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**A REVIEW OF POTENTIAL EFFECTS OF WINTER RECREATION ON WILDLIFE
IN GRAND TETON AND YELLOWSTONE NATIONAL PARKS: A BIBLIOGRAPHIC
DATA BASE**



FINAL REPORT

by

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ABSTRACT

This document is the Final Report of a two-month literature review to assess the effects of winter recreation on wildlife in Grand Teton and Yellowstone National Parks. Selected citations were annotated and organized in electronic format using the ProCite[®] bibliographic software program. The ProCite Bibliography includes all-season observations for birds and mammals in Grand Teton and Yellowstone National Parks in addition to those of other relevant continental and world-wide locations. Citations relating to the description, range, habitat, life history, ecology, and conservation needs of rare, sensitive, and endangered species of the Greater Yellowstone Ecosystem are included to provide a specific information source for listed species.

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INTRODUCTION

The National Park Service is charged with the management of the nation's most precious natural and cultural resources. These resources are inextricably woven into our national heritage, and they provide citizens the world over with invaluable opportunities for recreation, cultural enrichment, and environmental education. It is the responsibility of those involved with park management and policy formulation to ensure the protection of the resources managed by the National Park Service. Yet, fulfilling this enormous responsibility is neither easy nor free of controversy (National Parks for the 21st Century: The Vail Agenda 1992).

The dilemma presented in this statement is; how can a resource base be adequately protected in the face of increasing human demand? If the primary responsibility of the National Park Service is the protection of park resources, can each unit be managed to provide the nation's diverse public with access to and recreational and educational enjoyment of the lessons contained within that unit, or is there a finite human carrying capacity that is yet to be defined?

On 1 October 1994, the University of Wyoming Cooperative Fish and Wildlife Research Unit initiated a 2-month study to investigate what is known about the effects of winter recreation on wildlife in Grand Teton (GTNP) and Yellowstone National Park (YNP). Results of the study are presented as two components; (1) a hard copy document, and (2) an electronic bibliographic component assembled with the ProCite bibliographic software program (Version 2.2.1 for IBM compatibles). This report incorporates the hard copy printout of the ProCite bibliography with pagination integrated with the main text.

METHODS

The following procedure was developed to assist with meeting the objective of this study:

1. Determine the wildlife species most likely to be impacted by human disturbance in GTNP and YNP.

The selection of wildlife species was made after reviewing the following publications: Long 1965; Clark and Stromberg 1985; Greater Yellowstone Coordinating Committee 1987; Clark et al. 1989; and Wilkerson 1991. Citations relevant to the biology, ecology, and conservation needs of rare, sensitive, and endangered bird and mammal species of the Greater Yellowstone Ecosystem (GYE) were included to provide a quick reference to a more detailed account of the requirements of a specific species. These particular citations are identified in the bibliography with an asterisk (*) preceding the title.

2. Select and synthesize relevant literature.

A data base search was conducted using the CD-ROM computer indexes of WILDLIFE REVIEW AND FISHERIES REVIEW (NISC), AGRICOLA, DISS. ABSTRACTS, and the bibliographic data set of CARL plus CARL Government Documents (No. 83). Selected citations were downloaded and printed to assist the literature search process. Relevant portions of existing annotated bibliographies were consolidated with the ProCite bibliography. These citations can be located by using the descriptor "bibliography" in the "search database" function at ProCite's main menu screen.

3. Construct ProCite bibliography. Wildlife species can be located in the bibliography by their: (1) **common names** (e.g., mountain lion, wolverine, fisher, elk, bison, etc.); (2) **family level taxonomic name** (e.g., Felidae, Mustelidae, Cervidae, Bovidae, etc.); and by (3) **taxonomic class** (e.g., Aves, Mammals). Tables 1 and 2 show the mammalian and avian species listed in the ProCite bibliography respectively. Specific species citations can be located quickly using the common name whereas the broader categories of Family and Class include a wider range of additional species (e.g., Preble's shrew vs. Soricidae or mammal). Recreational descriptors are also identified by common usage language terms (e.g., skiing, snowmobiling, etc.).

The 3.5 in. diskette furnished with this report can be used in any IBM compatible computer with the ProCite program installed. New records (citations) can be inserted and edited if desired and records can be sorted and indexed. The bibliography can be searched using key words (descriptors) and an output record printed in Word (Windows), Word Perfect, or as an ASCII file format.

4. A questionnaire was sent to selected wildlife managers in the western United States soliciting information regarding their observations/knowledge of winter recreation impacts on wildlife.

Table 1. Mammalian species listed in ProCite© bibliography.^A

FAMILY	COMMON NAME	SCIENTIFIC NAME
Soricidae	Masked Shrew	<i>Sorex cinereus cinereus</i>
	Preble's Shrew	<i>Sorex prebei</i>
	Dwarf Shrew	<i>Sorex nanus</i>
	Pygmy Shrew	<i>Sorex hoyi montanus</i>
Vespertilionidae	California Myotis	<i>Myotis californicus californicus</i>
	Fringed Myotis	<i>Myotis thysanodes pahasapensis</i>
	Spotted Bat	<i>Euderma maculatum</i>
	Townsend's Big-eared Bat	<i>Plecotus townsendii pallescens</i>
Leporidae	Snowshoe Hare	<i>Lepus americanus</i>
Sciuridae	Yellow-bellied Marmot	<i>Marmota flaviventris</i>
	Black-tailed Prairie Dog	<i>Cynomys ludovicianus ludovicianus</i>
Canidae	Coyote	<i>Canis latrans</i>
	Gray Wolf	<i>Canis lupus</i>
	Red Fox	<i>Vulpes vulpes</i>
	Feral Dog	<i>Canis familiaris</i>
	Coydog	<i>Canis latrans X Canis familiaris</i>
Ursidae	Black Bear	<i>Ursus americanus cinnamomum</i>
	Grizzly Bear	<i>Ursus arctos horribilis</i>
Mustelidae	Martin	<i>Martes americana</i>
	Fisher	<i>Martes pennanti columbiana</i>
	River Otter	<i>Lutra canadensis pacifica</i>
	Wolverine	<i>Gulo gulo luscus</i>
Felidae	Mountain Lion	<i>Felis concolor</i>
	Lynx	<i>Felis lynx canadensis</i>
	Bobcat	<i>Felis rufus pallescens</i>
Cervidae	Elk	<i>Cervus elaphus nelsoni</i>
	Mule Deer	<i>Odocoileus hemionus hemionus</i>
	White-tailed Deer	<i>Odocoileus virginianus</i>
	Moose	<i>Alces alces shirasi</i>
Bovidae	Caribou	<i>Rangifer tarandus</i>
	Bison	<i>Bison bison</i>
	Mountain Goat	<i>Oreamnos americanus missoulae</i>
	Bighorn Sheep	<i>Ovis canadensis canadensis</i>
	Dall's Sheep	<i>Ovis dalli</i>

^A Nomenclature source: Clark, T. W. 1987. Mammals in Wyoming. Museum of Natural History, University of Kansas.

Table 2. Avian species listed in ProCite bibliography.^A

FAMILY	COMMON NAME	SCIENTIFIC NAME
Gaviidae	Common Loon	<i>Gavia immer</i>
Pelecanidae	American White Pelican	<i>Pelecanus erythrorhynchos</i>
	Brown Pelican	<i>Pelecanus occidentalis</i>
Phalacrocoracidae	Double-crested Cormorant	<i>Phalacrocorax auritus</i>
Ardeidae	Great Blue Heron	<i>Ardea herodias</i>
	Green-backed Heron	<i>Butorides striatus</i>
	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>
Threskiornithidae	White-faced Ibis	<i>Plegadis chihi</i>
Anatidae	Trumpeter Swan	<i>Cygnus buccinator</i>
	Mute Swan	<i>Cygnus olor</i>
	Canada Goose	<i>Branta canadensis</i>
	Canvasback	<i>Aythya valisineria</i>
	Harlequin Duck	<i>Histrionicus histrionicus</i>
Accipitridae	Osprey	<i>Pandion haliaetus</i>
	Bald Eagle	<i>Haliaeetus leucocephalus</i>
	Cooper's Hawk	<i>Accipiter cooperii</i>
	Red-shouldered Hawk	<i>Buteo lineatus</i>
	Swainson's Hawk	<i>Buteo swainsoni</i>
	Ferruginous Hawk	<i>Buteo regalis</i>
	Rough-legged Hawk	<i>Buteo lagopus</i>
	Golden Eagle	<i>Aquila chrysaetos</i>
	American Kestrel	<i>Falco sparverius</i>
	Merlin	<i>Falco columbarius</i>
	Peregrine Falcon	<i>Falco peregrinus</i>
	Gyrfalcon	<i>Falco rusticolus</i>
	Prairie Falcon	<i>Falco mexicanus</i>
Phasianidae	Ring-necked Pheasant	<i>Phasianus colchicus</i>
	Greater Prairie Chicken	<i>Tympanuchus cupido</i>
Gruidae	Sandhill Crane	<i>Grus canadensis</i>
	Whooping Crane	<i>Grus americana</i>
Charadriidae	Golden Plover	<i>Pluvialis dominica</i>
	Mountain Plover	<i>Charadrius montanus</i>
Scolopacidae	Upland Sandpiper	<i>Numenius longicauda</i>
	Long-billed Curlew	<i>Numenius americanus</i>
Laridae	Western Gull	<i>Larus occidentalis</i>
	Caspian Tern	<i>Sterna caspia</i>
Strigidae	Burrowing Owl	<i>Athene cunicularia</i>
	Great Gray Owl	<i>Strix nebulosa</i>
	Boreal Owl	<i>Aegolius funereus</i>
	Northern Saw-whet Owl	<i>Aegolius acadicus</i>
Picidae	Three-toed Woodpecker	<i>Picoides tridactylus</i>
	Black-backed Woodpecker	<i>Picoides arcticus</i>
	Pileated Woodpecker	<i>Dryocopus pileatus</i>
Corvidae	Black-billed Magpie	<i>Pica pica</i>
	Common Crow	<i>Corvus brachyrhynchos</i>

^A Nomenclature source: American Ornithologist's Union. 1983. Checklist of North American birds, 6th edition.

RESULTS

A review of the literature suggests that recreationists in natural areas can affect overt responses of wildlife in a number of ways ranging from benign to panic (Freddy et al. 1986). More subtle responses may include elevated metabolism, lowered body weight, and withdrawal from suitable habitat (Geist 1971). Recreational impacts may also affect the geographical distribution, dispersion patterns, fecundity, survival, and activity and energy budgets of wildlife populations (Knight and Cole 1991), disruption of foraging and social behavior (Burger 1981, Skagen et al. 1991, Edington and Edington 1986), and have been associated with declining wildlife densities (Werschkul et al. 1976, Erwin 1980).

Managers should expect the effects of recreationists on wildlife to be context dependent. That is, the impacts of a given recreation activity on a species during one set of circumstances may not be the same as those for the same species during another set of conditions (Vaske 1983). In most cases, the magnitude and frequency of disturbances determine whether or not the fitness of affected individuals will be altered. Additive and synergistic effects from multiple sources of disturbance can result in reduction of fitness, even when individual types of disturbance alone have no impact (Holmes et al. 1993).

Results from the questionnaire and literature review indicate a general "data gap" exists for determining the effects of winter recreation activities for most wildlife species. The following is a review of the current literature organized by recreation type and wildlife species affected.

Snowmobiling:

The effects of snowmobiles on wildlife has been well documented since the late 60s with the majority of research focused on snowmobile/ungulate interactions. Results range from observed beneficial effects (Lavigne 1976) to those suggesting the prohibition of snowmobiles and other off-road vehicles in National Parks to protect the wildlife and environment (Butcher 1972). The increasing popularity of snowmobiling in the GYE has been enhanced with the recent opening of the 340-mile Continental Divide snowmobile trail, which starts in Lander, WY, extending through a portion of GTNP and ends in YNP.

