Part 76 of Subchapter F of Title 42, Code of Federal Regulations. Specifically, Section 76.8(b)(3) which states that 'wastes shall not be left in open dumps'"

Shortly after issuance of the report, permanent closure of the remaining dumps was accomplished.

In 1970, garbage formerly going to the Rabbit Creek Dump was taken to a new sanitary landfill near Nez Perce Creek. The Trout Creek Dump received 51,873 cans of unseparated garbage. This was the last season of use for the Trout Creek Dump.

In 1971, garbage formerly taken to Trout Creek went to a new sanitary landfill on the Norris-Canyon road south of Grebe Lake. This season, all National Park Service open dumps were closed.

(3). Present-day solid waste management

The solid waste management program is a critical determinant of the success of the objective of a grizzly bear management program to maintain a wild, free-ranging population. Today, management

of solid waste includes the installation and maintenance of bear-resistant trash cans; the timely collection of trash, garbage, and litter from roadsides, campgrounds, picnic areas, lodges, and other developed sites; the disposal of refuse in sanitary landfills or by incineration; and the protection of these sites from invasion by bears. The pack-in, pack-out policy is enforced for all backcountry campsites. To supplement this, routine sanitation occurs to prevent accumulation of garbage and litter.

The presence of bears greatly increases the cost and difficulty of carrying out the solid waste management program: garbage disposal sites must be remotely located from the point of collection and constructed and maintained at standards that are higher than required in "bear-free" areas; both initial construction costs and maintenance of bear-resistant trash cans exceed the normal costs by many times; the frequency of trash collection is greater than normal, and the times of collection may be unusual, e.g., late evenings.

A study is being undertaken to determine the feasibility of developing regional sanitary landfill facilities outside the boundaries of the national park. Such facilities could be operated under contract. However, because of the unusual and high standards required and the critical nature of the trash collection program, it is believed that the collection of solid waste from within the park must be carried out by Service employees.

b. Management of natural habitat

Present management is oriented to maintaining the integrity of natural ecosystems. Artificial control of resources and natural processes are held to the absolute minimum required to offset known human impacts on those resources and/or processes.

Former programs to regulate large populations of elk and bison within the national park by live trapping and slaughter programs have been replaced by natural regulation (Cole 1971; Meagher 1973). In lieu of removing assumed surplus animals from

the ecosystem, either for use in restocking other ranges or as food for man, those animals that are predestined to die because of age, malnutrition, disease, or other natural factors are permitted to complete their full cycle without human interference. This concept is based on the premise that nothing in nature is either "good" or "evil" and the death of the individual is as natural and necessary an event as is birth.

Late winter and early spring is the period when the greatest number of elk and bison deaths occur in the wild. The time of "winter kill" overlaps with the emergence of grizzly bears from their winter dens when food items other than carrion is scarce. Bears and other scavengers seek out the carcasses of elk and bison--a source of protein and energy that may be essential to the survival of the species within Yellowstone.

The grizzly bear is resourceful and has the ability to use a wide variety of foods--roots, berries, and other vegetative materials in addition to carrion, small rodents, etc. Some predation by bears, mainly on elk, has been noted by biologists in Yellowstone (Cole 1972). The grizzly bear is capable of killing both adults and calves, most frequently in spring.

Yellowstone National Park has initiated a program to reestablish fire as a natural factor of the park ecosystems. Many years of fire suppression have somewhat modified the natural mosaic and species composition of vegetation, particularly on the northern range (Houston 1974). The effects of fire on the grizzly bear are not fully understood but, because the bear evolved in an environment in which fire was a normal and perhaps essential element, the assumption is made that restoration of a natural fire regime will not have an adverse impact on the bear population. The reverse is likely because of the grizzly's ability to utilize diverse habitats.

6. Sub-populations.

//If the direct count figures for grizzly numbers during the period 1959-1970 given by the Craigheads are accepted, two further questions remain: (1) Do the bears counted at the

five or six census localities represent all or nearly all of the bears present in Yellowstone Park, or are there a significant number that are not counted because they remain mostly in the "back-country" and the probability of their being observed at a census locality is low? (2) Are there significant number of grizzlies inhabiting the Yellowstone Plateau outside of the Park boundaries?

Published statements regarding a distinct "back-country" population are contradictory. Craighead et al. (1974) stated: "Data on the movements of marked grizzlies, back-country censuses, and the relationship of the distribution of marked to unmarked animals, all indicated that the population of grizzlies we were censusing represented a large proportion of the entire population of grizzly bears inhabiting the approximately five million acre Yellowstone Ecosystem. These data conclusively demonstrated that the animals recorded in the annual censuses were from all parts of the Yellowstone Ecosystem and did not represent a local population addicted to garbage."

By contrast, Cole (1971) asserted that the Craighead censuses "since 1959 could be conservative because the portion of the population which remained in the more remote areas of the Park was underestimated." Cole later claimed (1973) that 50 to 100 grizzlies stayed in remote areas, and suggested that this estimate "could be overly conservative."

How determined

The controversy hinges upon differing interpretations of various sorts of evidence. Observations of marked grizzlies, radiotracking studies, and kill sites of marked grizzlies all demonstrate that individual grizzlies are capable of moving long distances, often in a short period of time (Craighead et al., 1974). However, this does not prove that all grizzlies actually came to the dump census areas, merely that they were capable of doing so.

The distribution of marked and unmarked bears throughout the Park provides the best opportunity for testing conflicting views. If most or all of the individuals in the population visit the dumps sufficiently often to be counted as part of the population and if these same individuals all also inhabit remote portions of

the Park and adjoining National Forests, then the proportion of marked bears seen in all observations of grizzlies in the "back country" should be about the same as the proportion of marked animals in the total population.

Cole (1973) emphasized this fact by citing observations by Barnes and Bray (1967) that "only one marked animal was observed in 113 sightings of grizzlies in back-country areas (Barnes, personal communication)" when "more than half of the grizzlies that used dumps or developed areas may have had markers during this period" As stated, this is misleading to the extent that data from the 113 sightings do not differentiate among individual bears nor do they indicate in which sightings it was possible to determine whether the bears were marked or unmarked. We, the National Academy of Sciences study team, have confirmed (Bray and Barnes, personal communication, 1974) that one of 27 different bears, closely observed in 1965, was marked. The proportion of marked bears in this back-country count was thus about 4 percent.

Since the proportion of marked bears at garbage dumps was 45 percent in 1965 (Craighead and Craighead, 1967), the low proportion of marked bears in the Barnes and Bray study supports the contention that the grizzlies of the Yellowstone ecosystem are not homogeneous in their behavior and that some individuals are much less likely to be observed at dumps than are others.

Craighead and Craighead (1967) also report that they made "numerous back-country censuses" in order to determine whether "a grizzly population other than the six described units /dump census sites/ exists" They concluded: "These censuses showed that few grizzlies confine their activities to remote areas of the park." They did not, however, present any evidence to support this conclusion. In a later report, Craighead and Craighead (1971) state, "During a 3-year period /1966-68/, 37 percent (42 of 114) of all the marked grizzlies that visited the Trout Creek Dump were also observed in the backcountry," as evidence to support their contention. Table 8 of the 1967 report lists all individual bears visiting Trout Creek Dump in 1966, whereas Table 1 of the 1971 paper lists marked grizzlies observed at the Trout

Creek Dump and reobserved in back-country areas from 1966 to 1968. A comparison of these tables reveals, despite a few discrepancies, that most re-observations apparently took place in either 1966 or 1968 and that about 13 of the total of 42 marked bears observed in the back-country were seen there in 1966. Since a total of 66 bears that visited Trout Creek in 1966 were marked, it follows that about 20 percent of the marked bears at Trout Creek were also observed in remote areas.

The critical question--how many unmarked bears were observed in the course of these same back-country censuses--remains unanswered. More detailed reporting of the Craigheads' back-country censuses is desirable, but reliable population estimates may not be possible (Craighead *et al.*, 1974).

Further evidence as to the homogeneity of the grizzly population can be sought by examining the proportion of marked animals killed inside and outside the National Park boundaries (Craighead *et al.*, 1974). Outside the Park, grizzlies were killed by hunters in the autumn, when the dumps were less used and when the bears were widely dispersed as they moved to hibernation sites (Craighead *et al.*, 1974). Craighead and Craighead (1967), reported a total hunter kill of 46 grizzlies outside the Park during 1959-1965; of these, 20 (43 percent) were marked. They further reported (personal communication) that of the total 131 grizzlies killed outside the Park in 1959-1970, 31 (24 percent) were marked. These figures were later modified to 55 killed (20 marked) for the 1959-1965 period, and 143 killed (31 marked) for the 1959-1970 period (Craighead *et al.*, 1974). However, these included nonhunter as well as hunter kills. Finally, Cole (1974), reported a total hunter, plus depredation, kill of 55 for the 1970-73 period; of these, 7 (13 percent) were marked.

The following data pertaining to these periods are available concerning the proportion of grizzlies within the Park that were marked. In 1960, 77 (Craighead *et al.* 1963) or 78 (Craighead and Craighead, 1972a) animals out of a total count of 169 (46 percent) were marked. In 1965, of 187 bears counted, 87 (45 percent) were marked (Craighead and Craighead, 1967). Overall,

They did not count
near this. Very few
grizzlies were marked in
this area because they
were likely to be
killed at dumps.

during 1959-70, 39 percent of all bears censused were marked (Craighead et al., 1974).

There might appear to be some agreement between the proportion of marked bears within the population (45-46 percent, 1960, 1965) and those killed outside the Park (43 percent, 1959-1965). However, the proportion of marked bears within the in-Park population varied with the age-class of the bears. Data for 1966 have been published only for the Trout Creek segment of the population (Craighead and Craighead, 1967). Of 128 bears counted, 66 (52 percent) were marked. However, for bears 3 years old and older, the proportion of marked animals ranged from 69-93 percent, averaging 76 percent. Since almost all grizzlies shot are in these age classes (Greer, 1972, 1974), this is the proportion that should be compared with the hunter-kill. The Trout Creek segment averaged 112 animals during 1960-65, or 65 percent of the total Park population (average 173). In the Trout Creek sample for 1966, 76 of the 128 bears counted, or 59 percent, were 3 years old or older. In the population as a whole, the proportion of bears of these age classes was 58 percent during 1960-65, and 58 percent for 1965 alone. Thus, 58 percent seems a reasonable estimate for the proportion of marked grizzlies in the Park population subjected to risk of hunting outside the Park; the average size of this segment of the population was 100 grizzlies, 3 years old or older, during 1960-65. The difference in the two proportions is 15 percent (58 percent minus 43 percent). This difference can be accounted for if an additional 33 grizzlies of these ages were on the average present in the population subject to hunting, but unmarked and uncounted. If 133 grizzlies comprised 58 percent of the total population, including all age classes, the estimate for the total population is 229, or 56 (32 percent) more than the average population size of 173 estimated for 1960-65.

With reference to the entire period, the average proportion of marked bears in the observed population during the period 1959-70 was 39 percent (Craighead et al., 1974). The average proportion of bears 3

years old and older during this longer period was 60 percent (106 of 177) of the mean total of bears counted. If three-quarters of the marked grizzlies were 3 years old and older (see preceding paragraph), then on the average 50 percent of the 106 bears estimated to be exposed to risk of hunting each year were marked. But in fact only 24 percent of bears killed during this period were marked. This suggests that as many as 196 unmarked, uncounted bears existed in the population, or more than the average population size of 179 estimated by the Craigheads for the 1959-1970 period.

However, the rate at which newly-marked bears were added to the population apparently declined sharply after 1964. If this were the case, the proportion of marked bears in the population must have been considerably less after 1966 than in the early years of the study. This probably accounts for the lower proportion (24 percent) of marked bears in the kill when the entire 1959-1970 period is considered, compared to 43 percent in the 1959-1965 period, and particularly the low proportion (13 percent) in the 1970-1973 period. Since changes in the proportion of marked bears were occurring, the most conservative estimate for the size of the unmarked, uncounted portion of the population is probably that based on the 1959-1965 period, or about 32 percent beyond that of the counted population. In view of the observations by Barnes and Bray, this should be regarded as a minimum estimate. Craighead et al. (1974), using the same approach but a somewhat different set of figures (all mortalities rather than hunter kill only), estimated that 141 bears were uncounted. This value is close to the mean of the two different estimates based on hunter kills, which is 126. They point out; however, that certain sources of bias tended to inflate the estimate of uncounted bears. Their adjusted estimate is 57*, which is very close to our independently derived minimum figure of 56 (see above). When the final analyses are published, these estimates may be greatly refined by entering into the calculation the rate of input of newly marked animals and correcting for the age-specific mortality rate of those previously marked.