Cervidae - Aasheim (1980) reports that studies of snowmobile impacts on deer and elk have produced conflicting results, but there is little doubt that additional stress in winter is undesirable. Severinghaus and Tullar (1975) state that energy expenditure calculations demonstrate the danger of snowmobile harassment to deer already hard-pressed by winter conditions and that snowmobiles should not be permitted in deer wintering areas, and established trails should be kept one half mile from such areas. Freddy et al. (1986), in a Colorado study, state that minimizing all responses by deer would require persons afoot and snowmobiles to remain >334 m and 470 m from deer, respectively.

Moen (1976) analyzed the energy-conserving behavioral adaptations of white-tailed deer in northwestern Minnesota in winter and found energy conservation of up to 1,000 Kcal/day for a 60 kg deer can result from reduced activity levels (seeking level land and less snow depth, walking slowly, etc.). He believes that winter harassment by snowmobile traffic is detrimental to these adaptations. Parker et al. (1984) calculated energy expenditures for several activities using indirect calorimetry with 5 mule deer and 8 elk. They found that the average energetic increment of standing over lying was 25%. Net energy costs (Kcal/kg/km) of horizontal locomotion without snow decreased as a function of body weight. Energy expenditures for locomotion in snow increased curvilinearly as a function of snow depth and density.

Snow compacted by snowmobiles requires a greater energy expenditure by ungulates when digging to desirable vegetation. Fancy and White (1985) determined the rate of energy expenditure by caribou digging in snow was about 118 J/stroke, whereas in denser snow with a thin, hard crust the mean cost was 219 J/stroke. The cost of cratering through snow compacted by a snowmobile was 418 J/stroke.

Huff and Savage (1972) studied the correlation of deer movements with snowmobile activity in Minnesota and compared deer activities between areas of high and no snowmobile use. The size of deer home ranges was much reduced at the high use area, and snowmobile use appeared to force deer into less preferred habitats where nighttime radiant heat loss was greater. Dorrance et al. (1975) report that deer responded to very low intensities of intrusion by man and snowmobiles and were displaced from areas along trails and in some cases, changes in their home range size and increased movement was observed. These authors suggest that the observed disturbances could be detrimental to deer, especially during severe winters.

Eckstein et al. (1979) found in Wisconsin that the impacts of snowmobiles on white-tailed deer was minimal and that daily activity patterns, home range size, and habitat use was little affected by snowmobiles. Richens and Lavigne (1978) studied deer response to snowmobiles in Maine and concluded that deer were not driven from the area by snowmobiles and frequently followed snowmobile trails where the snow was firmer. They suggest that snowmobiles could be used to manage deer in winter by providing trails where walking in snow is easier and inducing winter movements to suitable habitat. Lavigne (1976) found that snowmobile trails in Maine enhanced deer mobility during periods of deep snow and probably reduced energy expenditures.

The effect of snowmobile activity on moose behavior is poorly documented. Altman (1958) found that the distance at which free-ranging elk and moose would flee from humans varied with habitat, social groupings, nutrition, reproductive status, and specific experience of individual animals of the group. Denniston (1956) states that moose were tolerant of close observers when no quick motions or loud noises were made. Moose can be found in many developed and backcountry areas of GTNP and YNP throughout the year and are known to retire in winter to open mountain ridges and "yard up" on south facing slopes (Craighead 1978). The effects of snowmobiles on moose would probably be minimal if established trails are maintained away from these areas, although I could find no reference as to a recommended distance.

BOVIDAE - Snowmobiles have been implicated in the decline of a bighorn sheep population in Montana (Berwick 1968). This author suggests that snowmobile harassment on bighorn sheep winter ranges may be debilitating to winter-stressed animals. Stress, frequently human-induced, appears to be a major limiting factor in the bighorn's struggle for survival (DeForge 1976, Dunaway 1971, DeMarchi 1975, Geist 1971, and others). Horejsi (1976) notes that active harassment results in visible responses by sheep, while passive harassment produces no visible response but may have psychological and physiological impacts on individuals and populations leading to a variety of conditions which reduce fitness.

Snowmobile effects on mountain goat populations have not been documented to my knowledge. This may be in part to the rugged habitat occupied by these animals which precludes safe snowmobile operation.

The effects of snowmobiles on bison behavior is also unrecorded in the literature. Personal observation suggests that bison are more tolerant of vehicles than persons afoot or on horseback. Perhaps the most significant effect of snowmobiles on bison behavior would transboundary movement from federal land to adjoining private land. Bison may be enticed to follow the resulting trails under certain snowfall conditions.

URSIDAE - As noted in the "Grizzly Bear Compendium (1987)", impacts on grizzly bears from snowmobile activity are largely unknown. Jonkel (1980) observed that 1 grizzly bear den was abandoned after snowmobile disturbance. Reid et al. (1983) felt the most serious consequences of the proposed Clark Fork snowmobile corridor to grizzlies were associated with off-season uses, especially in the late fall and early spring.

CANIDAE - The recent reintroduction of gray wolves to YNP presents an opportunity to study wolf behavior in the presence of snowmobiles and other winter recreational activities. In the process of conducting a gray wolf biological feasibility study for reintroduction of wolves in Colorado, Bennett (1994) collected over 1,000 citations specific to the gray wolf, but only 2 dealt with potential winter recreation impacts.

In response to the concern that snowmobile use may be harmful to wolf survival, the staff of "International Wolf" polled 40 wolf biologists with the question, "do you believe that snowmobiles are harmful to wolves in any way other than to provide accessibility to kill or to harass them?" The general consensus of the 17 biologists who responded was that snowmobiles were not a threat to wolves and in many cases may enhance their survival (see bibliography, pp. 114-117). Given the same qualification as in the preceding question, it seems reasonable to assume that coyotes would not be adversely affected by snowmobiles.

Purves et al. (1992) documented grizzly bear and gray wolf habitat use and displacement in Banff, Yoho, and Kootenay NPs in Canada and concluded that wolves showed aversion to regions where winter human use exceeded 10,000 visitors per month.

SMALL MAMMALS - Neumann and Merriam (1972) found that snowmobile use in Ontario caused significant changes in snow structure and wildlife behavior.

Snowmobile use affected snowshoe hare and red fox mobility and distribution causing significant damage to browse plants. Schmid (1983) states that compaction of snowfields by snowmobiles alters the mild snow microenvironment, potentially affecting organisms that live within or beneath the snow by increasing temperature stress or restricting movement. Experimental manipulation of a snowfield showed that winter mortality of small mammals was significantly increased by snowmobile compaction.

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BIRDS - Although many avian species are absent from GTNP and YNP during the winter months, certain waterfowl species remain to take advantage of the warm springs and waters associated with certain regions of the two parks. The literature is particularly sparse on the effects of winter activities on avian species. Braun (1971) found that unregulated use of snowmobiles was a prime factor for habitat loss of the white-tailed ptarmigan in Colorado. The following human disturbance effects on waterfowl are included to serve as a rough guide in lieu of specific published study results and recommendations.

Korschgen and Dahlgren (1992) reviewed the effects of human disturbances on water fowl and concluded that human activities cause different degrees of disturbance to waterfowl which may be grouped into four main categories. Listed in order of decreasing disturbance these categories are:

1. Rapid overwater movement and loud noise (power-boating, water skiing, aircraft);
2. Overwater movement with little noise (sailing, wind surfing, rowing, canoeing);
3. Little overwater movement or noise (wading, swimming); and
4. Activities along shorelines (fishing, bird-watching, hiking, and traffic).

It is unknown if these predominantly summer activities can be equated to a winter setting or not. If the effects of rapid movement and noise associated with snowmobiles are comparable with that of power-boating, then it is speculated that snowmobiles could serve as a significant disturbance source to waterfowl and other avian species.

Korschgen and Dalgren (1992) summarized human disturbances of waterfowl by source of disturbance, effect, and number of citations in 211 journal articles on the subject (Table 3). Most of the sources of disturbance and observed effects they list are applicable to avian species found in GTNP and YNP, depending upon season.

Table 3. Human disturbances of waterfowl by source of disturbance, effect, and number of citations in 211 journal articles on the subject (SOURCE: Korschgen and Dalgren 1992).

Subject	Number of citations
Sources of disturbance (in alphabetical order)	
Aircraft	
Airplanes	15
Helicopters	10
General	22
Anglers (see fishing)	
Baiting/artificial feeding	7
Barges/shipping	9
Boating (boats, canoes, rowing, airboats, sailing)	66
Cats	2
Development (industrial, pollution, urban, construction)	24
Dogs	6
Farming	19
Fishing	
Commercial	5
Sport (angling)	50
Hazing (scaring)	12
Human activity/disturbance, general	58
Hunting	
Sport	71
Subsistence	2
Military	5
Noise	22
Recreation	
General	18
Aquatic	27
Research/investigator	55
Roads	
General	10
Traffic	11
Trains	1
Trapping	
Furbearer	1
Waterfowl	5

Table 3. (Cont.)

Effects (in alphabetical order)	
Breeding chronology interrupted	2
Brood breakup	14
Brood rearing disrupted	7
Energetic cost (flight) increased	23
Family breakup	6
Feeding interrupted or decreased	52
Molting birds harassed	9
Nest/nesting	
nest disturbed by researchers	55
nest disturbed by others	27
nesting success reduced	14
Predation on clutches and chicks increased because of research	31
Wariness (alertness, tolerance distance) increased	43

Cross-country skiing

Cervidae - Cassirer et al. (1992) studied the effects of cross-country skiers on elk in the Lamar and Stephen's Creek drainage's and the Mammoth Hot Springs area of the northern winter range in YNP during the winters of 1987 and 1988.

The management implications of their study are (Cassirer et al. 1992):

Restricting cross-country skiers to locations >650 m from elk wintering areas would probably minimize displacement of most nonhabituated elk by skiers on shrub steppe winter range similar to that in northern Yellowstone. Seventy-five percent of non-habituated elk flight responses in northern Yellowstone occurred within 650 m. Skiers would likely have to remain at distances of >1,700 m to completely avoid disturbing elk. Although elk can habituate to human activity, this may be a localized phenomenon even in national parks. The amount of winter range used by skiers and the number of days involved seemed to be more important than skier numbers.

Therefore, when skier activity is located on elk winter range we recommend concentrating use into an area as small as possible. Locating skiers in sites with abundant topographic relief and providing security areas in drainage's adjacent to those where skiing occurs also might minimize added energy costs and displacement of elk.

This is the only study I could locate that specifically examined the effects of cross-country skiers on any species of wildlife.

DISCUSSION

Projections of likely future recreation participation show expected increases across all recreational activities, including simple activities such as picnicking, day hiking, and sightseeing that can be enjoyed close to home, with demands for snow-related recreation expected to grow at a faster rate than most land- and water-based activities (USFS 1989). Table 4 shows the expected index increases for outdoor recreation in the United States through the year 2040.

Table 4. Medium-level indexes of future consumption of outdoor recreation trip in the United States, projections to 2040 (SOURCE: USDA, Forest Service. 1989. RPA assessment of the forest and rangeland situation in the United States).