*In preparing the 1974 final draft for publication, Craighead et al. revised their calculations to arrive at an estimate of 52 bears in the "peripheral" population.

The minimum estimate of 32 percent (approximately 57 bears) may be considered to comprise the "back-country" and/or "peripheral" population. Both back-country censuses (see above) and data on marked individuals among bears killed outside the Park thus support the view that some grizzlies in the Yellowstone ecosystem had a significantly lower probability of visiting dump census areas and hence of being observed or captured and marked.

The concept of two or three wholly distinct populations--i.e., "back-country" versus "dump" populations (Cole, 1971) or "peripheral" populations--is misleading. All grizzlies inhabiting the Yellowstone Plateau must be regarded as belonging to the same population, as their great mobility demonstrates (Craighead and Craighead, 1971). Within this single population, heterogeneity of behavior exists; some bears apparently visited dumps more frequently than did others, and some spent more time outside of the Park boundaries than did others (Craighead and Craighead, 1971). Indeed, some probably never visited garbage sites. The uncertainty lies in ascertaining how many bears fall into each of the several behavioral categories.

To summarize, based on counts of marked and unmarked but individually--identifiable bears, the grizzly population at the garbage dumps of Yellowstone rose from 154 in 1959 to 202 in 1966, declined to 175 in 1967, rose again to 195 in 1969, and dropped to 179 in 1970. The average count for this period was 177. If this mean count is accepted, and if an uncounted additional 32 percent is added, the total population is estimated to have averaged 234 grizzlies over the 1959-70 period. Thus, the National Academy of Sciences study team concurred with Craighead et al. (1974) that no more than about three-fourths of the total ecosystem population was included in the garbage dump census.

In the summer and fall of 1970, and for two years thereafter, mortality of grizzly bears increased (see section II-C-9 of this statement); hence population size was probably reduced by 1972-73.//

7. Movement of the park's grizzly bears.

//That grizzly bears may move long distances has been amply documented by observation of marked bears and by radio-tracking studies (Craighead et al., 1963; Craighead and Craighead, 1970, 1971, 1972b, 1973). Normal movement patterns for Yellowstone Park bears traditionally included summer concentration at dumps, and spring and fall movements to and from den sites, often peripheral to the Park. There is some evidence that grizzlies are seen in the National Forests outside the Park more frequently in the spring and fall than in the summer months. Some bears that den outside the Park may thus be summer residents within the Park. However, unequal temporal distribution of observers--there are more hunters and outfitters in the forests in spring and fall--biases the data. Present understanding of normal seasonal movement patterns of grizzlies is fragmentary.

It has been asserted (Craighead and Craighead, 1971) that an unusual pattern of movements of grizzlies to developed areas (campgrounds, etc.) within the Park was caused by closure or partial closure of the dumps where they had traditionally congregated. It is clear that movements, often of considerable length, to developed areas, occurred in the summers of 1968-1970. Because baseline data on normal summer movements during earlier years (1959-1967) have not been presented, it cannot be established that the alleged increase in movements between dumps and campgrounds was caused by dump closure.//

8. Reproduction.

//Reproductive rate is here defined to be the ratio of the number of cubs surviving to midsummer of their natal year to the number of adult females. From the available data there are two methods of estimating the reproductive rates: (1) the ratio of observed number of adult females; and (2) the reproductive history of identifiable females.

It should first be emphasised that the ratio defined in (1), above, is not to be confused with another statistic often given: the ratio of cubs to females with cubs. The latter ratio is found, for example, in recent reports by Cole dealing with this population. It can be converted to the reproductive rate if the frequency of pregnancy is known. If this frequency is not constant, the ratio of the number of cubs to the number of females with cubs is useful only as an indication of litter size.// However, there is some evidence that litter size may have declined following closure of the dumps. Knight (1974) noted that cub:female ratios in 1973 were lower than the 2.2 reported by Craighead and Craighead (1967) when bears were utilizing the open-pit dumps, and slightly lower than the 1.9 reported for 1972 by Cole (1973). Knight (1974) states, "This could be

sample variation, increased cub mortality or the result of more younger females breeding and producing only one cub. The latter interpretation is supported by the increased number of females with cubs seen and the number of females with only one cub, but the data is not sufficient to warrant a conclusion at this time."

//The main difficulty in estimating the ratio of cubs to all adult females is in the assumption that each group is equally identifiable. In general, this will not be the case, since a female with cubs is much more likely to be observed than one without. Also there is a possibility that some adult females are misidentified. Undoubtedly, animals observed at the garbage dumps were equally observable and well identified, but it is not known whether all age and sex groups frequented the garbage dumps to the same degree.

The estimate of reproductive rate from the history of identified females is biased unless information is available on the length of the period from maturity to the occurrence and recording of the first pregnancy. In Craighead *et al.* (1974) this is taken into account, and their estimate of the reproductive rate from the reproductive histories of 30 marked female bears is 0.658.

On the other hand, another estimate is obtainable by Method (1), above, using the data of Table 1 of Craighead *et al.* (1974). This table does not separate adults from subadults for the first year of observation (1959); therefore, we use the data from 1960 to 1970. During this period, 890 adults and 351 cubs were observed. If one uses the sex ratio of 46.3 to 53.7 (Craighead *et al.*, 1974), an estimate of the reproductive rate as $351/(0.537(890))$ or 0.734 is obtained.

As will be pointed out below, both of these values appear to be too low.

9. Mortality.

//Mortality rates can be estimated from the data given in several tables in Craighead *et al.* (1974) showing the age composition of the population, provided some assumptions are made. The critical assumptions are: (1) that the different age classes are equally observable; and (2) that there are no trends in the population. If the population were growing, for example, then any present adult year class would be the survivors of a smaller group of cubs than are currently observed.

As is pointed out by Craighead *et al.* (1974), there is a significant upward trend in the total population count for the whole period 1959-70 the rate of growth is apparently 2.8 bears per

year where $t=2.80$ (probability level 0.02). However, if the same analysis is applied to the cub segment of the population, the trend is downward (-0.5 bears per year), though this is statistically nonsignificant. The positive trend in the total population is therefore explainable in one of three ways:

- There had been an increasing number of cubs prior to 1959, but this increase ceased during the 1959-70 period.
- The mortality rate decreased during the 1959-70 period.
- The proportion of the total population that was observed and recorded increased during the period of observation.

Since 2.8 bears per year on the basis of the average observed population of 177 (1959-70) is a percentage increase of only slightly more than 1.5 percent, it seems appropriate to begin with the simplest assumption and assume that the population was basically stable during this period. To do so does not imply that there were no fluctuations, in response either to population pressures or to external factors. We assume further that the mortality rate is age-dependent in the subadult ages but essentially constant thereafter.

From Table 1 of Craighead *et al.* (1974), the 1959-70 population averages by age are as follows:

Age Class	Number of Individuals
1/2 - 1-1/2:	0.72
1-1/2 - 2-1/2:	0.78
2-1/2 - 3-1/2:	0.80
3-1/2 - 4-1/2:	0.84
4-1/2 - 5-1/2:	0.87

The basic data combine 3-1/2 and 4-1/2 year-olds, so that only a combined mortality estimate for the age span 2-1/2 to 4-1/2 is obtained directly from the data. The separate values are determined by interpolation to yield this average and to give a smooth series. The final result is unaffected by this interpolation.

The adult mortality rate is estimated by a formula (Chapman and Robson, 1960) based on the mean adult life span (i.e., measuring from age 5.5). This is calculated from the basic data given in Table 2 of Craighead *et al.* (1973), which is based on a sample

taken in 1966 (52 animals plus 8 animals of known age and known to be members of the adult population in 1966).

$$a = \frac{1}{1 + l}$$

" l " is the mean adult life span and " a " is the annual adult mortality rate. From the data cited, $a = 0.136$.

If it is assumed that the mortality rate of subadult bears between the ages of 3-1/2 to 5-1/2 is the same as the adult rate, then an alternative estimate is available. The subadults, of course, represent the potential recruits to the adult stock. It is well known that the mortality rate can be estimated by the proportion of recruits to the total of subadults and adult stock (Heincke, 1913). This has to be modified here, since the subadults represent recruitment over 2 years. The formula for the survival rate, $s(s=1-a)$, is

$$s^2 = \frac{\text{No. of adults}}{\text{No. of subadults and adults}}$$

For the 1960-to-1967 data given in Table 1 of Craighead *et al.* (1974), the mortality rate $a=0.137$; for the 1960-to-1970 date, the estimate by this method is 0.139. These two estimates, based on the proportion of subadults and the one above ($a=0.136$) from the whole age structure, are very similar.

However, the mortality rates are not consistent with the reproductive rates determined in Craighead *et al.* (1974) or above. If the population were stable or increasing, then the recruitment to the adult stocks must equal or exceed the adult mortality. If the reproductive rate is 0.734 and half the cubs are females, then the recruitment rate to the adult population is derived as follows:

$$(0.734)(0.5)(0.72)(0.78)(0.80)(0.84)(0.87) = 0.120,$$

which is less than 0.136. (The last five figures on the left-hand side of the equation are the successive mortality rates from ages 1/2 to 1-1/2, 1-1/2 to 2-1/2, etc.)

Craighead *et al.* (1974) show an even greater discrepancy between estimated recruitment and estimated adult mortality, since their reproductive rate is estimated as 0.658. Actually, they go further and develop an "applied reproductive rate," which for the period 1959 to 1970 averages out as 0.641. They overcome this discrepancy by adjusting the mortality rate between ages 1/2 and 1-1/2 from 0.6296 to 0.8 (Craighead *et al.*, 1974, Table 12).

The recruitment rate, calculated with the mortality rates estimated above and the reproductive rate estimate of 0.658, is 0.108. The discrepancy can be shown by another analysis of the basic data for the population model of Craighead *et al.* (1974). This table shows a refined age structure with 42.1 adult females and 33 cubs. But with a reproductive rate of 0.658, 42.1 adult females produce only 27.7 cubs on average. Still further, the adjustment noted above--i.e., to the survivorship estimate from age 1/2 to 1-1/2, attributed to early weaned yearlings--leaves an unexplained deficiency in the older subadult counts.

All of these discrepancies become reasonable if one assumes that the bears observed by the Craigheads and their colleagues were in fact only a portion of the total population. If this is true, there are sampling errors in observations. In addition, it is probable that given elements of the population did not all have the same chance of being observed at the garbage dumps (see page 21).

Thus, in assessing future population trends, it is necessary to take into account both sampling errors and biases in the estimates obtained for the period 1959 to 1970 and those changes in the parameters that could be expected after 1970.

In particular, there is the question of compensatory mechanisms in the population in response to changes imposed externally. From 1959-67 the average man-imposed mortality upon the population was 18.9 bears per year. From 1968-73 the man-imposed mortality (or removal of bears from the ecosystem) was 189, or an average of 31.5 per year (Craighead *et al.*, 1974).

A large portion of these losses may undoubtedly be attributed to the changes brought about by garbage-dump closures in 1970-71. In these two years the removals were 53 and 48, respectively. However, the next heaviest mortality (43 in 1967) was primarily due to a large hunter kill (24) in Wyoming. Man-imposed mortality declined to 27 in 1972 and 17 in 1973. In particular, removals due to control actions within the Park fell to 9 in 1972 and 0 in 1973 (Cole, 1973) /Table 3/. There is also some evidence that kills of all types have declined throughout the Yellowstone ecosystem during the period from 1970 to 1973 (Cole 1974, Table 4).

If the 1959-67 rate is considered to be characteristic of a stable situation, the "normal" 1968-73 removal could have been 6×18.9 or 113 bears. Thus it may be asserted that the "excess" losses in 1968-73 were 76 (189-113). If there were no other changes in population parameters, then the population that we have estimated to be 234 or greater could have been as low as

158 by 1973. This figure may be compared with the most probable figure of 144 (for 1974) given in Craighead et al. (1974). The difference is explained by the lower reproductive rate they calculated for 1970-73 and extrapolated to 1974. This rate is calculated from the litter size observations made in 1970-73 by different observers and under different conditions. As noted above (page 31), the Craigheads' values for reproductive rates, even for the earlier period, are not fully consistent with other observations. Moreover, these calculations make no allowance for such other changes as a decrease in mortality from age 1/2 to 1-1/2 as suggested by Cole (1973).