(1987 = 100)

Activity	2000	2010	2020	2030	2040
Land					
Developed camping	115	130	143	157	167
Picnicking	106	113	119	128	134
Sightseeing	128	143	160	181	203
Family gatherings	124	145	168	192	210
Pleasure driving	126	140	156	175	197
Visiting historic sites	130	147	167	193	220
Attending events	114	126	139	152	162
Visiting museums	119	135	152	171	184
Off-road driving	106	112	118	124	129
Biking	126	149	174	201	220
Running/jogging	137	170	206	243	270
Walking	114	127	141	156	166
Cutting firewood	121	131	143	159	176
Collecting berries	128	143	161	184	208
Visiting prehistoric sites	142	165	191	222	255
Photography	112	123	135	150	160
Day hiking	122	143	164	188	205
Horseback riding	132	158	184	208	226
Nature study	113	125	138	153	163
Backpacking	136	167	202	238	265
Primitive camping	114	127	139	153	162
Wildlife observation	124	145	168	190	207
Water					
Pool swimming	124	143	162	182	196
Sunbathing	116	129	142	154	161
Motorized boating	111	120	129	138	145
Water skiing	115	127	139	151	160
Rafting/tubing	125	156	192	246	287
Canoeing/kayaking	117	132	148	167	180
Other boating/rowing	113	125	138	151	161
Stream/lake swimming	107	113	120	128	133
Snow					
Downhill skiing	164	230	310	399	469
Cross-country skiing	145	193	249	322	378

Recreational impacts on wildlife are difficult to identify (Vaske 1983). Wall and Wright (1977) suggest four factors that limit ecological studies and introduce difficulties in identifying human impacts: (1) there is often no baseline data for comparison to natural conditions, (2) it is difficult to disentangle the roles of man and nature; (3) there are spatial and temporal discontinuities between cause and effect; and (4) in light of complex ecosystem interactions, it is difficult to isolate individual components. Some impacts take the form of naturally occurring processes that have been speeded up by human interference, while in other cases, human disturbances become insignificant when compared to natural fluctuations and disturbances (Wall and Wright 1977, Schreyer 1976).

Pomerantz et al. (1988) developed a recreational impact scheme that classifies the negative impacts to wildlife that result from recreational activities on wildlands (Table 5). The impacts are generic and 1 type does not necessarily exclude another and one disturbance may result in a combination of several individual effects. At issue is not whether the intended outcome of an activity is considered consumptive or nonconsumptive of wildlife, but whether the impact on wildlife is acceptable. The classification scheme is also valid for winter recreational activities.

Table 5. Classification of recreational-use impacts on wildlife derived from interviews with refuge managers in the Northeast (SOURCE: Pomerantz et al. 1988).

Category of impact	Description of impact
Direct mortality	Immediate, on-site death of an animal
Indirect mortality	Eventual, untimely death of animal caused by an event or agent that predisposed animal to death.
Lowered productivity	Reduced fecundity rate, nesting success or reduced survival of young before dispersal from nest or birth site.
Reduced use of refuge	Wildlife not using refuge as frequently or in the manner they normally would in the absence of visitor activity.
Reduced use of preferred habitat on refuge	Wildlife use is relegated to less suitable habitat on refuge.
Aberrant behavior or stress	Wildlife demonstrating unusual behavior or signs of stress that are likely to result in reduced reproductive rates or survival rates.

Gutzwiller (1993) states that:

Presently, little information is available that relates the frequency, spatial scale, periodicity, or daily and seasonal timing of various recreational disturbances with wildlife variables...we do not understand how effects on individuals influence the age structure or persistence of populations. With few exceptions (e.g., Skagen et al. 1991), impacts of recreationists on the structure and functioning of guilds and communities have not been examined. We do not know how effects of recreation perturbations "ripple" (Emlem et al. 1992) through communities by way of interspecific interactions, and long-term data on impacts are rare. Cumulative effects of several different disturbances (e.g., hiking, wildlife photography, camping) deserve attention....

In summary, the literature suggests that recreational impacts on wildlife range from "no effect" to direct mortality depending upon a complex array of interacting variables and wildlife managers should expect the effects of a given recreation activity on a species during one set of circumstances may not be the same for the same species under another set of conditions (Vaske 1983).

Grubb and King (1991) suggest the following parameters must be quantified when assessing the potential impacts of recreational activities on wildlife: (1) Type of activity (what kind?), (2) Severity (how much?), (3) Proximity (how close?), (4) Frequency (how often?), (5) Duration (how long?), and (6) Occasion (when?).

Wildlife variables include, but are not limited to: degree of habituation to human activity (e.g., backcountry vs. frontcountry habitat), age, experience of the animal, group size, characteristics of the animal, physical, nutritional, reproductive and physiological status, parasite load, and proximity of escape cover.

It is hoped this report will contribute to a better understanding of the complex issue of recreation impacts on wildlife in GTNP and YNP and will serve as a preliminary database that will be expanded through time and experience.

Annotated Bibliography: Winter Recreation Effects on Wildlife

1. Aasheim, R. SNOWMOBILE IMPACTS ON THE NATURAL ENVIRONMENT. in: R. N. L. Andrews; and P. F. Nowak, eds. Off-road Vehicle use: A Management Challenge; Conf. Proc., 16-18 March 1980. Ann Arbor, MI. 1980.

Snowmobiling and its impacts on natural environments in Montana are described. Studies of impacts on deer and elk have produced conflicting results, but there is little doubt that additional stress in winter is undesirable. Animals accustomed to humans are less affected by snowmobiles than animals in more remote areas. Effects on small mammals and possible effects of packed snowmobile trails are discussed.

2. Aitchison, S. W. SOME EFFECTS OF A CAMPGROUND ON BREEDING BIRDS IN ARIZONA. Pages 175-182 in: Importance, preservation, and management of riparian habitat; A symposium, 9 July 1977, Tuscon, AZ. U.S. For. Serv. Gen. Tech. Rep. RM-43. 1977.

In a 3-year study in Oak Creek Canyon, Arizona, bird populations were compared between a constructed campground and a more natural control area. When the campground was closed to campers, bird densities were similar but species composition was different. When the campground was opened for human use, the breeding bird population decreased in density and diversity.

3. Albert, D. M.; and R. T. Bowyer. FACTORS RELATED TO GRIZZLY BEAR-HUMAN INTERACTIONS IN DENALI NATIONAL PARK. Wildl. Soc. Bull.; 19:339-349. 1991.

Although improved management has reduced the number of more serious incidents between grizzly bears and people in Denali National Park, the rate of interactions has increased from 80 per million visitors in 1987 to 197 per million in 1989. Most interactions in frontcountry areas occurred in early June and late August, and probably involved bears habituated to humans. Backcountry interactions were strongly correlated with the number of people riding shuttle buses and may have

been caused by less-habituated bears moving from frontcountry to backcountry areas, or from seasonal changes in habitat selection by bears. Interactions occurred on river and gravel bars more frequently and on tundra less frequently than expected by the occurrence of these habitats within the park. Although bears in Denali NPP are seldom conditioned to people by the reward of food, there is a high rate of bears approaching people or entering camps with people present. Further, bears showed a greater tendency to approach people in developed areas, along the park road, and in camps than when people were hiking in the backcountry. Efforts to minimize interactions between bears and people will increase visitor safety and reduce opportunities for bears to obtain food from humans. The authors believe that better education of NPS personnel, concession employees, and park visitors about bears, and reducing human activity in habitats used by both people and bears offer the greatest likelihood of achieving this goal.

4. Allbrecht, J.; and D. Smith. ENVIRONMENTAL EFFECTS OF OFF-ROAD VEHICLES: A SELECTED BIBLIOGRAPHY OF PUBLICATIONS IN THE UNIVERSITY OF MINNESOTA FORESTRY LIBRARY. Univ. Minnesota, St. Paul Campus Libraries, For. Serv. Libr. Bibliogr. Ser. 2. 9 pp. 1977.

*Bibliography.

5. Alldredge, R. B. SOME CAPACITY THEORY FOR PARKS AND RECREATION AREAS. National Park Service Reprint. 1972.
6. Allen, J. N. *THE ECOLOGY AND BEHAVIOR OF THE LONG-BILLED CURLEW IN SOUTHEASTERN WASHINGTON. Wildl. Monogr. 73:1-67. 1980.
7. Allen, R. P. *THE WHOOPING CRANE. National Audubon Society, Rep. 3, New York. 246 pp. 1952.
8. Allendorf, F. W.; and C. Serveen. *GENETICS AND THE CONSERVATION OF GRIZZLY BEARS. Trends in Ecol. and Evol.; 1:88-89. 1986.

9. Altman, M. THE FLIGHT DISTANCE IN FREE-RANGING BIG GAME. J. Wildl. Manage.; 22(2):207-209. 1958.

The distance at which free-ranging elk and moose would flee from humans varied with habitat, social groupings, nutrition, reproductive status, and specific experience of individual animals of the group (Ream 1980).

10. Altman, M. PATTERNS OF HERD BEHAVIOR IN FREE-RANGING ELK OF WYOMING. Zoologica (NY); 41:65-71. 1956.

Account of free-ranging elk behavior. Compares behavior of disturbed and undisturbed elk herds during rut. Describes reactions of previously undisturbed elk to the opening of hunting season (Ream 1980).

11. American Ornithologist's Union. *Checklist of North American Birds, 6th ed. Allen Press, Inc., Lawrence, KS. 1983.

12. Ames, P. L.; and G. S. Mersereau. SOME FACTORS IN THE DECLINE OF THE OSPREY IN CONNECTICUT. Auk; 81:173-185. 1964.

Studies of osprey ecology in southern Connecticut revealed factors in the mortality of eggs and nestlings. Prevention of incubation due to human presence was common but the effects were not known. Incidents of disturbance by picknickers and boaters are mentioned, as well as accounts of removal of young by humans. No evidence of human-induced predation on osprey nests was found (Boyle and Sampson 1983).

13. Amstrup, S. C.; and J. Beecham. ACTIVITY PATTERNS OF RADIO-COLLARED BLACK BEARS IN IDAHO. J. Wildl. Manage.; 40: 340-348. 1976.

The impacts of the investigators on black bear activities appeared to be negligible. Instrumented bears often withdrew from observers, but human-induced alterations of their behavior appeared to be short-lived.

14. Anderson, D. W. DOSE-RESPONSE RELATIONSHIP BETWEEN HUMAN DISTURBANCE AND BROWN PELICAN BREEDING SUCCESS. Wildl. Soc. Bull.; 16:339-345. 1988.

This study evaluated the negative effect of human disturbance on reproduction of California brown pelicans on Isla Coronado Norte, Mexico. The author concluded that the pelican colony has been disturbed to such an extent that nesting success has been reduced and nesting populations on that island are threatened. Nest abandonments increased with nearness of human activity, and human disturbances versus nesting success followed a typical dose-response pattern, thus providing also an estimate of a "safe" distance without apparent negative effects. Pelicans began to suffer detriment at distances less than about 600 m, illustrating the extreme sensitivity of brown pelicans to human disturbance.

15. Anderson, D. W.; and J. O. Kieth. THE HUMAN INFLUENCE ON SEABIRD NESTING SUCCESS: CONSERVATION IMPLICATIONS. Biol. Conserv.; 18:65-80. 1980.

Studies of brown pelicans and Heerman's gulls indicated that disturbances by recreationists, educational groups, and scientists could seriously disrupt seabird breeding on the coast of Baja California. Human disturbances lead to inter- and intra-specific behavioral imbalances in seabirds. Methods for minimizing disturbances are discussed (Boyle and Sampson 1983).

16. Anderson, E. M. *A CRITICAL REVIEW AND ANNOTATED BIBLIOGRAPHY OF LITERATURE ON THE BOBCAT. Colorado Division of Wildlife, Special Report No. 62. 61 pp. 1987.

17. Anderson, J. M. PROTECTION AND MANAGEMENT OF WADING BIRDS. Pages 99-103, in: A. Sprunt, IV, J. C. Ogden, and S. Winckler, eds. Wading Birds. Natl. Audubon Soc. Res. Rep. 7. 1978.

The role of the National Audubon Society in the protection and management of wading birds is discussed, with emphasis on the Texas Gulf Coast. Among problems facing wading birds is human disturbance, especially during the nesting season. Sport fishing and boating are increasingly popular in coastal waterways where many colonial waterbirds nest (Boyle and Sampson 1983).

18. Anderson, S. H. *COMPARATIVE FOOD HABITS IN OREGON NUTHATCHES. Northwest Sci.; 50:213-221. 1976.
19. Anonymous. FISHLINE IS FOULING OUR FLYWAYS. Minn. Vol.; 35(205):62-63. 1972.

Waterfowl mortalities caused by entanglement in fishing line are cited in this nontechnical article. Many waterfowl, especially diving ducks, may become ensnared underwater and be undetected. The problem will continue until manufacturers develop biodegradable fishing line (Boyle and Sampson 1983).