This and other possible compensatory responses are discussed more fully in the following section.//

Table 3. Removal of Grizzly Bears due to Control Program in Yellowstone National Park

Year	No. of Bears
1970	20
1971	6
1972	9
1973	0
	<u>35</u>

Source: Cole 1974

Table 4. Grizzly Bears Killed, 1970-1973

Year	Removals due to Control Programs		Killed by Vehicles	Other Known kills ^a		
	Park ^b	Mont.		Wyo.	Mont.	Idaho
1970	20	0	2	8(1)	4(1)	7(1)
1971	6	14	1	6	6(3)	5
1972	9 ^c	2	1	5	0	4
1973	0	1	0	5(1)	2	3
	<u>35</u>	<u>17</u>	<u>4</u>	<u>23</u>	<u>12</u>	<u>19</u>

^aTotal deaths from hunting or kills to protect livestock or property, with those marked inside Yellowstone prior to or since 1970 in parentheses.

^bIncludes 9 animals donated to zoos, 13 unintentional, and 13 intentional deaths.

^cIncludes 1 unintentional and 1 intentional death due to control actions that were not in developed areas.

Source: Cole 1974.

10. Ability of the grizzly bear population to compensate for closure of garbage dumps.

The ability of the grizzly bear population to survive following short-term closure of park dumps has historical precedent. During World War II, the garbage dumps were closed for several years because of a significant drop in park visitation. In 1942, a minimum 28 grizzly bears were reported killed in the park--more than twice the number killed in any other year for which records were kept. The grizzly bear survived the closures, but reliable data on the effects of the closures on population dynamics are not available. Because the dumps were closed only for a few years and then reopened, the predictive value of this historical event in assessing the long-term adaptability of the grizzly bears to dump closure is minimal.

//The grizzly bear is a species that is characterized by a long life span, delayed maturity, extended parental care of young, nonreproductive intervals, and high adult survivorship--attributes typical of a species that is adapted to living at population densities close to the upper limit of resources (i.e., strongly K-selected, Pianka, E. R., 1972). Furthermore, the grizzly bear is a fearsome carnivore with few natural enemies other than humans. Modern firearms have shifted the balance greatly in favor of humans, but aboriginals on foot, with stone-tipped weapons, represent the condition under which most of the grizzly bear-human interactions occurred over evolutionary time. It seems unlikely that grizzly bear populations in aboriginal North America were controlled by predation to a level substantially below that the resource base would support.

This being the case, one would expect that the grizzly bear would evolve variable life history parameters that would allow flexibility in achieving a balance between the population density and a resource base that varies by season and year.

The number of variable parameters known in bears is very great. In fact, it is doubtful that any parameter is a constant. The age of first breeding is variable (Craighead et al., 1974). The interval between litters is highly variable, and presumably the number of bears (Jonkel and Cowan, 1971) may allow the response as to number of young born to be conditioned by quality of late summer and fall foods, and the condition of females going into hibernation. Litter size in Yellowstone bears, as reflected by number of cubs at six months of age, varies, whether due to variations in conception or in early mortality. High early mortality of young is typical of mammals and schedules of mortality for all age classes vary depending upon resources and population density (Caughley, 1966).

shorter life span

What mechanisms

The rigid characteristics of the model of Craighead et al. (1974) seems, a priori, to be unrealistic, because no compensatory mechanisms are built into the model. The reproductive rate is altered between two fixed levels on rather arbitrary grounds. The model assumes a stable age distribution and is established on the basis of a stationary population. A model based on such equilibrium, in which a given reproductive parameter is lowered, will obviously lead to extinction if compensatory mechanisms are not built into the model; this is true irrespective of the initial population size. Thus, the absence of compensatory mechanisms in the Craighead et al. (1974) model means that a change of reproductive or mortality parameters will, in general, lead to indefinite increase or to extinction. Equilibrium would be achieved only in the special instance where the two rates were adjusted in concert so that changes were in the proper directions and magnitudes as just to offset each other. Since the Craighead et al. (1974) model does not incorporate compensatory mechanisms, the population predictions are subject to question.

What data length of reproductive cycle? likely to be lengthened

Closing the garbage dumps, at which females had formerly been brought into close contact with juveniles and males, may have altered the population status by altering survivorship rates in the population. There is thus the question whether the Craigheads' data (which are by far the best available) are applicable to a population now dispersed rather widely over the Park.

There is little question that increased adult mortality will be offset by compensatory increases in juvenile recruitment. However, it is equally apparent that grizzly bears are limited in the range of compensatory response that is possible and that, at best, grizzly populations are vulnerable when high rates of mortality are imposed.

In our opinion, the data at hand are not sufficient to make accurate predictions about population responses to various levels of adult mortality.

Our calculations are intended to be on the conservative side. It is agreed that the population observed at the garbage dumps did not represent the total number of bears in the Park, and certainly not those of the entire ecosystem. Most important, if the garbage dump closure altered the biological parameters of the population, then any model based upon data collected prior to 1970 would not yield accurate population projections.

At the same time, our evidence does not suggest that there are compensatory mechanisms adequate to maintain the Yellowstone population under the impact of continued mortality as high as that which occurred in the years 1970-72.

D. People

1. Visitation.

Visitation passed the two million mark in 1965 (Table 5). Since that year, however, small increases and decreases have occurred but with no net gain. In fact, between 1965 and 1973 a slight (0.05%) decrease in visitation was recorded. Since winter use has grown approximately 20% per year since 1963 (USDI 1972) summer visitation must have declined even more.

The rate of increase in visitation peaked around 1950 (wartime decreases probably were partially responsible) and has been steadily declining. Possibly the park is reaching its "natural carrying capacity" with cultural, social, and economic factors acting as automatic regulators (Table 6).

2. Overnight and backcountry use.

The park contains overnight accommodations for 23,190 persons at any one time. Trends of use appear fairly constant, often determined more by campground closures, etc., than by public choice patterns. Backcountry camping is the exception to the otherwise stabilizing trend in overnight use. Over the past 5 years, backcountry use has increased more than 100 percent (Table 7). Backcountry use is most intensive in the areas indicated in Figure 5.

3. Attitudes toward bears.

Man's relationship with grizzly bears has received much attention. Recent studies of the evolution of man's attitude toward wildlife suggest that evolution is similar in many areas of the world. (Tocher et al. 1973; Shaw 1974). Historically, as wildlife populations decreased and human populations increased, man's relationship to wildlife went through the stages characterized by utilitarian and consumptive motivations, fear and challenge, and finally aesthetic appreciation which in many areas of the world is the present day attitude.

Wildlife concerns today can be compared with contemporary social movements involving the liberation of a human social type; that is, the liberation of non-human species through a growing respect for and appreciation of life in its many diverse forms.

Table 5. Yellowstone National Park Visitation 1895-1973.

The number of visitors during the period between the establishment of the park (1872) and the beginning of this compilation (1895) was estimated to be not less than 1000 nor more than 5000 each year.

Year		Year		Year	
1895	5,438	1930	227,901	1960	1,443,288
96	4,659	31	221,248	61	1,524,088
97	10,680	32	157,624	62	1,925,227
98	6,534	33	161,938	63	1,872,417
99	9,579	34	260,775	64	1,929,316
		35	317,998	65	2,062,475
1900	8,928	36	432,570	66	2,130,313
01	10,769	37	499,242	67	2,210,023
02	13,433	38	466,185	68	2,229,657
03	13,165	39	486,936	69	2,193,894
04	13,727				
05	26,188	1940	526,437	1970	2,297,290
06	17,182	41	581,761	71	2,120,487
07	16,414	42	191,830	72	2,246,827
08	18,748	43	64,144	73	2,061,537
09	32,545	44	85,347		
		45	178,296		
1910	19,575	46	814,907		
11	23,054	47	932,503		
12	22,970	48	1,013,531		
13	24,929	49	1,133,516		
14	20,250				
15	51,895	1950	1,109,926		
16	35,849	51	1,166,346		
17	35,400	52	1,350,295*		
18	21,275	53	1,326,858		
19	62,261	54	1,328,893		
		55	1,368,515		
1920	79,777	56	1,457,782		
21	81,651	57	1,595,875		
22	98,225	58	1,442,428		
23	138,352	59	1,408,667		
24	144,158				
25	154,282				
26	187,807				
27	200,825				
28	230,984				
29	260,697				

*Beginning in 1952 the figures represent travel during the calendar year instead of the period October 1 to September 30 as previously used. Source: Yellowstone National Park files.

Table 6. Rates of Change - Yellowstone National Park Visitation 1929-1973.

(Rounded to nearest whole number)

1929-1939	87%
1940-1950	111%
1951-1961	31%
1962-1972	17%
1963-1973	10%
(1965-1973)	-.05%

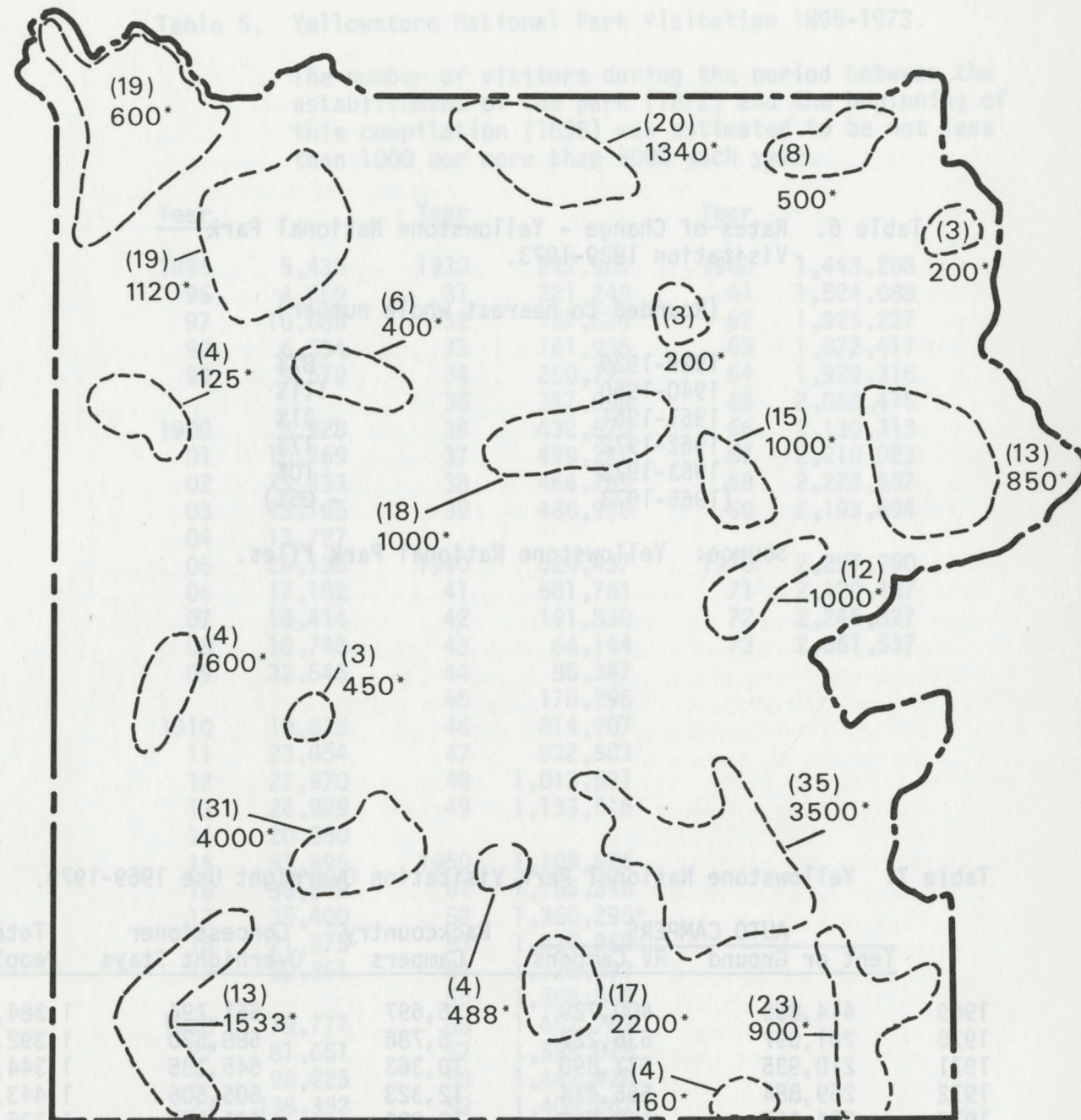
Source: Yellowstone National Park files.

Table 7. Yellowstone National Park Visitation Overnight Use 1969-1973.

	AUTO CAMPERS		Backcountry Campers	Concessioner Overnight Stays	Total People
	Tent or Ground	RV Campers			
1969	414,855	400,729	6,697	561,794	1,384,075
1970	261,097	536,227	6,786	588,520	1,392,630
1971	210,935	577,890	10,363	545,185	1,344,375
1972	259,884	565,474	12,323	605,506	1,443,187
1973	234,437	467,530	13,833	621,100	1,336,900

Source: Yellowstone National Park files.