20. Armstrong, F. H. *NOTES ON SOREX PREBLEI IN WASHINGTON STATE. Murrelet; 38:6. 1957.
21. Aune, K. E. IMPACT OF WINTER RECREATIONISTS ON WILDLIFE IN A PORTION OF YELLOWSTONE NATIONAL PARK, WYOMING. M.S. thesis; Montana State Univ., Bozeman. 111 pp. 1981.

General responses of wildlife to winter recreationists in Yellowstone National Park were attention or alarm, flight, and, rarely, aggression. Responses varied with the species involved, nature of the disturbance, and time of season. Winter recreation activities was not a major factor influencing wildlife distributions, movements, or population sizes, although minor displacement of wildlife from areas adjacent to trails

was observed. Management recommendations are presented (Boyle and Sampson 1983).

22. Austin, J. E. WINTER ECOLOGY OF CANADA GEESE IN NORTHCENTRAL MISSOURI. Ph.D., University of Missouri, Columbia. 284 pp.. 1988.

Canada geese tended to spend more of their time in agricultural habitats where they were more vulnerable to disturbances than in seasonal wetlands in the refuge interior or the water roost sites. Vigilance of waterfowl did not differ by habitat in the hunting season, thus the effects of disturbances by hunters are far-reaching. All use of wetlands in late fall occurred in the refuge interior, which is not hunted. However, in response to gunshots from the hunting zone, geese in the refuge interior often ceased other activities and, at least briefly, became alert or vigilant. Habituation of Canada geese to disturbances in some locations may account for the lower vigilance of geese in pastures in winter. These pastures seemed to be traditionally used by geese and may be considered safe fields. Geese seemed to avoid or leave locations where excessive disturbances restricted feeding and where they did not habituate to disturbances.

23. Bailey, T. N. *FACTORS OF BOBCAT SOCIAL ORGANIZATION AND SOME MANAGEMENT IMPLICATIONS. Pages 984-1000 in: J. A. Chapman and D. Pursley, eds. Proc. Worldwide Furbearer Conf., Frostburg, MD. 1981.
24. Baldwin M. F.; and D. H. Stoddard. THE OFF-ROAD VEHICLE AND ENVIRONMENTAL QUALITY. Second edition, the Conservation Foundation; Washington, DC. 61 pp. plus foldout chart. 1973.

This report updates an earlier edition describing the effects of off-road vehicles, particularly snowmobiles. A section on fish and wildlife reviews literature describing harassment of wildlife, and legal responses to adverse impacts of off-road vehicles on wildlife. Policies for control of environmental impacts are suggested (Boyle and Sampson 1983).

25. Baldwin, M. F. THE SNOWMOBILE AND ENVIRONMENTAL QUALITY. Living Wilderness; 32(104):14-17. 1968.

Recreational uses of snowmobiles is examined in terms of effects on environmental quality through noise, fumes, and impacts on fish, wildlife and trails. Harassment of wild game, nongame, and predators by snowmobile users is described. Policy recommendations are suggested and discussed (Boyle and Sampson 1983).

26. Baldwin, P. H. DIET OF THE MOUNTAIN PLOVER AT PAWNEE NATIONAL GRASSLAND, 1970-1971. U.S. Int. Biol. Prog. Rep. No. 134. 1971.

27. Bangs, E. E.; T. H. Spraker; T. N. Bailey; and V. D. Berns. EFFECTS OF INCREASED HUMAN POPULATIONS ON WILDLIFE RESOURCES OF THE KENAI PENINSULA, ALASKA. Proc. N. Am. Wildl. Conf.; 47:605-616. 1982.

The authors trace the effects of man on wildlife on the Kenai Peninsula, Alaska. They state that the typical patterns of habitat alteration and wildlife exploitation dramatically altered plant and animal communities on the Kenai Peninsula. Species of immediate value of man, such as caribou, salmon, or trumpeter swan, were overexploited. Species believed to compete with man, such as wolves and eagles, were persecuted. Generalist wildlife species, such as moose, benefitted from unplanned habitat alterations, but species with specialized habitat requirements or that were intolerant of human activity declined as the Kenai Peninsula was developed. The authors conclude that solutions to future problems related to wildlife management will primarily depend upon innovative resource management techniques and the importance that society places upon the value of wildlife and wildlands.

28. Banko, W. E. *THE TRUMPETER SWAN. N. Am. Fauna 63, U.S. Fish Wildl. Ser., Washington, DC. 214 pp. 1960.

29. Bansner, U. MOUNTAIN GOAT-HUMAN INTERACTIONS IN THE SPERRY-GUNSIGHT PASS AREA, GLACIER NATIONAL PARK. Univ. Montana; Missoula; Unpubl. Rep. 46pp.. 1976.

Mountain goat-human interactions in Glacier National Park were characterized as goat approaches to people and people approaches to goats. Attractants causing goats to approach people were identified, and overt aggressive behavior of goats toward humans noted in less than 5% of goat approaches. Goats generally approach people remaining quiet, but are frightened by sudden movements or appearances of people. Management recommendations are presented (Boyle and Sampson 1983).

30. Barbour, R. W.; and W. H. Davis. *BATS OF AMERICA. Univ. Kentucky Press, Lexington. 286 pp. 1969.

31. Barnes, V. G. ,. Jr. ACTIVITIES OF BLACK BEARS IN YELLOWSTONE NATIONAL PARK. M.S. thesis; Colorado State Univ., Fort Collins, CO. 116 pp.. 1967.

A study of black bears in Yellowstone National Park found that backcountry and roadside areas were utilized by two separate populations. Bearproof garbage containers affected bear use of campgrounds but not of roadside areas. Artificial food was the most important constituent of roadside area bears. Most black bear-human incidents occurred in campgrounds (Boyle and Sampson 1983).

32. Bart, J. IMPACT OF HUMAN VISITATIONS ON AVIAN NESTING SUCCESS. Living Bird; 16:187-192. 1977.

Analysis of data collected for the North American Nest Record Card Program, Cornell University Laboratory of Ornithology, revealed influences of human visitation on nest mortality rates for 5 species of birds. The data indicate a need to prevent predators from following human trails to bird nests (Boyle and Sampson 1983).

33. Basil, J. V.; and T. N. Lonner. VEHICLE RESTRICTIONS INFLUENCE ELK AND HUNTER DISTRIBUTION IN MONTANA. J. Forestry; 77:155-159. 1979.
34. Batcheler, C. L. COMPENSATORY RESPONSES OF ARTIFICIALLY CONTROLLED MAMMAL POPULATIONS. Proc. of the New Zealand Ecol. Soc.; 15:25-30. 1968.
35. Bear, G. D.; and G. W. Jones. HISTORY AND DISTRIBUTION OF BIGHORN SHEEP IN COLORADO. Colorado Division of Wildlife, Denver, CO. 232 pp. 1973.

Available information on the history, distribution, population trends, and ecological factors for bighorn sheep herds in Colorado are summarized. Human influences are discussed for each of the herds; while few quantitative data are available, observations suggest that in many cases, such as camping, hiking, and driving off-road vehicles, influence sheep distributions and activities (Boyle and Sampson 1983).

36. Beaver, R. D.; and V. Lewin. *SCHEDULING CENSUSES OF BREEDING WHITE PELICANS. Can. Field-Nat.; 95(2):198-201. 1981.
37. Behle, W. H. *THE BIRD LIFE OF GREAT SALT LAKE. University of Utah Press, Salt Lake City. 1958.
38. Beier, P. COUGAR ATTACKS ON HUMANS IN THE UNITED STATES AND CANADA. Wildl. Soc. Bull.; 19:403-412. 1991.

The author examined historical records of unprovoked attacks by cougars on humans in the U. S. and Canada during the last century (1890-1990) to determine historical trends and characteristics of victims and offending cougars. There were 9 attacks resulting in 10 human deaths and at least 44 nonfatal attacks. Attacks on humans increased markedly during the last 2 decades, during which cougar numbers and human use of cougar habitat also increased. Most victims (64%) were children; the modal age class was 5-9 years. Of 37 child victims, 35% were alone, 43% in groups of

children, and 22% were accompanied by adults; 11 of 17 adult victims were alone at the time of the attack. The data suggests that yearlings and underweight cougars were most likely to attack humans. Aggressive responses on the part of intended victims may avert an impending attack and repel an attack in progress.

39. Belanger, L.; and J. Berdard. **ENERGETIC COST OF MAN-INDUCED DISTURBANCE TO STAGING SNOW GEESE.** *J. Wildl. Manage.*; 54:36-41. 1990.
40. Bell, D. V.; and L. W. Austin. **THE GAME-FISHING SEASON AND ITS EFFECTS ON OVERWINTERING WATERFOWL.** *Biol. Conserv.*; 33:65-80. 1985.
41. Bell, J. N. **WILD ANIMALS ARE WILD.** *Natl. Wildl.*; 1(5):34-36. 1963.

Problems of human-wildlife interactions in National Parks are described in this popular article. Park visitors unaware of the potential hazards of confrontations with wildlife sometimes create dangerous situations by inappropriate behavior. Park visitors are entitled to wildlife viewing experiences, but must be educated about wildlife behavior and maintain respect for wild animals (Boyle and Sampson 1983).

42. Bellrose, F. C. ***DUCKS, GEESE, AND SWANS OF THE WORLD.** Stackpole Books, Harrisburg, PA. 540 pp. 1980.
43. Bennett, L. E. **COLORADO GRAY WOLF RECOVERY: A BIOLOGICAL FEASIBILITY STUDY.** Univ. Wyo. Coop. Fish Wildl. Res. Unit. Laramie. 318 pp. 1994.
44. Bent, A. C. ***LIFE HISTORIES OF NORTH AMERICAN SHOREBIRDS.** Smithsonian Institution, U.S. Nat. Mus. Bull. 146. 412 pp. 1929.
45. Bent, A. C. ***LIFE HISTORIES ON NORTH AMERICAN BIRDS OF PREY. PART 1.** U.S. Natl Mus. Bull. 170. 409 pp. 1937.

46. Berg, R. L.; L. L. McDonald; and M. D. Strickland. DISTRIBUTION OF MOUNTAINS LIONS IN WYOMING AS DETERMINED BY MAIL QUESTIONNAIRE. Wildl. Soc. Bull.; 11(3):265-268. 1983.

The mail survey used in this study provided some valuable base-line data on the distribution and relative densities of mountain lions in Wyoming. The large number of reported sightings of lions (lion sign) and their distribution indicated the widespread presence of mountain lions in the state. Relative lion densities were indicated by the density of sightings and by the percent of questionnaires which reported sightings in different areas. Lion sightings reached highest densities in Douglas fir forests and were correlated (albeit weakly) with mule deer and elk distribution.

47. Berger, D. D.; and H. C. Mueller. NESTING PEREGRINE FALCONS IN WISCONSIN AND ADJACENT AREAS. Pages 115-122 in: J. J. Hickey ed. Peregrine falcon populations: Their biology and decline. Univ. of Wisc. Press, Madison. 1969.

The reproductive history of 14 falcon eyries along the upper Mississippi river are summarized. From 1955 to 1964 all known peregrine falcons disappeared from the study area; human activity increased very little during that time and is not considered important in the decline. One instance of disturbance to a peregrine eryie by picnickers and rock climbers is mentioned (Boyle and Sampson 1983).

48. Bergerud, A. T.; R. D. Jakimchuk; and D. R. Carruthers. THE BUFFALO OF THE NORTH: CARIBOU (RANGIFER TARANDUS) AND HUMAN DEVELOPMENT. Arctic; 37:7-22. 1984.

49. Berwick, S. H. OBSERVATIONS ON THE DECLINE OF THE ROCK CREEK, MONTANA, POPULATION OF BIGHORN SHEEP. M.S. thesis; Univ. of Montana, Missoula. 245 pp. 1968.