FIGURE 5. DISTRIBUTION OF BACKCOUNTRY USE, YELLOWSTONE NATIONAL PARK

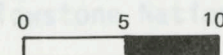


DISTRIBUTION OF BACKCOUNTRY USERS (1973)

() = No. of Campsites

* = No. of Campers During Season

= Backcountry Use Areas



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Western man's contemporary pursuit of the wilderness exemplifies present-day attitudes toward bears.

"My impression of this relationship is that the grizzly has had, and still does have the ability to uniquely stimulate the imagination and mind of man, and that human beings, in visiting grizzly country, face a situation which induces qualities phylogenetically developed in man, but which are often not allowed simple expression (socially and legally acceptable author's note) in our modern and complex technological society." (Herrero 1970)

In sum, therefore, from primitive times to the present, man's relationship with the grizzly bear has been significant and of great depth, changing in content but not in dimension through different cultures and times. Johnson (1973) sketched a brief history of park visitors and grizzlies which denotes the basic predicament of public popularity:

Yellowstone Park soon became famous for its bears, both black and grizzly, and remains so to this day. Bears became synonymous with Yellowstone and were the main attraction of the park for many people. Visibility of the bears came to be accepted as desirable, even necessary to the continued growth and prosperity of the park."

The attitudes of travellers to the Yellowstone region were solicited through a 1970 study by the National Advertising Company. "What would you say was the most enjoyable place you visited on this trip? Why?" was a major question asked of these auto travelers. Several response types are illuminating, for example: "Seeing wildlife in their natural habitat. There are no many places you can see natural wildlife." "... Also, seeing bears, deer, rabbits, etc., in their natural environment." When asked: "What would you say was the least enjoyable place that you visited, or the least enjoyable thing that you did while on this trip? Why?: Vacationers responded: "Yellowstone National Park. All the bears and other wildlife were gone." Nearly all such comments refer to opportunities to see black bears, which, until a few years ago, were commonly seen on roadsides. Grizzly bears have rarely been seen at any time waiting for handouts at park roadsides.

Regardless of the particular species involved, wildlife is important to the viewing public. Grizzly bears are aesthetically important to the visiting public although they are actually seen infrequently.

In a questionnaire survey conducted 1969-70 in Alberta, Canada, the objective was "to determine the degree to which wildlife in western mountain national parks is perceived as being hazardous and factors associated with the perceptions" (Bryan and Jansson 1973). The implicit assumption was that perception of wildlife as a hazard affects behavior toward wildlife. The data suggested that more contact (by frequency of national park visits, size and location of residential community, hunter, non-hunter status) instilled a lesser perception of hazard.

One interpretation of such results (although not that of the researcher) is that as human populations become more distant, experientially and proximally, from wildlife, (urbanized, etc.) and contact lessens, perception of hazard will increase, hopefully followed by more cautious behavior when hazardous species are in the vicinity.

E. Bear-People Interactions

1. Nature of interactions.

a. Passive--viewing bears

Many visitors come to Yellowstone National Park primarily to see and enjoy its diverse native wildlife, including the grizzly bear. Most of the bears seen in the park are the more common black bears, which are sometimes responsible for major traffic jams as visitors stop to observe or photograph bears that are visible from the roadway.

Opportunities to see grizzlies have never been common. At certain seasons and in particular areas, opportunities do exist for visitors in cars to view wild grizzlies safely as the bears travel and forage naturally. Such opportunities cannot be guaranteed.

Sightings may be made in many places in the park, but are not frequent in the areas indicated on Figure 5. In areas where grizzly bears are known to occur, sightings are possible at any time the bears are active.

b. Active

Active interactions occur when visitors intentionally or unintentionally attract bears, or when visitors encounter a

Table 8. Grizzly Bear Control Actions in Developed Areas, Yellowstone National Park, 1968-73 (after Cole 1974).

Developed areas:	Control actions ^a					
	1968	1969	1970	1971	1972	1973
Old Faithful Canyon	1 ^b	0 ^b	22	1	0	0
Lake Outlet	14	16	9	11	10	3
Grant Village	16	25	11	20	13	4
Bridge Bay	20	5	15	5	0	0
Eleven other units	8	9	0	1	3	3
	0	2	13	1	0	0
Total control actions	59	57	70	39	26	10
No. different bears ^c	?	?	50	33	21	7
Pct. successful transplants	33 ^d		60	80	74	70
No. bears destroyed ^e	5(3)	10(5)	12(6)	6(2)	6(4)	0
No. bears to zoos	0	0	8	0	1	0

^aNumber of times a bear was captured for transplanting, shipped to a zoo, or destroyed.

^bGrizzlies present until Rabbit Creek dump opened each year.

^cNumbers in 1968 and 1969 unknown due to unmarked animals; 4 of 33 were 1970 transplants, 4 of 21 were 1970 or 1971 transplants.

^dSample of 20 marked and 1 recognizable bear.

^eYearly totals with the number that were unintentional because bears charged personnel, came out of drugs during handling, injured themselves in traps, or failed to recover from drugs shown in parentheses.

bear that illustrates aggressive behavior, often in defense of cubs or to protect a food supply. A small percentage of these interactions result in injury to the visitor. Such injuries often are due to the visitors lack of awareness of the potentially dangerous nature of these powerful animals. Carelessness, often inadvertent, may subject the visitor to increased risk of serious injury.

Active interactions may occur anywhere there are both grizzly bears and visitors.

Bears in campgrounds are always potentially dangerous, and established campgrounds in areas that may be frequented by grizzly bears during spring and early summer sometimes are opened late to reduce the likelihood of personal injury. To day, permanent closure of only one campground--the Pelican Creek campground--has been required because of unusually high grizzly bear density.

Restrictions on the types of camping equipment may also be applied. Canyon and Fishing Bridge campgrounds are located in areas of high grizzly bear density and prior to 1969 were both considered to have critical grizzly bear problems. In 1970, camping in the Canyon Campground was limited to hardsided recreation vehicles. The use of tents, tent trailers, and bedrolls on the ground is prohibited. There is evidence to suggest that with the increased standards of campground sanitation and food storage in effect, bears are avoiding developed area campgrounds (Table 8). In 1973, it was necessary to capture and relocate two sow grizzly bears and one black bear from the Canyon Campground. This is in contrast with the necessity to destroy four in and relocate ten grizzly bear and eleven black bear from the Canyon Campground in 1969.

No grizzly bears required control actions within the Fishing Bridge Campground during 1973, compared to a need to destroy three and relocate six in 1969. This may be attributed to the fact that no food--in the form of groceries or garbage--was available for bear use. It may be possible in future years to relax the equipment restrictions.

Hiking and backcountry camping are becoming increasingly popular activities within Yellowstone. Many of the backcountry campsites are within areas of relatively high bear densities and/or can be reached only by traveling through prime grizzly bear habitat. (See Figures 4 and 5). To date, personal injuries attributed to grizzly bears in the backcountry have been rare. The potential danger, however, is there. In order to minimize the potential of human-bear conflicts, backcountry activities and facilities (trails and campsites) must be closely regulated and monitored. Trails and backcountry campsites are closed when the area is known to contain a bear that is considered to be a special hazard, such

as a bear that has demonstrated an aggressive behavior pattern. Relatively short walks into the backcountry normally do not expose the visitor to the same degree of danger as the backpacker. Hiking is a day-use activity and takes place during the period when bears are least active, often in fairly open country with good visibility adjacent to main park roads. Walks, however, are often spontaneous events in which the participants are relatively unprepared, in terms of equipment, background, and attitude, to avoid conflicts with bears. Portions of the interpretive program and monitoring program are directed toward making hiking a safe activity.

Fishing is either a primary purpose of or an incidental activity in the majority of backcountry visits. Backcountry fishing may expose the visitor to risk of bear-induced injury, especially in areas where discarded fish carcasses serve as bear attractants. Fish cleaning and cooking also have the potential to attract bears. Therefore fishing areas must be monitored very closely to prevent the development of backcountry nuisance bears.

To date, no fishing areas have been closed specifically to prevent possible bear-visitor interactions. However, in 1973, the National Park Service closed the first mile of the Yellowstone River--including the popular Fishing Bridge area--to fishing. The action was taken in response to the concern of the U.S. Fish and Wildlife Service that continued fishing pressure would adversely affect the outlet-spawning cutthroat trout, causing high cutthroat mortality and excessive competition from the fry of suckers and shiners (Dean 1972). Fishing Bridge is in an area of documented high density of grizzly bears (see Figure 4). Closure of the area to fishing undoubtedly reduced the number of discarded fish carcasses along the river, thereby reducing the area's attractiveness to grizzly bears. The likelihood of bear-visitor interactions in this area possibly is less than before the closure.

The black bear is more common, more often seen, probably more adaptable to man or tolerant of man, and responsible for more injuries than the grizzly. Indeed, the majority of bear injuries to park visitors have been attributed to the black bear (Table 8). During the period 1931-69 an average of 45 people per year were injured by the black bear. The highest recorded number of injuries occurred in 1937 when 115 people were injured. The lowest number of injuries were recorded during the period 1943-45 when visitation was greatly reduced. An average of 25 black bears per year during the period 1931-69 have been killed either as the result of a nuisance bear control program or through accidents with visitor automobiles (Table 10).

Approximately 500 black bears live within the park. Historically, large numbers of the population were associated with park roadsides

Table 9. Personal Injuries Attributed to Black Bears and Grizzly Bears, 1963-73.

Year	Number of Personal Injuries	Attributed to:	
		Grizzly Bears	Black Bears
1963	36		
1964	30		
1965	39		
1966	66		
1967	61	(3)	(58)
1968	20	(2)	(18)
1969	27	(6)	(21)
1970	11	(3)	(8)
1971	9	(0)	(9)
1972	8	(3)*	(5)
1973	4	(0)	(4)

* One was fatal. *perhaps 2*

Source: Yellowstone National Park files.

Table 10. Bear Incidents, Yellowstone National Park, 1931-1973.

Year	Personal	Property	Damage	Total No.	No. of	Park
	Injuries	Damage	Amount	Bears Killed	Grizzlies	
	(all bears)	(all bears)		for Control	Killed ^a	Visitation
				(all bears)	(for control)	
1931	78	209	--	34	--	221,248
1932	34	451	--	55	--	157,624
1933	22	146	--	22	--	161,938
1934	25	38	--	2	--	260,775
1935	36	141	--	69	3	317,990
1936	42	34	--	14	4 ^b	432,570
1937	115	81	--	51	10	499,242
1938	97	81	--	46	--	466,185
1939	78	92	--	23	--	486,936
1940	41	75	--	12	--	526,437
1941	90	102	--	26	--	581,761
1942	29	118	--	83	28	191,830
1943	5	38	--	14	--	64,144
1944	2	18	--	12	3	85,347
1945	2	7	--	2	--	178,296
1946	15	20	--	4	--	814,907
1947	40	9	--	8	--	932,503
1948	36	27	--	8	3	1,013,531
1949	47	26	--	19	8	1,133,516
1950	51	48	--	20	--	1,109,926
1951	38	75	--	44	4	1,166,346
1952	40	84	--	9	1	1,350,295
1953	43	66	--	11	1	1,326,858
1954	45	115	--	11	5	1,328,893
1955	73	121	--	23	5	1,368,515
1956	109	106	--	14	--	1,457,782
1957	91	125	--	21	1	1,595,875
1958	39	117	--	28	2	1,442,428
1959	41	269	--	30	6	1,408,667
1960	69	358	14,620	89	4	1,443,288
1961	58	247	13,138	59	1	1,525,368
1962	42	112	3,510	52	4	1,923,063
1963	36	278	10,810	21	2	1,870,644
1964	30	224	9,520	12	2	1,962,742
1965	39	290	8,239	11	2	2,056,198
1966	66	298	11,192	39	3	2,123,160
1967	61	195	6,769	20	4	2,202,790
1968	20	240	8,659	10	6	2,222,994
1969	28	207	5,269	42	10	2,186,033
1970	11	89	2,582	19	12	2,297,290
1971	9	71	2,832	8	6	2,120,047
1972	8	87	8,161	16	8	2,246,827
1973	4	38	8,206	3	0	2,061,537

^aThis number is included under "Bears Killed."

^bMuseum specimens.

and developed areas. As a corollary to the grizzly bear management program, the absence of garbage and increased enforcement of regulations prohibiting bear feeding has resulted in the black bear's return to the forest.