Among factors that may be responsible for an observed decline in a Montana bighorn sheep population are human disturbance and harassment of sheep. Snowmobile use of an important segment of sheep winter range is increasing. It is suggested that harassment may be debilitating to winter-stressed animals (Boyle and Sampson 1983).

50. Bicak, T. K.; R. L. Redmond; and D. A. Jenni. EFFECTS OF GRAZING ON LONG-BILLED CURLEW BREEDING BEHAVIOR AND ECOLOGY IN SOUTHWESTERN IDAHO. Pages 74-85 in: J. M. Peek and P. D. Dalke, eds. Wildlife-livestock relationships symposium: Proc. 10. Univ. Idaho For. Wildl. and Range Exp. Sta., Moscow. 1982.

51. Bird, D. M. BIRDS OF PREY: A PLEA FOR ETHICS. Ont. Nat.; 17(5):16-23. 1978.

Problems facing birds of prey are described in this nontechnical article. Effects of man on raptors are discussed, including impacts on research, wildlife photography, and bird watching. Disturbances of birds by these activities can cause adults to abandon nests, and decrease survival of eggs and young through predation or exposure. Education of public on the values of birds of prey is essential for their protection (Boyle and Sampson 1983).

52. Black, H. L. *A NORTH TEMPERATE BAT COMMUNITY: STRUCTURE AND PREY POPULATIONS. J. Mammal.; 55:138-157. 1974.

53. Blackford, J. L. *WOODPECKER CONCENTRATION IN BURNED FOREST. Condor; 57:28-30. 1955.

54. Blokpoel, H. AN ATTEMPT TO EVALUATE THE IMPACT OF CANNON-NETTING IN CASPIAN TERN COLONIES. Colon. Waterbirds; 4: 61-67. 1981.

From studies of Caspian terns on Lake Huron, Ontario, it was found that visits to tern colonies resulted in losses of eggs to predation by gulls. Human activities at tern nesting colonies should be restricted until more is known about the nature and extent of human-induced nest losses (Boyle and Sampson 1983).

55. Bock, C. E.; and J. H. Bock. *ON THE GEOGRAPHICAL ECOLOGY AND EVOLUTION OF THE THREE-TOED WOODPECKERS. Am. Midl. Nat.; 92:397-405. 1974.
56. Boyce, M. S.; and L. D. Hayden-Wing. *NORTH AMERICAN ELK: ECOLOGY, BEHAVIOR AND MANAGEMENT. Univ. Wyo., Laramie. 294 pp. 1971.
57. Boyd, R. J. *AMERICAN ELK. Pages 10-29 in: J. D. Schmidt and D. L. Gilbert, eds. Big game of North America. Stackpole Books, Harrisburg, PA., and Wildl. Manage. Inst., Washington, DC. 1978.
58. Boyle, S. A.; and F. B. Samson. NONCONSUMPTIVE OUTDOOR RECREATION: AN ANNOTATED BIBLIOGRAPHY OF HUMAN - WILDLIFE INTERACTIONS. USDI, U.S. Fish Wildl. Serv. Special Sci. Rep. No. 252. 1983.

*Annotated Bibliography.

59. Brand, C. J.; L. B. Keith; and C. A. Fischer. *LYNX RESPONSES TO CHANGING SNOWSHOE HARE DENSITIES IN CENTRAL ALBERTA. J. Wildl. Manage.; 40:416-428. 1976.

60. Braun, C. E. HABITAT REQUIREMENTS OF WHITE-TAILED PTARMIGAN. Proc. Annu. conf. West. Assoc. State Game Fish Comm.; 51:284-292. 1971.

Studies of white-tailed ptarmigan in Colorado revealed distribution, habitat requirements, and other biological factors of this alpine grouse. Losses of habitat affecting ptarmigan include the destruction of willow communities through road construction, development of winter recreation sites, and unregulated use of snowmobiles (Boyle and Sampson 1983).

61. Braun, C. E.; K. W. Hamon; J. A. Jackson; and C. D. Littlefield. MANAGEMENT OF NATIONAL WILDLIFE REFUGES IN THE UNITED STATES: ITS IMPACTS ON BIRDS. Wilson Bull.; 90:309-321. 1978.

Management activities on refuges affecting birds are discussed, including recreational activities. Although fishing and boating on refuge waters can be regulated to ensure compatibility with bird populations, frequently control of such activities is inadequate, resulting in disturbance of birds, loss of production of young, and displacement of waterbirds. Management recommendations are suggested (Boyle and Sampson 1983).

62. Brazda, A. R. DOGS VS. DEER. N. Dak. Outdoors; 19(7):17. 1957.

63. Brown, L. H.; and D. Amadon. *EAGLES, HAWKS AND FALCONS OF THE WORLD. McGraw-Hill, New York. 2 vol. 945 pp. 1968.

64. Brown, W. M.; R. C. Drewien; and E. G. Bizeau. *MORTALITY OF CRANES AND WATERFOWL FROM POWERLINE COLLISIONS IN THE SAN LUIS VALLEY, COLORADO. Pages 128-139 in: J. C. Lewis and J. W. Ziewitz, eds. Proc. 1985 Crane Workshop. Platte River Whooping Crane Maintenance Trust and U.S. Fish and Wildlife Service, Grand Island, NE. 1987.

65. Buckley, P. A.; and F. G. Buckley. GUIDELINES FOR PROTECTION AND MANAGEMENT OF COLONIALY NESTING WATERBIRDS. U.S. Natl. Park Serv.; North Atlantic Regional Office, Boston, Mass. 52 pp. plus appendices. 1978.

This comprehensive review of of protection and management of colonial waterbirds discusses the nature and effects of human disturbance at nesting colonies. Impacts on the biology of birds are discussed in relation to the nature of disturbances. Protective measures include public education and restriction of activities (Boyle and Sampson 1983).

66. Budowski, G. TOURISM AND ENVIRONMENTAL CONSERVATION:: CONFLICT, COEXISTENCE, OR SYMBIOSIS? Environ. Conserv.; 3:27-31. 1976.

Relationships between tourism and conservation are described as conflicting, coexisting, or symbiotic. Widespread environmental degradation has often resulted from tourism, as many places visited by tourists support fragile ecosystems. Proper attitudes and management schemes can lead to symbiotic relationships instead of conflicts (Boyle and Sampson 1983).

67. Buehler, D. A.; T. J. Mersmann; J. D. Fraser; and J. K. D. Seegar. EFFECTS OF HUMAN ACTIVITY ON BALD EAGLE DISTRIBUTION ON THE NORTHERN CHESAPEAKE BAY. J. Wildl. Manage.; 55:282-290. 1991.

68. Buehler, D. A.; T. J. Mersmann; J. D. Fraser; and J. D. Seegar. NONBREEDING BALD EAGLE COMMUNAL AND SOLITARY ROOSTING BEHAVIOR AND ROOST HABITAT ON THE NORTHERN CHESAPEAKE BAY. J. Wildl. Manage. 55(2):273-281. 1990.

The authors studied roosting behavior and habitat use of nonbreeding bald eagles on the northern Chesapeake Bay during 1986-1989. Results of the study included the recommendation that a 1,360-m-wide shoreline management zone that extends 1,400 m inland should be provided to encompass roost sites and provide a buffer from human disturbance.

69. Buell, N. E. REFUGE RECREATION: HIGH STANDARDS EQUAL QUALITY. *Living Wilderness*; 31(98):24-26. 1967.

The role of U. S. National Wildlife Refuges in providing recreational opportunities is discussed in this popular article. Planning for recreation on refuges is based on the view that quality of experience rather than quantity of use is most desirable to visitors and protected wildlife. Responsibilities and approaches to recreation management are discussed (Boyle and Samson 1983).

70. Bull, E. L. *ECOLOGY OF THE PILEATED WOODPECKER IN NORTHEASTERN OREGON. *J. Wildl. Manage.*; 51(2):472-481. 1987.
71. Bull, E. L.; and M. G. Henjum. *THE NEIGHBORLY GREAT GRAY OWL. *Natural History*; 9:32-41. 1987.
72. Burger, J. THE EFFECT OF HUMAN ACTIVITY ON SHOREBIRDS IN TWO COASTAL BAYS IN NORTHEASTERN UNITED STATES. *Environ. Conserv.*; 13:123. 1986.
73. Burger, J. FORAGING BEHAVIOR AND THE EFFECTS OF HUMAN DISTURBANCE ON THE PIPING PLOVER. *J. Coast. Res.*; 7:39-52. 1991.
74. Burger, J.; and L. M. Miller. COLONY AND NEST-SITE SELECTION IN WHITE-FACED AND GLOSSY IBIS. *Auk*; 94:664-676. 1977.
75. Burget, A. A. INTERREALTIONS OF EIDERS, HERRING GULLS, AND BLACK-BACKED GULLS NESTING IN MIXED COLONIES IN PENEBOBSCOT BAY, MAINE. M.S. thesis; Univ. of Maine, Orono. 123 pp. 1970.

Effects of observer's presence during an ecological study were examined by comparing disturbed and undisturbed colonies. As a result of human disturbance the breeding cycles of eiders, black-backed gulls, and especially herring gulls were delayed by as much as one

week. Hatching success of eiders appeared to be unaffected (Boyle and Sampson 1983).

76. Burk, D. ed. *THE BLACK BEAR IN MODERN NORTH AMERICA. Proc. of the workshop on the management biology of the North American black bear, Kalispell, MT., 17-19 Feb 1977. Boone and Crockett Club, New York, and Amwell Press, Clinton, NJ. 300 pp. 1979.

77. Bury, R. L. IMPACTS OF SNOWMOBILES ON WILDLIFE. Trans. N. Am. Wildl. Nat. Resour. Conf.; 43:149-156. 1978.

Existing research on snowmobile-wildlife interactions and future research needs are discussed (Boyle and Sampson 1983).

78. Bury, R. L. OFF-ROAD RECREATION VEHICLES: RESEARCH RESULTS AND ADMINISTRATIVE REPORTS, AND TECHNICAL ARTICLES, 1970-1975. Council of Planning Librarians, Monticello, Ill., Exch Biblio. 1067. 23 pp. 1976.

*Bibliography.

79. Bury, R. B. WHAT WE KNOW AND DO NOT KNOW ABOUT OFF-ROAD VEHICLE IMPACTS ON WILDLIFE. Page 110-122 in: R. N. L. Andrews; and P. F. Nowak, eds. Off-road vehicle use: A management challenge. Conf. Proc., 16-18 March 1980, Ann Arbor, MI. 1980.

Research concerning off-road vehicle impacts on wildlife is reviewed to illustrate the levels of impacts and to provide guidance for more effective protection of wildlife in off-road vehicle areas. Effects on wildlife include direct mortality, damage to vegetation, disruption of soil, and noise harassment. Research and management recommendations are suggested (Boyle and Sampson 1983).

80. Bury, R. L.; S. F. McCool; and R. J. Wendling. RESEARCH ON OFF-ROAD VEHICLES: A SUMMARY OF SELECTED REPORTS AND A COMPREHENSIVE BIBLIOGRAPHY. Pages 234-272, in: Proc. of the Southern States Recreation Research Applications Workshop, 15-18 September 1975, Asheville, NC. U.S. For, Serv. Gen. Tech. Rep. SE-9. 1976.

Bibliography.

81. Busnel, R. G. EFFECTS OF NOISE ON WILDLIFE: INTRODUCTION. Pages 7-22 in: J. L. Fletcher and R. G. Busnel. 1978.

This introductory article reviews some aspects of animal behavior associated with noise, citing examples from scientific literature and anecdotal observations. Theoretical approaches and aspects of policy relating to noise effects and the conservation of wildlife are discussed (Boyle and Sampson 1983).

82. Buss, I. O.; and A. S. Hawkins. *THE UPLAND PLOVER AT FAVILLE GROVE, WISCONSIN. Wilson Bull.; 51:202-220. 1939.

83. Butcher, D. SNOWMOBILES AND THE NATIONAL PARKS. Am For.; 78(4):28-31, 46-49. 1972.

The author cites Congressional testimony, popular literature, and personal experiences to document environmental impacts of snowmobiles, including impacts on wildlife. Habitat destruction and deliberate harassment of animals are noted. The author calls for the prohibition of snowmobiles and other off-road vehicles in National Parks to protect the environment and ensure the satisfaction of other park visitors (Boyle and Sampson 1983).