Following closure of the dumps, the number of personal injuries attributable to both black and grizzly bears declined markedly (Tables 9 and 10) during a period when total park visitation remained roughly constant. The number of bears killed for control was positively correlated with the number of injuries during the period. Both black bears and grizzlies have been less often killed for control purposes since the dumps were closed and high protection standards enforced.

The National Academy of Sciences report (Cowan 1974) provides the following analysis of bear-visitor interactions:

//If dump closure did result in increased movements of bears to, and activity in, campgrounds, this ought to be reflected in an increase in bear-human interactions in campgrounds within the Park except where special techniques were implemented to prevent them.

Injuries to humans by grizzlies constitute one sort of interaction. Craighead and Craighead (1971, page 850) and Cole (1971, page 861) seem to accept nearly the same injury total--63 known and provable grizzly-caused injuries to humans within the Park over the 40 years since 1930. However, a closer examination of these two papers reveals a serious discrepancy in injury figures. Table 11 was constructed from data in these two papers and shows that Cole's injury figures are much higher than those published by the Craigheads for the 1959-70 period. These discrepant figures form the basis for the conflicting conclusions reached by the respective authors.

Cole (1973, 1974) claimed that the 1970-72 mean of 1.0 injuries per year, or the 1970-73 mean of 0.7 injuries per year in developed areas "was significantly different ($p = 0.05$) from the 1963-69 mean of 4.4 per year . . ." Craighead and Craighead (1971) asserted, by contrast, that the rate of injuries was 1.67 per year during 1959-67, but increased to 3.33 per year during 1968-70; they believe that "the increase is due largely to the present management practices that have forced grizzly bears into campgrounds and developed areas. . . ."

The management practice alluded to is the phase-out of open-pit dumps. Of the four main dumps, the one at Gardiner was closed in 1968, Rabbit Creek in 1970, and Trout Creek and West Yellowstone in 1971. Thus the principal closure period was 1970-71.

However, the dump most heavily used by grizzlies, Trout Creek, suffered a drastic reduction in amount of edible garbage disposed of there in 1968 (Craighead and Craighead, 1971, page 852). There was some increase in garbage dumped at Trout Creek in the summers of 1969 and 1970, before the dump was finally closed, but the Craigheads regard the period of dump phase-out as extending from 1968 through 1970.

Cole's basic position is that there was no dramatic increase in injury rates during the period of dump closure but that the injury rate has fallen since then (Table 3). The Craigheads argue that the injury rate did increase during dump closure, as compared to previous years; they do not comment on the 1971-73 period. The figures summarized in Table 3 are cited by each to support their respective conclusions.

These comparisons of injury rates are also suspect because of other uncontrolled factors that may affect them, such as changes in: (1) number of visitors to Yellowstone; (2) garbage disposal practices in campgrounds; (3) frequency and intensity of campground patrols by Park personnel; and Park personnel in campgrounds. It is reasonable to suppose that in the years immediately following the deaths of two persons in Glacier National Park in 1967, Park authorities were especially sensitive to the threat posed by grizzlies in areas of visitor concentration and were especially vigorous in patrol and control activities.

Finally, data on injury rates or control actions are reliable only to the extent that Park records have been kept accurately. Certain discrepancies among injury records have been noted (Table 11). It has also been alleged (H. V. Reynolds, personnel communication, January 19, 1974) that control actions have not always been recorded. If this allegation is true, such failure jeopardizes rational research and management programs for grizzly bears within the National Parks.//

F. Probable Future Environment Without the Proposed Action

The primary emphasis of the proposed action addresses itself to the regulation of human activities and solid waste management. Failure to continue to implement these measures could lead to significant environmental changes through pollution and could increase the potential for people-bear conflicts. The latter could result in personal injuries, deaths and property damages, accompanied by an increased destruction of individual bears, and the possible loss of the grizzly bear from the Yellowstone ecosystem. The integrity of the natural environments would be weakened, and the value of the national park for visitor enjoyment and scientific study would be altered.

*What about death of
Walker, boy + another
death of woman at
Trout Creek in 1970?*

Table 11. Number of Persons Injured by Grizzly Bears in Yellowstone National Park, 1959-1970 (from Cowan 1974).

Year	Source		Difference
	Craighead and Craighead, 1971, Table 5 ¹	Cole, 1971 Table 3, Fig. 2 ²	
1959	0	1	1
60	0	1 + (1)	2
61	1	2	1
62	2	2	
63	6	8	2
64	1	2	1
65	4	8	4
66	1	2 + (2)	3
67	0	3	3
68	1	2	1
69	6	6	
70	3	2 + (1)	
	25	39 + (4) = 43	18

¹Include all in-Park injuries.

²Injuries in developed areas (from Fig. 2), with backcountry injuries in parentheses (from Table 3, plus Cole, 1973 for 1970).

Wright n. 148. "But I had a lot of sport, and had begun to find out, as later on I was to prove more thoroughly, that the Yellowstone Park grizzlies differ in no material respect from others of their species".

III. ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

A. Impacts on Bears

The analysis of the impacts of continuing the existing grizzly bear management program is based on information collected during three periods in the park's history. The data collected on the grizzly bear population before closure of the dumps (1968) provide a base-line against which to evaluate the effects of the management program on the grizzly bear population. The data amassed during the period of dump closings (1968-1971) provide some indication of the immediate effects of that significant management decision on the population. The data collected since the last park dump was closed in 1971 facilitate assessment of trends in the population dynamics and ecological interrelationships of the grizzly bear that have occurred since the dumps were closed. The latest data, collected during the last three years, have substantial value in predicting the impacts of continuing the existing management program.

The report of the National Academy of Sciences (Cowan 1974) indicates that the available data have "many shortcomings," owing in part to still incomplete analyses, inconsistencies in the methods of various investigators in collecting and analyzing data, variability in the skill of observers and resultant effects on the accuracy of observations, and differing emphasis in interpretation of data. However, the Academy also states that "to overemphasize the inadequacies of the data . . . would be as ill advised as to ignore them." The richness of the data bank is praised at the same time the need for more research on the grizzly bear is emphasized. The impacts of continuing the grizzly bear management program therefore fall on a continuum of probability depending on the comprehensiveness and reliability of existing information. Some impacts are certain or nearly so, others probable, and still others only possible. Based on the Academy's findings and other available information cited in Section II of this statement, the following conclusions may be made as best estimates of impacts on the future of the grizzly bear population.

1. Relatively certain impacts.

Continuation of the grizzly bear management program will require that the park's grizzly bears will have to rely exclusively on natural food sources so long as they remain within the park boundary. The only occasion for bears to have access to garbage will be through intentional or unintentional violation of existing regulations for solid waste management, visitor activities, or visitor behavior with respect to bears. The park's grizzly bear population therefore will continue to be an essentially wild population that is integrated into the natural food web.

William H. Wright "The Grizzly Bear" 1922
Always wild. n. 162 - "Altogether I did not find the grizzlies of Yellowstone Park in any degree more tame or less cunning than they are to-day, for example, in the Selkries. Many of them, it is true, come to the garbage-pits to feed, but these very bears, fifty yards back in the timber, are again as wild as any of them anywhere."

The concern that rapid closure of the park's open-pit dumps with no supplemental feeding would result in a significant decline and probably rapid extirpation of the park's grizzly bear population has not been borne out by documented changes in the population following this management action. Indeed, there was an increase in the number of problem bears that had to be killed or removed from the population immediately following closure of the dumps. However, such actions have become progressively less necessary during the last few years and, in 1973, no grizzly bears were killed or removed from the population (vs. 20 bears in 1970). Today, young bears do not learn to use people-introduced foods from either open-pit dumps or camping areas. Habituation of bears to the natural environment has been largely responsible for the steady decrease in the incidence of control actions. Available population data indicate that the population decline during and immediately following the dump closures was temporary and that replacement of losses is likely. The National Academy concludes that "compensatory processes . . . have resulted in, or will lead to, replacement of bears that were removed from the ecosystem in 1968-1973." Such compensatory processes may involve increases in reproductive success, reduced competition between bears in a more dispersed population and therefore less morbidity and mortality (particularly of young), and increased juvenile recruitment.

The closure of the dumps would have affected primarily those bears that were habitual users of the dumps, but would have had relatively little impact on bears that were infrequent users or that may not have used the dumps at all. About a third of the park's population had a 'significantly lower probability of visiting dump census areas' and 'may be considered to comprise the 'back-country' and/or 'peripheral' population' (Cowan 1974). Because of its behavior and movement patterns, this portion of the population would have been less subject to any adverse effects of the dump closures. The existence of a substantial, relatively unaffected portion of the population, as well as the compensatory ability of the affected population, lend support to the major conclusion of the National Academy's study to the effect that "there is no convincing evidence that the grizzly bears in the Yellowstone ecosystem are in immediate danger of extinction." This evaluation indicates that the management policy should not impair the viability of the park's grizzly bear population in the short-term. Long-term perpetuation of a stable, viable population will depend on land use and management practices throughout the Yellowstone ecosystem, of which the park is merely a part. Because these conditions are subject to change either to the benefit or the detriment of the grizzly bear, the long-term prognosis for survival of a wild grizzly bear

population is not certain. However, at the present time, the population appears to be recovering from the adverse effects of the dump closure and there is no evidence to support the contention that the management action itself has induced, or will continue to induce, a long-term population decline.

Continuation of the management program will have some adverse effect on the grizzly bear population whenever control actions are needed. While the objective is to reduce to zero the use of garbage and other introduced foods by bears, it is recognized that individual grizzly bears may occasionally become dependent upon man's food through human carelessness. Bears may also accidentally wander through campgrounds located near prime habitat such as at Fishing Bridge or Canyon. If food is received, the bear may become accustomed to man's food. When attempts to restore such bears to an independent existence fail, they must be removed from the population as a public safety measure. It is difficult to predict the number of grizzly bears that annually may be affected by this phase of the management program. Cole (1974) notes that 35 grizzly bears were removed from the park population during the period 1970 through 1972 (Table 7). Twenty-two of this total were intentionally removed, with 9 bears being donated to zoos and 13 being destroyed. The remaining 13 bears were killed either accidentally or to prevent human injury during capture attempts.

Since closure of the open-pit garbage dumps and implementation of higher standards of campground sanitation, the campground visits by grizzly bears are becoming less frequent. Bears that have not had previous experience with garbage and food chests may have a tendency to avoid campgrounds that are filled with the sounds and scents of man. The campground foraging of old adults, however, may persist for a number of years.

Nuisance bears that become serious safety hazards from time to time to the point where they must be removed from the park's population will be either (1) transferred to other jurisdictions for use in restocking programs, (2) donated to zoos, or (3) destroyed. Unfortunately, grizzly bears that have been corrupted by man's garbage are not good risks in restocking programs. In effect, relocating such bears would be merely transferring the problem from one area and one jurisdiction to another. Zoos have requested grizzly bears from time to time. Wild bears, however, are much more difficult to maintain in captivity than zoo-reared bears. As there appears to be an abundant supply of the latter, it is questionable if many requests for Yellowstone grizzly bears will be forthcoming in the next few years. Destruction of individual bears known to be extremely hazardous, therefore, is often the only course of action available to

prevent human injuries. However, it is of interest to note that through July of this year (1974) no grizzly bears have been killed and no control actions taken in the park. If the current level of control actions continues, the impact of artificial removal of grizzly bears from the population on the long-term stability of the population should be negligible.

It is anticipated that the continuation of the grizzly bear management program will have a positive impact on the black bear population by significantly reducing the number of nuisance bears that must be destroyed. Reduced dependence on cultural sources of food may be expected to have somewhat similar effects on black bears as on grizzly bears, although differences in behavior and habitat requirements will unquestionably be associated with differences in response. Data are inadequate to enable prediction of these differences at this time.

2. Less certain impacts.

Data collected on the park's grizzly bear population since the dumps were closed indicate various changes in the population which may represent trends that will continue in the future. Data insufficiencies and the short period of record often make it difficult to determine whether these possible trends are significant in the long run or whether they merely represent temporary fluctuations in population characteristics.

* Knight (1974) reported that cub:female ratios (i.e., litter size) in 1973 were lower than the 2.2 reported by Craighead and Craighead (1967) when the bears were using the open-pit dumps, and slightly lower than the 1.9 reported for 1972 by Cole (1973). Knight indicated that the most likely explanation is relative increase in the proportion of younger females with only one cub. Alternatively, increased cub mortality could be a causal factor. This increase may be caused by the fact that during the period of relative intensive control actions, 1970-72, "... proportionally greater numbers of adult males were removed (from the population) than of either adult females or younger bears..." (Cole 1974). The former explanation is supported by the increased numbers of observations of females with cubs and the larger proportion of one-cub females. However, the existing data are not sufficient to determine whether a real trend exists and what the long-term effect on the population will be.

what proportion? why?