84. Cade, T. J. THE FALCONS OF THE WORLD. Comstock/Cornell University Press, Ithaca, NY. 188 pp. 1982.

85. Cade, T. J.; J. H. Enderson; C. G. Thelander; and C. M. White. *PEREGRINE FALCON POPULATIONS: THEIR MANAGEMENT AND RECOVERY. The Pregrine Fund, Inc., Boise. 949 pp. 1988.
86. Call, M. W. HABITAT MANAGEMENT FOR BIRDS OF PREY. U.S.D.I; Bureau of Land Manangement, Tech. Note 338. 70pp. 1979.

Habitat management considerations for birds of prey are reviewed. Human activities that should be controlled in nesting and roosting areas include recreational activities; many areas preferred by humans for recreation are important raptor nesting sites as well. Management considerations include siting recreational developments away from important raptor habitats, and restricting human activities during the breeding season (Boyle and Sampson 1983).

87. Caras, R. MEET WILDLIFE ENEMY NO. 2. Natl. Wildl.; 11(2):30-31. 1973.

The author lists feral dogs and cats as a major menance to wildlife populations nationwide. Many of these feral predators become wild when people vactioning in rural summer homes abandon them when it is time to return to the city in the fall. In some states the immensity of the problem is staggering. Conservation officers in Georgia estimate nearly a half a million feral dogs inhabit that state alone and are believed responsible for killing 5,000 head of cattle in 1972. In North Carolina, feral dogs are estimated to kill three times as many deer as do bobcats... (Neil et al. 1975).

88. Carbyn, L. N. WOLF POPULATION FLUCTUATIONS IN JASPER NATIONAL PARK, ALBERTA, CANADA. Biol. Consev.; 6(2):94-101. 1974.

Population flucuations mainly a result of human pressures in areas adjacent to park. Population negatively affected by disturbance at den site and high

percentage of ungulates on heavily traveled roads as wolves tend to avoid traveled roads.

89. Carbyn, L. N. *WOLF PREDATION OF ELK IN RIDING NATIONAL PARK, MANITOBA. J. Wildl. Manage.; 47(4):977-988. 1983.
90. Carbyn, L. N.; and P. C. Paquet. LONG DISTANCE MOVEMENT OF A COYOTE FROM RIDING MOUNTAIN NATIONAL PARK. J. Wildl. Manage.; 50(1):89. 1985.

A long distance movement of about 544 km of an adult female coyote was recorded between January 1983 and February 1984. Reasons for this unusually long movement were not identified although possible causes are discussed.

91. Carlson, R. D. DESTRUCTION OF COLONIAL BIRDS ON AN ISLAND ON SUGGI LAKE. Blue Jay; 24:96-97. 1966.

The destruction of a colony of white pelicans, double-crested comorants, and great blue herons in Saskatchewan is documented. The island was used by a group of fishermen, who apparently killed some pelicans and indirectly caused losses of nestlings to California gull predation by disturbing nesting birds (Boyle and Sampson 1983).

92. Casey, D. *AMERICAN MARTEN. Dodd-Mead, New York. 64 pp. 1988.
93. Cassirer, E. F.; D. J. Freddy; and E. D. Ables. ELK RESPONSES TO DISTURBANCE BY CROSS-COUNTRY SKIERS IN YELLOWSTONE NATIONAL PARK. Wildl. Soc. Bull.; 20:375-381. 1992.

The objectives of this study were to measure the immediate movements of elk when disturbed by cross-country skiers, to assess energy costs associated with these movements, and to identify factors that might influence elk behavior. The results of this disturbance study indicate that restricting cross-

country skiers to locations > 650 m from elk wintering areas would probably minimize displacement of most nonhabituated elk by skiers on shrub steppe and upland steppe winter ranges similar to that in Yellowstone. Seventy-five percent of nonhabituated elk flight responses in northern Yellowstone occurred within 650 m. Skiers would likely have to remain at distances of >1,700 m to completely avoid disturbing elk. The amount of winter range used by skiers and the number of days involved seemed to be more important than skier numbers.

94. Chapman, R. C. THE EFFECTS OF HUMAN DISTURBANCE ON WOLVES. M.S. thesis; Univ. Alaska, Fairbanks 209 pp. 1977.

Wolves responded to humans near pups by barking or howling, leaving the area, or moving the pups. Low intensity disturbance does not seem to cause significant pup mortality. Recommends closing areas of 2.4 km radius around homesites to disturbance from 4 or 5 weeks before whelping until wolves leave the area. Contains appendix of more than 100 published and unpublished accounts of wolf/man interactions (Ream 1980).

95. Chapman, R. C. HUMAN DISTURBANCE OF WOLF DENS--A MANAGEMENT PROBLEM. Pages 323-328 in: R. M. Linn, ed. Proc. of the First Conf. on Scientific Research in the National Parks, 9-12 November 1976, New Orleans, LA, Vol. 1. U. S. Natl. Park Serv. Trans. Proc. Ser. 5. 1979.

Aspects of human disturbance at wolf dens was studied in Alaska. Wolves at homesites were experimentally disturbed, and wolf response documented. Results are discussed in relation to determination of the size of closed areas in Mount McKinley National Park (Boyle and Sampson 1983).

96. Chester, J. M. FACTORS INFLUENCING HUMAN-GRIZZLY BEAR INTERACTIONS IN A BACKCOUNTRY SETTING. Pages 351-357 in: C. J. Martinka and K. L. McArthur, eds. Bears--their biology and management. Fourth Int. Conf. on Bear Research and Management, February 1977, Kalispell, MT. Bear Biology Association. 1980.

Grizzly bear distribution and behavior and human behavior were studied in Yellowstone National Park, Wyoming. Grizzlies used areas with elevations greater than the study area's average trail elevation. On-trail grizzly observations peaked when grizzlies migrated to lower elevations. Some backcountry travelers engaged in activities that could encourage human-bear conflicts (Boyle and Samson 1983).

97. Chester, J. M. HUMAN WILDLIFE INTERACTIONS IN THE GALLATIN RANGE, YELLOWSTONE NATIONAL PARK, 1973-1974. M.S. thesis; Montana State Univ., Bozeman. 114 pp. 1976.

Relationships between human use and the distribution, movements, and behavior of seven species of wildlife in the backcountry of the Gallatin Range, Yellowstone National Park, were investigated. Variation in the intensity of human use was rarely responsible for shifts in wildlife distribution. Wildlife belligerency towards humans was rare, although backcountry travelers tended to engage in activities that could increase detrimental encounters with wildlife (Boyle and Samson 1983).

98. Clark, K. L.; D. L. Euler; and E. Armstrong. PREDICTING AVIAN COMMUNITY RESPONSE TO LAKESHORE COTTAGE DEVELOPMENT. J. Wildl. Manage.; 48(4):1239-1247. 1984.

Breeding songbird species were studied in both developed and undeveloped lakeshore habitat of central Ontario. The findings of this study are presented in a simple model that can be used to assess the negative impact of cottage development.

99. Clark, T. W. *ANALYSIS OF PINE MARTEN POPULATION ORGANIZATION AND REGULATORY MECHANISMS IN JACKSON HOLE, WYOMING. Nat. Geogr. Soc. Research Report; 1982:131-143. 1982.
100. Clark, T. W.; and M. R. Stromberg. *MAMMALS IN WYOMING. Univ. Kan. Pub., Mus. Nat. Hist., Lawrence. 314 pp. 1987.
101. Clark, T. W.; E. Anderson; C. Douglas; and M. Strickland. *MARTES AMERICANA. Mammalian Species No. 289:1-8. 1987.
102. Clark, T. W.; A. H. Harvey, R. D. Dorn; D. L. Genter; and C. Groves, eds. RARE, SENSITIVE, AND THREATENED SPECIES OF THE GREATER YELLOWSTONE ECOSYSTEM. Northern Rockies Conservation Cooperative, Montana Natural Heritage Program, The Nature Conservancy, and Mountain West Environmental Services. 153 pp.. 1989.
- This report gives a description, range, habitat, life history and ecology, and conservation needs of each rare, sensitive, and threatened species (animal and plant) associated with the Greater Yellowstone Ecosystem (GYE).
103. Clark, T.; M. Bekoff; T. M. Campbell; and T. Hauptman. AMERICAN MARTEN, MARTES AMERICANA, HOME RANGES IN GRAND TETON NATIONAL PARK, WYOMING. Canadian Field-Nat.; 103(3):423-425. 1988.
104. Clark, W. S. *THE FIELD IDENTIFICATION OF NORTH AMERICAN EAGLES. Amer. Birds; 37(5):822-826. 1983.
105. Clark, W. S.; and B. K. Wheeler. *PETERSON FIELD GUIDE: HAWKS. Houghton Mifflin, Boston. 198 pp. 1987.

106. Clevenger, G. A.; and G. W. Workman. THE EFFECTS OF CAMPGROUNDS ON SMALL MAMMALS IN CANYONLANDS AND ARCHES NATIONAL PARKS, UTAH. Trans. N. Am. Wildl. Nat. Resour. Conf.; 42:473-484. 1977.

Small mammal studies in 2 National Parks in Utah indicated that campgrounds may have significant effects on populations of small mammals inhabiting them. Additional food available at campgrounds may be partly responsible for larger populations observed in campgrounds (Boyle and Samson 1983).

107. Cochran, B. DELINQUENT DOGS AND DEAD DEER. Outdoor Okla.; 23(11):12-13, 20. 1967.
108. Cole, David N. WILDERNESS RECREATION MANAGEMENT. J. For.; 91(2):224. 1993.
109. Cole, David L. WILDLIFE PRESERVATION AND RECREATIONAL USE: CONFLICTING GOALS OF WILDLIFE MANAGEMENT. Trans. N. Am. Wildl. Nat. Resour. Conf.; No. 5 p. 233-237. 1991.
110. Colorado Division of Wildlife. DOG KILLING DEER PROBLEM GROWS. Outdoor News; Apr. 22. p 2. 1973.
111. Connolly, G. E. *LIMITING FACTORS AND POPULATION REGULATION. Pages 245-285 in: O. A. Wallmo, ed. Mule and Black-tailed deer of North America. Univ. Neb. Press, Lincoln. 1981.
112. Connolly, G. E.; and D. C. Wallmo. *MANAGEMENT CHALLENGES AND OPPORTUNITIES. Pages 537-545 in: O. C. Wallmo, ed. Mule and black-tailed deer of North America. Univ. Neb. Press, Lincoln. 1981.
113. Connor, J. PROTECTING BIRDS OF PREY WITHIN ROCKY MOUNTAIN NATIONAL PARK FROM ROCK CLIMBING AND PARK BOUNDARY DEVELOPMENT. Proc. Issues Technol. Manage. Impacted Wildlife (Thorne Ecol. Inst.); No. 5 p. 14-16. 1991.

114. Conrad, A. H. WILDERNESS PRESERVATION, PLANNING AND MANAGEMENT: AN ANNOTATED BIBLIOGRAPHY. Council of Planning Librarians, Monticello, Ill., Exch. Biblio. 1515. 54 pp. 1978.

*Annotated Bibliography.

115. Corbet, P. S. SNOWMOBILES: FOR PLEASURE, PROFIT, AND POLLUTION. Ont. Nat.; 8(2):10-12. 1970.

Impacts of snowmobiles on urban and rural environments, including effects on wildlife, are discussed in this nontechnical article. Snowmobiles compact snow, changing the physical and thermal properties and thus potentially affecting animals that live beneath snow in winter. Deliberate harassment of wildlife by snowmobilers is uncommon but may be significant. Effective legislation and enforcement are needed to control the impacts of snowmobiles on the environment (Boyle and Samson 1983).

116. Corbett, R. L.; R. L. Marchinton; and C. E. Hill. PRELIMINARY STUDY OF THE EFFECTS OF DOGS ON RADIO-EQUIPPED DEER IN MOUNTAINOUS HABITAT. Proc. S. E. Assoc. Game and Fish Comm. Conf.; 25:69-77. 1971.

117. Corbus, M. MOOSE AS AN AESTHETIC RESOURCE AND THEIR SUMMER FEEDING BEHAVIOR. Am. Moose Conf. Workshop 8:244-273. 1972.

A moose herd in Sibley Provincial Park, Ontario, is described as an appreciative resource used by many campers who go there specifically to view moose. Responses of moose to the presence of humans and aspects of the resource users are discussed (Boyle and Samson 1983).

118. Craig, G. *PEREGRINE FALCON. Pages 807-826 in: Audubon Wildlife Report 1986. The National Audubon Society, Washington, DC. 1986.

119. Craighead, F. C. ,. Jr; and J. J. Craighead. DATA ON GRIZZLY BEAR DENNING ACTIVITIES AND BEHAVIOR OBTAINED BY WILDLIFE TELEMETRY. Pages 84-106 in: S. Herrero, ed. Bears--their biology and management, 6-9 November 1970, Calgary, Alberta. IUCN Publ. New Ser. 23, Morges, Switzerland. 1972.

Denning behavior of telemetered grizzly bears was studied in Yellowstone National Park. Observations suggested that grizzlies do not actively defend dens from other bears or humans if alternate courses of action are available. Most grizzlies apparently prefer to avoid humans; the most dangerous bears are those that have been wounded, sows with cubs, and those that have learned to associate food with humans (Boyle and Samson 1983).

120. Craighead, J. J.; and F. C. Craighead, Jr. GRIZZLY BEAR-MAN RELATIONSHIPS IN YELLOWSTONE NATIONAL PARK. BioScience; 21:845-857. 1971.

Results are reported of 12 years of research on grizzly bears and their relationships with man in Yellowstone National Park and surrounding national forests. The chance for injury from grizzly bears is very small, but grizzly attacks provide exciting news and generate an exaggerated public response, which in turn may initiate over-reactionary bear control measures harmful to bear-human coexistence. Management must be carefully tailored to the facts of bear behavior, while visitors must be willing to accept a small risk (Boyle and Samson 1983).

121. Craighead, J. J.; J. R. Varney; and F. C. Craighead. *A POPULATION ANALYSIS OF THE YELLOWSTONE GRIZZLY BEARS. Mt. For. Cons. Exp. Sta. Bull.; No 40. 40 pp. 1974.

122. Craighead, K. LARGE MAMMALS OF YELLOWSTONE AND GRAND TETON NATIONAL PARKS. Publisher unknown, printed in Canada. 1978.

123. Crockett, A. B.; and P. L. Hansley. *APPARENT RESPONSE OF PICOIDES WOODPECKERS TO OUTBREAKS OF THE PINE BARK BEETLE. Western Birds; 9:67-70. 1978.
124. Crowlet, K.; and M. Link. LOVE OF LOONS. Voyageur Wilderness Books, Voyageur Press, Stillwater, MN. 96 pp.. 1987.
125. Cryer, M.; R. M. Ward; J. O. Stafford; and P. F. Randerson. DISTURBANCE OF OVERWINTERING WILDFOWL BY ANGLERS AT TWO RESEVOIR SITES IN SOUTH WALES. Bird Study; 34:191-199. 1987.
126. Currier, M. J. P. *FELIS CONCOLOR. Mammalian Species No. 200. 7 pp. 1983.
127. Curtis, S. HOW TO TRACK WILDLIFE ON SKIS. Backpacker 2(4): 40-45, 79-80, 83. 1974.

Recommends techniques for approaching wildlife in winter for observation and photography. Warns of negative effects of disturbance on wintering wildlife. Cites snowmobile harassment of ungulates (Ream 1980).

128. Dahlgren, R. B.; and C. E. Korschgen. HUMAN DISTURBANCES OF WATERFOWL. USDI, U.S. Fish Wildl. Serv. Res. Pub. 188. 62 pp. 1992.

Annotated Bibliography.

129. Dalle-Molle, J.; and J. Van Horn. OBSERVATION OF VEHICLE TRAFFIC INTERFERING WITH MIGRATION OF DALL'S SHEEP, OVIS DALLI DALLI, IN DENALI NATIONAL PARK, ALASKA. Canadian Field-Nat.; 105(3);409-411.

Two observations of Dall's sheep groups unsuccessfully attempting to cross the Denali National Park Road, during a seasonal migration, are described. Where the road passes through sheep range, sheep have habituated to the traffic and readily cross. Sheep occupying ranges away from the road must cross the road during

seasonal migrations and have not habituated to traffic, even though the road has been there for 54 years.

130. Daon, K. H. EFFECT OF SNOWMOBILES ON FISH AND WILDLIFE RESOURCES. Conv. Int. Assoc. Game Fish Conserv. Comm.; 60:97-103. 1970.

Increases in demand for snowmobiles and potential impacts on fish and wildlife resources are reviewed. Impacts of snowmobiles are listed as benefits and liabilities; other sections discuss registration, regulation, and education of snowmobile users (Boyle and Samson 1983).

131. Decker, D. POPULATION FLUCTUATIONS AND SPATIAL RELATIONSHIPS AMONG WOLVES, COYOTES, AND RED FOXES IN JASPER NATIONAL PARK, ALBERTA. Can. Field-Nat.; 103(2):261-264. 1989.

Coyote sightings increased in the Athabasca River valley of Jasper National Park, Alberta, increased from 0.13/d in 1980 to 0.91/d in 1984, and decreased to 0.07/d in 1988, coinciding with a fluctuation in the local wolf population. Observations of coyotes and red foxes suggested strong spatial segregation, with coyotes predominant in prey-rich valley bottoms and foxes common only on mountainsides. The authors hypothesized that foxes were unable to utilize valley bottoms because of coyote presence.

132. DeForge, J. R. STRESS: IS IT LIMITING BIGHORN? Trans. Desert Bighorn Council; 20:30-31. 1976.

The bighorn sheep is an ice-age mammal that has become highly specialized, evolving essentially outside the influence of man. Today, however, human encroachment on sheep habitats and disturbance of populations result in stress in bighorns, forcing them to adapt socially. Stress, frequently human-induced, appears to be a major limiting factor in the bighorn's struggle for survival (Boyle and Samson 1983).

133. Dekker, D. DISAPPEARANCE OF THE PEREGRINE FALCON AS A BREEDING BIRD IN A RIVER VALLEY IN ALBERTA. Blue Jay; 25:175-176. 1967.

The author discusses possible factors for the disappearance of falcons from a region in Alberta. Robbing of young by falconers, pesticides, and disturbances by bird watchers and photographers are held to be partly responsible. The disappearance of falcons has been characterized by an apparent shortage of adult birds (Boyles and Samson 1983).

134. Delgiudice, G. D.; F. J. Singer; and U. S. Seal. PHYSIOLOGICAL ASSESSMENT OF WINTER NUTRITIONAL DEPRIVATION IN ELK OF YELLOWSTONE NATIONAL PARK. J. Wildl. Manage.; 55(4):653-664. 1991.

During 13 January-29 March 1988, the authors assessed the extent of nutritional deprivation in cow elk groups on the lower, middle, and upper Northern Range and on the Madison-Firehole Range in Yellowstone National Park by 4 sequential collections and chemical analyses of urine excreted in snow (snow-urine). Throughout winter, snow-urine samples with metabolic profiles indicative of severe energy deprivation and accelerated degradation of lean body tissue were most apparent in areas associated with increased elk density and/or deep snow cover.

135. DeMarchi, R. REPORT AND RECOMMENDATIONS OF THE WORKSHOP ON CALIFORNIA BIGHORN SHEEP. Pages 143-163 in: J. B. Trefethen ed. The wild sheep in modern North America. Boone and Crockett Club and the Winchester Press, NY. 1975.

Objectives and procedures for management of California bighorn sheep for consumptive and nonconsumptive uses are described. Protection of bighorn sheep includes regulating off-road vehicles and human activities such as hiking, camping, picnicking, and sightseeing. Nonconsumptive recreational uses of bighorn sheep are recognized as valuable and important criteria (Boyles and Samson 1983).

136. Denniston, R. H. ECOLOGY, BEHAVIOR AND POPULATION DYNAMICS OF THE WYOMING OR ROCKY MOUNTAIN MOOSE. Zoologica (NY); 41:105-118. 1956.

This report of ecological studies of moose in Wyoming includes sections on man-moose interactions. Moose were found to be tolerant of close observers when no quick motions or loud noises were made. Cases of moose aggression toward people and automobiles are noted (Boyle and Samson 1983).

137. Denny, R. N. THE IMPACT OF UNCONTROLLED DOGS ON WILDLIFE AND LIVESTOCK. Trans. N. Amer. Wildl. and Nat. Resour. Conf.; 39:257-291. 1974.

138. DesGranges, J. L.; and A. Reed. DISTURBANCE AND CONTROL OF SELECTED COLONIES OF DOUBLE-CRESTED COMORANTS IN QUEBEC. Colon. waterbirds; 4:12-19. 1981.

Double-crested comorants nesting in mixed colonies in the St. Lawrence estuary were subjected to various disturbances. Visits to colonies by investigators resulted in significant losses of eggs and young to gull predation. Nests near the colony peripheries and those containing no hatched young suffered the greatest losses.

139. Dey, N. H. STATEWIDE WATERFOWL MANAGEMENT STUDY: COLOR MARKING AND FIELD OBSERVATION OF CANADA GEESE TO DETERMINE BREEDING TERRITORIALISM, FAMILY ORGANIZATION, AND POPULATION DYNAMICS. Utah Wildl. Resour. Div. Proj W-029-R-14/WPG/J01. 8 pp.. 1960.

During population studies of nesting Canada geese in Utah, responses of geese to human disturbance were noted. Some nest desertions appeared to be caused by disturbance, but it was unclear whether the abandonments were related to the presence of the researchers or to low-flying aircraft from a nearby Air Force base.

140. Diem, K. L. WHITE PELICAN REPRODUCTIVE FAILURES IN THE MOLLY ISLANDS BREEDING COLONY IN YELLOWSTONE NATIONAL PARK.
In: R. M. Linn, ed. Proc. of the 1st Conf. on Sci. Res. in the Nat. Parks. National Park Serv. Trans. and Proc. Series No. 5:489-496. 1979.
141. Diem, K. L.; and D. D. Condon. BANDING STUDIES OF WATERBIRDS ON THE MOLLY ISLANDS, YELLOWSTONE LAKE, WYOMING.
Yellowstone Library and Museum Assoc., Yellowstone National Park, WY. 41 pp. 1967.
142. Diem, K. L.; and I. Zeveloff. *PONDEROSA PINE BIRD COMMUNITIES. Pages 170-197 in: R. M. DeGraff (tech. coord.). Management of western forests and grasslands for nongame birds. USDA, U. S. For. Serv. Gen. Tech. Rep: INT-86.
143. Dorrance, M. J.; P. J. Savage; and D. E. Huff. EFFECTS OF SNOWMOBILES ON WHITE-TAILED DEER. J. Wildl. Manage.; 39(3):563-569. 1975.

In studies of white-tailed deer in Minnesota, deer responded to very low intensities of intrusion by man and snowmobiles. Displacement of deer from areas along trails occurred; in some cases changes in home range size and increased movement were observed. It is suggested that the observed disturbances could be detrimental to deer, especially during severe winters.
144. Doucet, G. T. HOUSE CAT AS PREDATOR OF SNOWSHOE HARE. J. Wildl. Manage.; 37(4):591. 1973.
145. Douglas, C. W.; and M. A. Strickland. *FISHER. Pages 511-529 in: M. Novak, J. A. Baker, M. E. Obbard. and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario. 1987.