The National Academy report (Cowan 1974) concludes that "compensatory changes in the survival of young during the 1968-1973 period may have occurred as a response to the reduced population size. There is no evidence for or against a change in natural mortality of adults during this period." Indeed, the increased mortality of adults during the period

(mean:31.5/year) was due primarily to large numbers of removals in 1970 and 1971 following dump closure (101 ex 189 man-induced kills and removals) and a higher hunter kill in Wyoming (24) in 1967. If man-induced mortality continues to decline (there were only 17 documented grizzly bear kills in the ecosystem in 1973), and if the dispersed population illustrates an increased survivorship of young, then the grizzly bear population of the Yellowstone ecosystem should stabilize at a larger size than presently exists. As the need for artificial controls (capturing, relocating, destroying individual bears) is reduced in the park and as suitable in-park habitats become saturated with the expanded population, subadult animals may be forced to imigrate to less densely populated areas outside the park. The magnitude of such possible emigrations will depend on future population dynamics and cannot be assessed at this time.

B. Impact on Other Natural Resources in the Park

In general, intraspecific and interspecific relationships and interactions of many plant and animal species may be affected by the restoration of the black and grizzly bear to their natural distribution, abundance, and behavior. The current knowledge of the ecological role of the grizzly bear in a natural ecosystem is insufficient, at this time, however, to predict with any degree of accuracy ultimate effects upon the grizzly bear population itself as a population solely dependent upon natural foods and the resultant effects upon the endemic flora and fauna of the park. A relatively high proportion of natural foods was reported in the diets of bears at garbage dumps in Yellowstone (Craighead et al. 1960). Vegetation comprises a large part of the grizzly bear diet but it is not known at this time if the quantity of garbage formerly used by bears will be replaced by additional grazing and digging or by increased use of pocket gophers, ground squirrels, and other rodents, fish, carrion, or insects. Bears are opportunistic feeders and their diets may vary from year to year and season to season according to availability. Feeding sites may be more evenly dispersed over the available habitat than when large numbers of bears were artificially concentrated around dump sites. Therefore, there may be a reduction of pressure on certain plant and animal communities adjacent to former dump sites, and a slight increase in use of more distant sites. In this respect, bear trails leading to former dump sites already show signs of recovery under reduced use.

C. Impact on People

Bears, both grizzly and black, are creatures of habit. It is believed that if the habit of eating man's food is broken, "if bears were deprived of handouts and if all garbage cans were made bearproof, the animals would be forced to seek their natural foods which are just as abundant today as they were before man came on the scene." (Cahn 1968). Such a change of habit would reduce human-bear contact, hence reducing possibilities of human-bear confrontations, hence improving visitor safety. Since the inception of the policy to remove "unnatural" food sources began, bear incidents involving personal injuries have decreased (see Table 9).

Although believed by some, there are no data to support the contention that the higher sanitation standards (i.e., denial of man's food) drives the grizzly bear outside the park seeking a food source replacement. Table 4 records the number of grizzly bears killed outside the park boundary that were identified as park bears.

There is a real possibility, however, that due to higher sanitation standards, and subsequent removal of unnatural high density bear concentrations (e.g., around garbage dumps), cub mortality may have decreased (see Table 2). As these bears reach adulthood the expanded total adult grizzly population may increase the number of grizzlies wandering out of the park attempting to locate their own home ranges. Such a phenomenon could be interpreted as a safety hazard increase to human residents outside the park boundary. On the other hand, because these emigrants will not be linked to man or his garbage the hazard may well be less. The degree of hazard would be determined largely by the comparability of sanitation standards outside the park boundary.

When sanitation standards require that particular campgrounds, backcountry campsites, trails, and fishing areas be closed to human activity, opportunity for the visitor to enjoy the park is subsequently lessened. Additionally, official reprimand by government (park) authorities either through verbal warnings or citations is not a pleasant experience for anyone, and especially for a park visitor whose purpose in the park is for a pleasant experience. The desirable experience of feeding a bear, as a visitor may envision it, will be denied to him. Generally speaking, the more a park visit is structured (i.e., by rules and regulations), the more the feelings of "freedom" and "relaxation" and the like are lessened.

Improvement of visitor safety is the purpose and direct consequence of any bear control measure. Some visitors will appreciate the removal of danger and other visitors will not. Unfortunately, the

proportions of both are unknown within the visitor-public as a whole. Gardiner B. Moment is a well-known advocate of hazard removal and speaks for the complete elimination of the grizzly from the park: "Old Faithful and St. Mary Lake cannot be seen elsewhere nor can they be transplanted. Grizzlies can." (Moment 1970). Garrett Hardin represents the opposite end of the continuum by requesting that we should make "the wilderness as difficult and dangerous as it legitimately can be." (Moment 1970). The general public is probably distributed on a normal curve between these two extremes.

Lastly, bear control operations are conducted in such a manner as to minimize the possibility that the park visitor could unintentionally blunder upon a baited trap or into a control action in progress.

Abiding by strict sanitation standards requires precautionary practices and generally more time and energy than not abiding by such standards. The storage of camping and food supplies, the pack-in, pack-out rule for backpackers, and required trash disposal methods are inconveniences for park visitors.

Although probably not extensive, particular gear for camping and hiking activities may be warranted in order to abide by sanitation standards, and this would entail additional investment to the park visitor.

D. Impact on Historical-Archeological Resources

After consultation with the National Register of Historic Places and National Park Service historians it has been initially determined that none of the historic or archeological resources in the park will be affected by the proposed action. However, at the present time the historic preservation officers of the States of Montana, Idaho, and Wyoming and appropriate persons at the Midwest Archeological Center are being contacted in order that they further examine the proposed action to insure that the park's historic and archeological resources are adequately considered. The President's Council on Historic Preservation will also be consulted.

E. Environmental Pollution

The increased standards of solid waste management, as proposed in the management action, will significantly reduce the potential pollution of surface and ground waters and terrestrial environments with man's garbage and litter. This in turn will enhance the park environments for human use, and, equally as important, will decrease the impact and stress of man on the national park ecosystems.

V. ANY ADVERSE EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

A. The wilderness is inherently dangerous. Many people seeking a wilderness experience are seeking the challenge of coping with the wilderness on a purely personal basis. It is an unavoidable probability that some number of wilderness users will suffer adverse consequences as a result of their wilderness experience. As long as there are grizzly bears, there will always be some element of danger, however minimized and mitigated, to park visitors, especially in the backcountry. Human danger must be considered in two ways. Danger which becomes a reality in personal injury is a complete and total negative consequence, an unavoidable adverse effect of the management program. However, the aura of danger which does not become a violent reality is an integral part of human experience in the wilderness for many.

An illustration of this seeming contradiction is a statement in 1968 by a Glacier National Park visitor, Robert Hahn, after he himself was injured by a grizzly bear: "The thing that makes me very unhappy about the whole incident is my fear that this will only add fuel to the fire for those people who advocate the destruction of the grizzly to make our national parks safe The only thing that will prevent me from hiking in the wilderness again is the eventual destruction of that wilderness itself and when anyone advocates the destruction of grizzlies they are in essence advocating the destruction of true wilderness." (Herrero 1970).

But once again, . . . "For a person who neither loves nor understands the grizzly any risk is too great." (Herrero 1970). In other words, by allowing the potential of realized danger to occur (Such potential is very small, as mentioned previously. For example, in 1973, four persons were injured by bears out of 2,061,537 who visited Yellowstone National Park that year, or less than two per million, all of which involved black bears rather than grizzly bears.) the benefit of "true wilderness experience" is preserved for others.

B. For those visitors whose trips to Yellowstone National Park were highlighted by feeding bears or observing black bears up close there will be a loss. Some number of visitors may be completely dissatisfied with their park visit without such experiences, and some may have their negative attitudes reinforced by having been cited for violating regulations concerning bears; regulations that did not exist a few years ago.

C. When the situation necessitates a bear-control action, the adverse effect of a bear being killed may not be avoidable. In 1973 for example, the fact that three black bears were killed in control situations was an adverse effect of the program.

VI. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The purpose of the proposed action, i.e., the restoration and maintenance of a wild grizzly bear population, is to minimize and offset the stresses and impacts associated with man's short-term uses of the park environments to insure that those environments will remain unimpaired for the benefit and use of future generations.

While it is the intention that the regulation of human activity in Yellowstone National Park will accomplish a great deal in preserving the Yellowstone ecosystem, including the grizzly bear, it may not be equally apparent that the intent of the bear control program is to have a similar effect of preserving the integrity of the Yellowstone National Park ecosystem.

When the decision is made to control a problem bear and the bear is killed, there is the immediate loss of a member of the grizzly or black bear population. However, when one less bear who has adopted the behavior pattern of frequenting campgrounds or otherwise foraging for man's food is eliminated, the grizzly population is that much further along in being restored to its wild, free-ranging nature. An additional direct, long-term benefit of the removal of a problem bear is that future public safety is enhanced.

When the control situation requires a bear to be relocated, that particular bear will go through a temporary readjustment period resulting from the stress of transplant and the process of defining new home territory with a bear population already in the area. Over the long run, the bear has been removed from a potentially dangerous (to humans and the bear) situation and the population is closer to being a totally wild, free-ranging population.

When the management program requires that a visitor use area be temporarily closed due to potential human-bear confrontation, the loss in terms of limitations on visitor enjoyment is immediate. Such actions cumulatively over time, however, enhance public safety and lessen the number of grizzlies in the population which have experienced contact with humans and hence are not given the opportunity to establish any undesirable behavioral relationships with humans. With the substitution of suitable alternative visitor use areas, the loss of enjoyment will be diminished.

The visibility of black bears in Yellowstone is important to many park visitors. A consequence of the sanitation phase of the grizzly bear management program is to reduce the probability of this visibility and "not seeing a bear" may be disappointing. In actuality, past viewing displayed the bear in an artificial manner which led to unsafe human behavior, and perpetuated an ill-informed public in terms of what bears "were really like."

In the future, therefore, when a bear is viewed, the visitor will see the animal as a wild animal in its natural ecosystem. Future observations will contribute to a better informed public that understands the true nature of the bear, both black and grizzly, appreciating it on its own terms as part of the Yellowstone ecosystem.

The inconvenience to the visitor of regulations and standards designed to reduce hazardous human-grizzly contacts will in a sense be short-term, although the initial perceived inconvenience is adapted to and becomes routine procedure as part of a visit to Yellowstone, the perception of inconvenience should dissipate. Therefore, the long-term end product becomes the positive benefits of modified human behavior which reduces the potential for hazardous human-grizzly contacts.

VII. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

The major part of the controversy during the last decade focused on the management program's effect on the actual survival of grizzly bear as a local population in the Yellowstone National Park. Little disagreement exists over the ultimate purpose of the action, but rather the disagreement was directed toward the methods employed to achieve the goal (i.e., abrupt and rapid closure of garbage dumps with no replacement supplemental feeding). Although the dumps are now closed, the methods employed to do so continues to be controversial in terms of the lasting effect on the Yellowstone grizzly bear population. Early in 1973, in fact, some researchers predicted eventual extirpation of the grizzly by 1998 if current park management procedures continued (Craighead 1973). The National Academy of Sciences' Committee on the Yellowstone Grizzlies (Cowan 1974) has reviewed all available data and concluded that there is no convincing evidence that this population of grizzly bears is in danger of extinction.

immediate

VIII. ALTERNATIVES TO THE PROPOSED ACTION

A. No Action

The alternative of no action on the continuing grizzly bear management program may be considered in two ways. First, the alternative can be taken to signify a reversion to the conditions that obtained before the dumps were closed during the period from 1968 to 1971. The alternative would require abandonment of the present program and would oblige return to the approach of treating the symptoms (i.e., control of bears to minimize hazards to visitor) without controlling the disease (i.e., the unnatural dependence of bears on cultural food sources). Implicit in this alternative is the reopening of the open-pit dumps, which have been closed by regulation. The decision to close the dumps and implement high standards of sanitation in order to reestablish a wild grizzly bear population has never been contested. The only significant subject of disagreement was the rate at which cultural food sources were to be eliminated from the grizzly bear's diet. It is apparent that the relatively sudden closure of the dumps has not severely impaired the integrity of the park's present grizzly bear population (Cowan 1974). Reopening the dumps, even if possible, would serve no useful purpose and would be in violation of existing regulations and the park's management objectives. Such an action would allow the grizzly bear population to return to an unnatural dependence on cultural food sources and thereby promote increases in potentially hazardous bear-people interactions. The no action alternative may be viewed more appropriately as failure to continue to implement those portions of the continuing program which could reasonably be discontinued while still allowing the park to fulfill its mission to provide for visitor use and to protect the integrity of natural resources. Fundamentally, this alternative would involve deemphasis of visitor use restrictions, sanitation standards, bear control, and research and monitoring of bears, but would not require the abandonment of these activities which are essential to perpetuating a park suitable for recreational use.

Impacts

Relaxation of sanitation standards and reduced effort on the part of the park staff to distribute information on bears and regulate visitor use to minimize bear-people interactions would have significant impacts on both bears and people. The

probability that an individual bear would become dependent on cultural food sources would rise and the number of nuisance bears would increase. Control actions would become more frequent and the grizzly bear population would probably decline unless natural compensatory mechanisms were sufficient to offset increased man-caused mortality. The visitor would experience increased freedom to use the park for a wide variety of recreational activities, but would also be subjected to a greater risk of injury as a result of active interaction with bears. A less well-informed visitor would also be more likely to attract bears inadvertently if information programs were deemphasized.

A less intensive research program would perpetuate existing informational voids in our knowledge of the park's grizzly bear population and would severely impair attempts to develop an ecologically sound plan for its management. The National Academy report (Cowan 1974) asserts that the park's research program since 1970 has not been sufficiently comprehensive "to provide the data essential for devising sound management policies for the grizzly bears of the Yellowstone ecosystem." Deemphasis of in-park research and the participation of the National Park Service in the Interagency Grizzly Bear Study Team could only jeopardize the long-term perpetuation of the species by increasing the risk of inappropriate management actions.

B. Eliminate Grizzly Bears from Yellowstone National Park

The alternative as stated would place the use of the park by people at a higher priority than the preservation of a local faunal form that under some circumstances poses great hazards to man. There is no question that the grizzly bear does pose a threat to the safety and lives of some individuals who find themselves deliberately or inadvertently in conflict with grizzly bears. Convinced that people and grizzly bears are incompatible and that bears are not essential to maintain a viable ecosystem, some persons have advocated that grizzly bears be eliminated from national parks (Mowat 1968).

Grizzly bears could be eliminated from the National Park by two methods: (1) eradication or (2) capture and relocation to areas outside of the park. The latter method, of course, is the more complex of the two. The restocking or reestablishment of a viable grizzly bear population has not been attempted, and a thorough study and analysis of the diverse factors involved would be required before a potentially successful program could be designed.

There are, however, areas in the western United States that may have potential for the reestablishment of grizzly bear populations.

Impacts

1. The impact of the total elimination of the grizzly bear from Yellowstone National Park cannot be predicted with certainty; however, it is probable that the elimination of the grizzly bear would:

a. relieve visitors from anxiety over possible conflict with grizzly bears. Fear of the grizzly bear undoubtedly effects the attitude of some visitors toward the park and its environment;

b. possibly result in an increase of backcountry use, including backpacking, fishing, horseback riding, hiking, and tent camping;

c. eliminate personal injuries and deaths attributed to the grizzly bear;

d. eliminate conflicts between park grizzly bears venturing outside the park and other land uses in the regional vicinity (It would not, however, eliminate all such degradations since some are caused by locally resident grizzly bears);

e. possibly result in a reduction of the visitors' perception of the need for proper food storage and handling, general housekeeping, and garbage and litter disposal;

f. guarantee that future generations of visitors would experience Yellowstone National Park as an ecosystem lacking a significant historical component.

g. preclude scientific study to determine the ecological role of the grizzly bear in one of the last refuges of the grizzly bear in the lower 48 states,

h. reduce the diversity of the park ecosystem which would increase its instability and eliminate a major predator-scavenger population which, in turn, would eliminate its role in the energy flow of the ecosystem; and

i. set a precedent for the eradication of grizzly bears in other national parks and national forests which may lead to demands for the elimination of other potentially hazardous species such as alligator, black bear, rattlesnakes, scorpions, and mountain lions.

2. Mitigating measures: Relocation of the Yellowstone grizzly bear to a new location would partially mitigate against loss of the species in the national park. Bears destroyed could be used as scientific specimens.

3. Short-term versus long-term relationship: The long-term implications of this alternative cannot be fully evaluated. There is a possibility that after an indeterminate period of adjustment, the Yellowstone ecosystem would achieve a new equilibrium. The nature of such an equilibrium, however, is not known except that without the grizzly bear it would be different in many major and subtle ways from the Yellowstone of today and yesterday. If the endemic grizzly bear population of Yellowstone National Park were eliminated, it could not be restored. A new population could probably at some future time be reestablished in the park, but genetic characteristics would be different even if the present population had only been relocated and not destroyed. The most extreme efforts in all probability could not trace an adequate number of previous population members to reconstitute the Yellowstone grizzly bear population.

C. Further Restrict Visitor Use

One solution to people-bear confrontations in the national park is to eliminate overnight camping in the park. The rationale for such a proposal is that injury to persons, destruction of private property, and the destruction of bears are the result of human carelessness and ignorance. During preparation of the Yellowstone National Park Master Plan, the implications of eliminating overnight accommodations were evaluated, and it was concluded that the possible benefits of such a solution would not justify the resultant reduction

of visitor opportunities to use and enjoy the park environments. As it relates to people-bear conflicts, effects of eliminating overnight accommodations can be approximated by the establishment of campgrounds as bear-free enclosures. This alternative was, therefore, considered as a possible solution to the people-bear conflict. The concept is similar to methods employed in some wildlife parks in Africa where visitors and hazardous wildlife are physically separated. The advantage of this alternative is that it would keep bears out of areas that have been designated exclusively for the use of people, without seriously disrupting the distribution, movement, and behavior of the bears. The method of creating bear-free enclosures, however, poses complex engineering and aesthetic problems.

Fencing has been considered as the most practical method of protecting campgrounds. Fences, however, must be of a special construction to stop the passage of a grizzly bear. Bears have been known to dig under, climb over, and go through sturdy, woven wire fences topped with three strands of barbed wire. Woven wire fencing supplemented with electric fencing is more effective. The conventional fence charger, however, does not have sufficient voltage to disturb a grizzly. The thick fur and foot pads of the grizzly bear apparently are an effective insulation. Park personnel previously developed a modified electric fence charger (turned on as necessary) that appears to be effective in discouraging bears from entering sanitary landfills. This gives the inquisitive bear a jolt of approximately 12,000 volts at 22 microamps. The charge is not lethal nor injurious to the bears, but persons receiving an electric shock of this magnitude would experience unpleasantness and possibly serious injury. Protective fences, therefore, would have to be designed and located to minimize the possibility of human contact with the fence.

1. Impacts

- a. No fence can be considered bear-proof, and it is highly likely that occasionally a bear--either black or grizzly--will gain entry to the enclosure. A bear inside a fenced enclosure may become disoriented and frightened. This could result in an extremely hazardous situation to both humans and bears.

- b. Supposed bear-free enclosures would provide campers with a sense of security from bears and would permit them to camp in a more relaxed and carefree manner. Some campers may subsequently limit their park experiences to the campground sanctuaries fearing non-fenced environments.

- c. The fencing of campgrounds would have a minimum of influence on bear movements (other than into the areas themselves) and habitats.

- d. The development of enclosed campgrounds would require the construction of several miles of fence that would be inconsistent with the park scene. The potential for impacts on archeological and natural resources of the park would be increased and would require examination.

- e. The flexibility of park development would be reduced by making it more difficult to relocate, decrease, or enlarge campgrounds.

- f. Fenced campgrounds as described would constitute a safety hazard to visitors coming in contact with the electric wires or attempting to scale the fence.

- g. The cost of campground maintenance and operation would increase significantly. (It would probably be necessary, for instance, to have almost daily inspections of the fence line and to post a guard at the campground entrance 24 hours per day).

- h. Some visitors may feel unduly restricted by fenced campgrounds.

2. Mitigating measures:

- a. The aesthetic impact of fences could be offset to some extent by sensitive design and location.

- b. The fences would be located to avoid archeological sites when feasible or if unfeasible the recovery of artifacts could be accomplished prior to construction.

c. Interpretive programs could be instituted to offset the belief that only those areas behind fences are safe.

d. Unfenced campgrounds could be provided for those individuals for whom the enclosed campgrounds would detract from their park experience.

e. Signs could be provided to warn visitors of the hazards of coming into contact with high voltage electric fence.

3. Unavoidable adverse impacts:

a. The degree of impact of fence construction would depend on the miles of fence to be built and the nature of the environment through which it was built. A fence through lodgepole forest, for instance, would require a clearing of sufficient width to preclude trees falling across the fence. (As the clearing would have to be maintained in the early stages of plant succession, the clearing could provide habitat requirements that would be attractive to bears.)

b. The aesthetic intrusion upon park environments and loss of the feeling of "openness" could not be avoided.

4. Short-term versus long-term relationships:

The permanency of bear-proof fencing would tend to make the location and size of campgrounds static. Such continually heavy use of campgrounds would very likely result in a deterioration of campground environments (vegetation, soil compaction, etc.).

D. Increase Grizzly Bear Population by Artificial Methods

Concerned with the relatively small populations of grizzly bears remaining in the conterminous 48 states, many individuals have proposed that the numbers of grizzly bears within the park be increased. The objectives of such a program would be, of course, radically different from the stated objective to maintain a natural dynamic equilibrium of all elements of the park ecosystems since it would necessitate artificially maintaining the population of a single species, at abnormally high levels. Past

programs that have favored a single species, while they may have achieved a short-range goal of producing high numbers, have generally proved disastrous on a long term basis. Attempts in the past to increase the number of elk by the removal of predators and implementation of artificial feeding programs is a case in point. The probability of a population's survival is not necessarily increased by artificially increasing the number of individual members of the population. Indeed, such programs may have an effect opposite to that desired by increasing the instability of the population.

Two basic methods could be considered in order to increase the number of grizzly bears within Yellowstone National Park: (1) enhance the grizzly bear habitat by implementing an artificial feeding program, or (2) increase natality and decrease mortality through the initiation of a trophy-hunting program.

1. Implement an artificial feeding program

Previously recommended as a means of drawing grizzly bears away from campgrounds (Craighead and Craighead 1967; Leopold et al. 1969), this alternative proposal requires that elk or other large mammal carcasses be provided for consumption by the bears. The original proposal was made at a time when it was believed that an artificial substitute for the open-pit garbage dumps might be required to prevent a massive grizzly bear invasion of the adjacent campgrounds.

This proposal and the alternative of reopening the open-pit dumps were considered as contingencies during 1970. The need to draw grizzly bears away from campgrounds did not arise, and there are indications now that the grizzly bears are avoiding the campgrounds. More recently, the proposal to implement an artificial feeding program has been made by people who are concerned that without garbage or some other form of supplemental energy a viable population of grizzly bears cannot be supported in Yellowstone.

An elk carcass in a favorable location can attract and hold one or several bears for a period of several days. Usually such bears are resident to the immediate area rather than bears moving in from

any great distance. The grizzly bear is an opportunistic feeder; if an elk, horse, or mule is made available it will feed upon it. However, under the situation that exists today in Yellowstone National Park, man-supplied carcasses will tend to inhibit the bears from procuring other natural food sources. The winter kill of ungulates supplies a large quantity of food at the critical time of emergence from hibernation and in quantity probably would exceed that provided by shooting elk for the same purpose.

Strict sanitation standards in the campgrounds have significantly reduced the attractiveness of the campgrounds to the grizzly bears. A large variety of foods, however, are found throughout the grizzly bear's environment and the bears will most often be found where the food is most abundant and available. Elk and other large mammal carcasses are most abundant during spring and early summer. Some natural deaths of elk, moose, bison, and other mammals, however, occur throughout the year, and the grizzly bear currently has a natural protein diet regime.

The artificial placement of carrion would provide an additional source of energy and may temporarily influence movement and location of individual grizzly bears. Food, however, is not a limiting factor for the grizzly bear population and it is doubtful that a supplemental feeding program would modify the size of the population.

a. Impacts:

The implementation of an artificial feeding program would result in the following impacts:

(1). Elk or other animals would have to be sacrificed for an artificial feeding program. Cropping to feed bears, however, cannot duplicate nature in timing, location, or age and sex of animals.

(2). The segments of the elk population that are most readily available for this purpose are those segments along park roads that provide the best opportunities for visitors to see this large native ungulate.

(3). Judging from past experience, many people would be distressed by the slaughter of elk in Yellowstone.

(4). In order to prevent personal injury, artificial bear feeding programs would have to be carried out in sites of considerable acreage that are closed to public use. The Federal Government may be held responsible for any human injuries attributed to bears attracted to an area to feed on artificial baits.

(5). If the carcass-feeding program were carried out at a specific site over a period of several years, conditions could approach those that formerly existed around the open-pit dumps.

(6). The use of elk carcasses may have limited value in the grizzly bear research program. A synthetic scent that would replace the elk or other wildlife carcasses as an attractant is presently being developed for such purposes.

2. Implement a trophy-hunting program

With the exception of man, the grizzly bear is the dominant species within the Yellowstone National Park environment. The grizzly is not preyed upon by other species of wildlife, and competition between the grizzly and other species is rare. The grizzly bear is relatively long-lived, and a few individual bears may obtain an age of 25 years (Craighead 1973). Other species of wildlife may indirectly influence the size of a grizzly bear population but it does not appear that they exert a direct influence. Intra-specific relationships, however, may be a significant factor in controlling population size. Several researchers (Glenn 1973; Murie 1961) have noted that dominant males may kill cubs and other subordinate grizzly bears. Glenn (1973) reported that harvest of adult males from a population of Alaska Brown Bears resulted in an apparent increase in the size of the population. It is possible that a similar phenomenon could be attained in Yellowstone National Park by the selective removal of adult male grizzly bears.

Done under Harrison
& Spiller did not
know about it. Research
by Ken Greer et al,

a. Impacts:

The implementation of a trophy hunting program would result in the following impacts:

- (1). Some proportion of individual adult male grizzly bears would be destroyed.
- (2). The population structure would be modified in favor of females and young age classes. Such a population modification could be accompanied by an increase in human-bear confrontations involving female-cub units.
- (3). The opportunity to study an unaltered population of grizzly bears would be lost.
- (4). All of the subsequent direct and indirect effects of such manipulation on the population cannot be determined with certainty at this time.

E. Alternative Actions Outside the Direct Authority of the National Park Service

1. Encourage state regulation of hunter kill

Under this alternative, the National Park Service would actively encourage the states of Idaho, Wyoming, and Montana to regulate hunting of grizzly bears. In view of the uncertainty over the ability of the grizzly bear population to compensate for man-induced mortality, the National Academy of Sciences report (Cowan 1974) recommends that "beginning in 1974, the total of man-caused removals should be held to about 10, if at all possible, until further research demonstrates that larger removals are consistent with maintenance of the population." In order to achieve this objective, the states should be urged "to determine in advance the legal kill level each year and to establish regulations that will provide sensitive control over this kill."

Impacts

Regulations of hunter kill on non-Federal lands outside the park would increase the size of the grizzly bear population and facilitate more rapid compensation for the man-caused mortality during the period immediately following closure of the park's open dumps. Cowan (1974) states "to the extent that the man-caused kill can be held below 10, the rate of recovery from the 1972 base, which is believed to be lower than the earlier long-term level /T.e., before closure of the dumps/, will be speeded."

Restrictions on hunting will be inconvenient to those intent upon taking a grizzly bear, but the numbers of hunters affected will be negligible. The increases in the grizzly bear population resultant from hunting pressure could increase the occurrence of man-bear interactions and property damage, but such impacts should be relatively minor. The main effect of the restrictions would be to allow the population to stabilize at the optimal ecosystem level more rapidly. The level of impact on man and his property associated with this population therefore would be achieved more quickly.

2. Encourage the U.S. Forest Service to eliminate sheep grazing from the ecosystems

Under this alternative, the National Park Service would strongly urge the U.S. Forest Service to phase out remaining sheep grazing permits within the ecosystem, as recommended in the National Academy of Sciences report (Cowan 1974).

Impacts

The elimination of sheep grazing from Federal lands in the ecosystem would eliminate possible predation on sheep by grizzly bears. Revegetation of grazed lands would improve their value as natural habitat for grizzly bears. The effect on the population dynamics of the grizzly bear is not known. If the improvement in natural habitat value more than offsets the loss of benefits from predation on sheep, the population of grizzly bears may increase. Population increase would be small, but the magnitude of change is impossible to predict from existing information.

Elimination of grazing permits would have an adverse economic impact on those holding the permits. At this writing, information on the extent of grazing on Forest Service land is not available for use in quantifying potential economic impact on private interests.

3. Encourage elimination of nuisance-bear control programs

Under this alternative, the National Park Service would encourage all land-managing agencies within the Yellowstone ecosystem to eliminate nuisance-bear control programs and replace them with legal hunting programs or compensation for proven damages. Bears would be killed only where human life is directly threatened and bears would be dispatched only as a last resort. Consideration of this approach is recommended in the Academy of Natural Sciences report (Cowan 1974).

Impacts

This alternative would reduce the number of grizzly bears killed for control purposes to the absolute minimum. The ecosystem grizzly population should increase more rapidly to its optimal size if removals for control decrease. Property damage and the risk of active man-bear interaction could increase although this possible impact cannot be quantified at this time. Since problem bears usually would be allowed to remain in the population, relocation of such bears to remote locations could be used to mitigate the adverse effects on man. If relocation were employed as soon as nuisance bears became apparent, the bears would be forced to adapt to the natural environment or die if they could not adapt. In the latter case, direct man-caused mortality would have been avoided. The significant impact of this alternative is to give every bear the greatest possible encouragement to live as an integrated part of the natural ecosystem and to minimize the direct impact of man in regulating the size of the grizzly bear population.

IX. CONSULTATION AND COORDINATION WITH OTHERS

A. The proposed grizzly bear management program is the continuation of a program initiated in the 1930's (Wright and Thompson 1934), and reaffirmed in 1969 (Leopold 1969). Since 1969 there have been annual meetings with various Federal and state agencies and organizations, including the Fish and Wildlife Service, U.S. Forest Service, state game and fish departments of Idaho, Montana, Wyoming, and Colorado, the International Association of Game, Fish and Conservation Commissioners, and others that have provided review and comment of the grizzly bear management program. A partial list of such meetings and related actions are as follows:

1. September 6 and 7, 1969. Yellowstone National Park

Participants:

National Park Service

Natural Sciences Advisory Committee

Dr. A. Starker Leopold (Chairman), University of California
Dr. Stanley A. Cain, University of Michigan
Dr. Charles E. Olmsted, University of Chicago
Mr. Sigurd Olson, Ely, Minnesota (absent)

Special Consultants

Dr. Frank C. Craighead, Jr., Moose, Wyoming } *not true*
Dr. John J. Craighead, University of Montana
Dr. Frederick C. Dean, University of Alaska
Dr. Albert Erickson, University of Minnesota

National Park Service Personnel

Mr. George B. Hartzog, Jr., Director, WASO
Mr. Harthon L. Bill, Deputy Director, WASO
Dr. Robert M. Linn, Chief Scientist, WASO
Mr. Neil J. Reid, Wildlife Management Specialist, WASO
Mr. Lowell Sumner, Consultant-Collaborator, WASO
Mr. Jack K. Anderson, Superintendent, Yellowstone
Mr. Glen F. Cole, Supv. Research Biologist, Yellowstone
Dr. Douglas B. Houston, Research Biologist, Grand Teton
Mr. William J. Barmore, Research Biologist, Yellowstone
Miss Margaret M. Meagher, Research Biologist, Yellowstone
Mr. Richard G. Prasil, Management Biologist, Alaska Field Office

The meeting report entitled "A Bear Management Policy and Pro-gram for Yellowstone National Park" discussed management goals for grizzly and black bears presently in force and recommended procedures to more fully achieve those goals. The report also addressed the controversy concerning these procedures.

"The ultimate objective agreed upon by all participants, is the incineration or sanitary disposal of trash and garbage in a manner that will completely isolate this food source from bears. Ideally all refuse should be hauled out of Yellowstone National Park for incineration and burial. Future plans for such a program of disposal are being considered now.

But in the meantime, there is disagreement as to the sequence of steps leading to the elimination of garbage from availability to grizzlies. One view is to cut off all garbage quickly, forcing the bears to turn immediately to natural foods. The opposite contention is to phase out garbage feeding over a period of time, "weaning" the bears gradually. The issue hinges on which of these procedures will result in the least number of bears going into camp grounds. Unfortunately, prognosticating how garbage-fed grizzlies will respond to deprivation depends on judgement rather than data. Much is known about the habits of garbage bears and of wild-living bears, but little is known about the process of transition. In any event, the transition must be made, and everything possible done to protect both park visitors and the population of bears during the process." (Leopold 1969)

2. January 15 and 16, 1970. West Yellowstone Montana. Participants: Fish and Wildlife Service, Directors of Wyoming Game and Fish Department; Idaho Fish and Game Department; Colorado Division of Game, Fish and Parks; and Montana Department of Fish and Game; special consultant, Dr. Frank C. Craighead, Jr., Chief Scientist, National Park Service, and Superintendent, Yellowstone National Park. Preservations were made concerning research findings and management recommendations representing the differing points of view on the subject of grizzly bear management. Also during this meeting the states represented were requested to consider the possibility of transplanting some of the grizzlies which must be removed from park campgrounds to remote wilderness areas.

3. A memorandum of agreement between the Fish and Wildlife Service and the National Park Service was signed on August 4, 1971, relating to the objectives and methods for accomplishing some of the research recommendations included in the Leopold Report (Leopold 1969). Research was to be conducted out of the Montana Cooperative Wildlife Research Unit, under the direction of unit leader Dr. John Craighead. Disagreements arose, however, as work plans were being devised as to the restrictions placed on the research effort, by the park. Disagreements were never overcome and the research effort never became operational.

4. On September 19, 1972, a meeting was held in Yellowstone National Park, co-conducted by Mr. Harry Woodward, Chairman of the grizzly bear committee of the International Association of Game, Fish and Conservation Commissioners, and Mr. Nathaniel P. Reed, Assistant Secretary of the Department of the Interior for Fish and Wildlife and Parks. Research findings were presented representing the opposing views on the future of the Yellowstone grizzly bear population. Contradictory interpretations of data were displayed and remained unresolved.

5. The Assistant Secretary for Fish and Wildlife and Parks has held annual meetings in Yellowstone National Park since 1970 with various state and Federal agencies during which the grizzly bear program has been discussed.

6. A number of meetings have been held with local citizen groups, state and Federal agencies concerning the development of a regional solid waste management program are closely related to the grizzly bear management plan.

Consultation during the preparation of this draft environmental statement included a variety of interests concerned with grizzly bear management. Comments were invited by letter from:

May 2, 1974	Idaho Fish and Game Department
May 2, 1974	Montana Fish and Game Department
May 2, 1974	Wyoming Game and Fish Commission
April 30, 1974	U.S. Fish and Wildlife Service

To date, comments have been received from the U.S. Fish and Wildlife Service (June 17, 1974) and separate comments from the Montana Cooperative Wildlife Research Unit of the U.S. Fish and Wildlife Service (August 20, 1974).

Additional comments have been received in response to the publication of the Yellowstone National Park Grizzly Bear Management Program in the Federal Register (Vol. 39, No. 96, May 16, 1974), from interested individuals and the Defenders of Wildlife, among others. A variety of concerns were voiced, evaluated and incorporated where applicable. The incorporation of further comment received will occur in the final environmental statement.

In 1974, the International Association of Game, Fish and Conservation Commissioners' Grizzly Bear Committee met during the Thirty-ninth North American Wildlife and Natural Resources Conference in Denver and discussed and commented on the Environmental Impact Statement for the Yellowstone Grizzly Bear Management Plan.

B. Review will be requested from the following:

Federal Agencies

Department of Agriculture
Forest Service
Department of Health, Education and Welfare
Public Health Service
Department of the Interior
Bureau of Land Management
Bureau of Outdoor Recreation
Fish and Wildlife Service
Environmental Protection Agency
Bureau of Solid Waste Management
President's Advisory Council on Historic Preservation

State Agencies

Idaho State Clearinghouse
Idaho State Historic Preservation Office
Montana State Clearinghouse
Montana State Historic Preservation Office
Wyoming State Clearinghouse
Wyoming State Historic Preservation Office

Private Organizations and Citizen Groups

The Conservation Foundation
Defenders of Wildlife
Friends to Animals, Inc.
Friends of the Earth
Fund for Animals
Idaho Chapter, The Nature Conservancy
Idaho Recreation and Park Society
Idaho Wildlife Federation
Idaho Wildlife, Inc.
International Association of Game, Fish and Conservation Commissioners, Grizzly Bear Committee
Montana Division Izaak Walton League of America
Montana Wildlife Federation
National Academy of Sciences
National Parks and Conservation Association
National Wildlife Federation
The Wilderness Society
Wyoming Outdoor Council, Inc.

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