146. Drent, R. H.; and C. J. Guiguet. A CATALOGUE OF BRITISH COLUMBIA SEABIRD COLONIES. British Columbia Provincial Museum; Victoria, Occ. Pap. 12. 173 pp. 1961.

Distribution and nesting habits of seabirds in British Columbia and impacts of human disturbance at colonies are discussed. The increase in use of motorboats for fishing and touring along the coast has made colonies more accessible; as a result, curious sightseers often frighten adult birds from nests, leading to losses in eggs and young from predation by crows and gulls. Regulation of visitation and public education are necessary to prevent disturbance (Boyle and Samson 1983).

147. Drewien, R. C. *THE SANDHILL CRANE IN WYOMING. Wyoming Wildl.; 37(7):20-25. 1973.
148. Drewien, R. C.; and E. G. Bizeau. *CROSS-FOSTERING WHOOPING CRANES TO SANDHILL CRANE FOSTER PARENTS. Pages 201-222 in: S. A. Temple, ed. Endangered birds: management techniques for preserving threatened species. University Wisconsin Press, Madison. 1979.
149. Drewien, R. C.; and E. G. Bizeau. *STATUS AND DISTRIBUTION OF THE GREATER SANDHILL CRANE IN THE ROCKY MOUNTAINS. J. Wildl. Manage.; 38:720-742. 1974.
150. Drewien, R. C.; and E. Kuyt. *TEAMWORK HELPS THE WHOOPING CRANE. Natl. Geogr.; 155:680-693. 1979.
151. Drewien, R. C.; and E. G. Bizeau. USE OF RADIOTELEMETERY TO STUDY MOVEMENTS OF JUVENILE WHOOPING CRANES. Pages 130-134 in: J. C. Lewis and H. Masatomi, eds. Crane research around the world. International Crane Foundation, Baraboo, WI. 1981.

152. Drewien, R. C.; W. M. Brown; and J. D. Varley. THE GREATER SANDHILL CRANE IN YELLOWSTONE NATIONAL PARK: A PRELIMINARY SURVEY. Pages 27-38 in: J. C. Lewis and J. W. Ziewitz, eds. Proc. 1985 Crane Workshop. Platte River Whooping Crane Maintenance Trust and U.S. Fish and Wildlife Service, Grand Island, NE. 1987.

153. Dunaway, D. J. HUMAN DISTURBANCE AS A LIMITING FACTOR OF SIERRA NEVADA BIGHORN SHEEP. Trans. N. Am. Wild Sheep Conf.; 1:165-173. 1971.

Disturbance caused by human recreation is suggested as a factor limiting populations of bighorn sheep in California. Three populations that have declined were in areas of increased recreational use; two other stable populations have suffered less disturbance by recreationists (Boyle and Samson 1983).

154. Dunning, J. THE LOON: VOICE OF THE WILDERNESS. Yankee Publishing, Dublin, NH. 143 pp. 1985.

155. Dunstan, T. C. THE BIOLOGY OF OSPREYS IN MINNESOTA. Loon; 45:108-113. 1973.

Results of 10 years of osprey research are summarized. While the effects of human disturbance to osprey productivity are difficult to evaluate, observations suggest that ospreys are sensitive to human interference, especially during incubation. Some nest abandonments have followed increased summer recreational use of the areas by boaters and fishermen (Boyle and Samson 1983).

156. Dunstan, T. C. BREEDING SUCCESS OF OSPREY IN MINNESOTA FROM 1963 TO 1968. Loon; 40:109-112. 1968.

The author reports results of his own studies plus observations gathered from several sources concerning osprey breeding success in Minnesota. Records indicate that human disturbance is a significant factor in reducing osprey productivity. Disturbances by direct shooting and by chilling or overheating of eggs when

adults are frightened from nests are recorded (Boyle and Samson 1983).

157. Dwernychuk, L. W.; and D. A. Boag. HOW VEGETATIVE COVER PROTECTS DUCK NESTS FROM EGG-EATING BIRDS. J. Wildl. Manage.; 36:955-958. 1972.

The importance of vegetative cover in protecting duck nests from avian predators was studied in Alberta. Human disturbance can lead to egg predation when adults are flushed from nests, but avian predators located even well-hidden artificial nests. Disturbance of vegetation around nests by humans apparently provides a visual clue aiding avian predators in locating unattended duck nests (Boyle and Samson 1983).

158. Eckstein, R. G.; T. F. O'Brien; O. J. Rongstad; and J. G. Bollinger. SNOWMOBILE EFFECTS ON MOVEMENTS OF WHITE-TAILED DEER: A CASE-STUDY. Environ. Conserv.; 6:45-51. 1979.

Effects of snowmobiles on winter home ranges, movements, and activity patterns of white-tailed deer were studied in Wisconsin. Daily activity patterns, home range size, and habitat use were little affected by snowmobiles. the impact of snowmobiles on deer appears to be minimal, but routing trails away from deer concentration areas in winter is suggested (Boyle and Samson 1983).

159. Edge, W. D.; and C. L. Marcum. MOVEMENTS OF ELK IN RELATION TO LOGGING DISTURBANCES. J. Wildl. Manage.; 49(4):926-930. 1985.

The objective of this study was to quantify the home ranges of nonmigratory cow elk, and to assess the effect of logging activities on home-range fidelity in the Chamerlain Creek area about 56 km east of Missoula, Montana. Results of the study indicate that cow elk will not abandon traditional home ranges because of logging activity when extensive areas of cover remain within their home range. Disturbances may alter habitat selection by increasing use of areas that

provide cover, but this will occur within the traditional home range. In areas where cover is limited, logging activity may increase home-range size and reduce home-range fidelity. If closed areas are provided adjacent to all sides of active logging sales, disturbed home ranges will more likely contain security zones for elk. Logging activities that are restricted as much as possible in time and space, or conducted on seasonal ranges during when the elk are not present, will be least disruptive.

160. Edge, W. D.; C. L. Marcum; and S. L. Olson. EFFECTS OF LOGGING ACTIVITIES ON HOME-RANGE FIDELITY OF ELK. J. Wildl. Manage.; 49(3):741-744. 1985.
161. Edington, J. M.; and A. M. Edington. ECOLOGY, RECREATION AND TOURISM. Cambridge Univ. Press, Cambridge. 200 pp. 1986.
162. Ehrlich, P. R.; D. S. Dobkin; and D. Wheye. *THE BIRDER'S HANDBOOK: A FIELD GUIDE TO THE NATURAL HISTORY OF NORTH AMERICAN BIRDS. Simon and Schuster Inc. 785 pp. 1988.
163. Elder, J. M. HUMAN INTERACTIONS WITH SIERRA NEVADA BIGHORN SHEEP: THE MOUNT BAXTER HERD. M.S. thesis; Univ. of Michigan, Ann Arbor. 93 pp. 1977.

A project begun in 1976 studied human disturbance of bighorn sheep in California. Human use of the area included backpacking and climbing. Hikers camped in very limited areas associated with the trail, water, and trees; climbers had the greatest potential effects on sheep. the levels of intrusion did not appear to be adversely affecting sheep, but if the number is allowed to increase the effects on sheep should be closely monitored (Boyle and Samson 1983).

164. Enderson, J. H.; and J. Craig. STATUS OF THE PEREGRINE FALCON IN THE ROCKY MOUNTAINS. Auk; 91:727-736. 1974.

Factors responsible for an apparent decline in the numbers of peregrine falcons in the central Rocky Mountains are discussed. Pesticides appear to be the major factor; human disturbances such as rock climbing, picknicking, and highways may be important locally but are not widespread enough to explain the general decline (Boyle and Samson 1983).

165. Erwin, R. M. BREEDING HABITAT USE BY COLONIALY NESTING WATERBIRDS IN TWO MIDWESTERN ATLANTIC REGIONS UNDER DIFFERENT REGIMES OF HUMAN DISTURBANCE. Biol. Cons.; 18:39-51. 1980.
166. Erwin, R. M. RESPONSES TO HUMAN INTRUDERS BY BIRDS NESTING IN COLONIES: EXPERIMENTAL RESULTS AND MANAGEMENT GUIDELINES. Colonial Waterbirds; 12:104-108. 1989.
167. Escherich, P. C.; and L. Blum, eds. *PROC. BOBCAT RESEARCH CONF. National Wildlife Federation Scientific and Technical Series 6, Washington, DC. 1979.
168. Evans, D. L. *STATUS REPORTS ON TWELVE RAPTORS. USDI, U.S. Fish Wildl. Serv. Special Sci. Rep. No. 238, Washington, DC. 68 pp. 1982.
169. Evans, R. D.; and C. W. Wolfe. EFFECTS OF NEST SEARCHING ON FATES OF PHEASANT NESTS. J. Wildl. Manage.; 31:754-759. 1967.

Data from 1,276 pheasant nests were analyzed to determine the effect of nest searching on nest fate. Nests where a visit resulted in the hen flushing had the highest abandonment rate, and nests where a hen was present during the visit but did not flush had the highest percent success. However, active nest visits compared to nests terminated before the visit suggested that nest visitation had a negligible effect on nest fate (Boyle and Samson 1983).

170. Fancy, S. G.; and R. G. White. ENERGY EXPENDITURES BY CARIBOU WHILE CRATERING IN SNOW. J. Wildl. Manage.; 49(4):987-993. 1985.

The rate of energy expenditure by caribou digging in snow for lichens was determined by heart rate telemetry and an analysis of cratering mechanics. Based on a significant linear relationship between energy expenditure and heart rate, the mean cost per digging stroke in light, uncrusted snow was 118 J, whereas in denser (0.36 g/sq.cm) snow with a thin, hard crust the mean cost was 219 J/stroke. The cost of cratering through snow compacted by a snowmobile was 481 J/stroke. A comparison of metabolic and mechanical energy required for cratering suggested that caribou have evolved an energetically-efficient mechanism for obtaining food from beneath the snow layer.

171. Fenton, M. B.; and G. P. Bell. *ECHOLOCATION AND FEEDING BEHAVIOR OF FOUR SPECIES OF MYOTIS (CHIROPTERA). Can. J. Zool.; 57:1271-1277. 1979.
172. Fenton, M. B.; C. C. Tennant; and J. Wyszecski. *A SURVEY OF THE DISTRIBUTION OF EUDERMA MACULATUM THROUGHOUT ITS KNOWN RANGE IN THE UNITED STATES AND CANADA BY MONITORING ITS AUDIBLE ECHOLOCATION CALLS. Report to USDI. U.S. Fish and Wildlife Service, Albuquerque. 20pp. 1983.
173. Ferguson, M. A.; and L. B. Keith. INTERACTIONS OF NORDIC SKIERS WITH UNGULATES IN ELK ISLAND NATIONAL PARK. Alberta Fish Wildl. Div. Wildl. Tech. Bull.; No. 6 31pp. 1981.
174. Fernandez, C.; and P. Azkona. HUMAN DISTURBANCE AFFECTS PARENTAL CARE OF MARSH HARRIERS AND NUTRITIONAL STATUS OF NESTLINGS. J. Wildl. Manage.; 57(3):602-608. 1993.

The authors studied the effects of human disturbance on parental care by marsh harriers (*Circus aeruginosus*) in spring 1991 at Dos Reinos Lake, Ebro Valley, Spain. They assessed changes in reproductive activities and nutritional condition of nestlings due to low-level

human disturbance during incubation and nestling phases. The number of food items delivered and the time spent by males and females in the nesting area and on the nest decreased during disturbed periods, especially during incubation, whereas behaviors related to stress (alarm calls, chases against other intruding birds, and percentage flying time) increased. Although annual productivity of the disturbed pairs was not affected, nestlings of disturbed birds exhibited levels of blood urea that were higher than those of undisturbed pairs. Thus, minor human disturbances may cause long-term effects on lifetime reproductive success of birds by increasing energy and time expenditure in non-reproductive activities and by reducing condition of nestlings.

175. Findholt, S. L. NEW AMERICAN WHITE PELICAN NESTING COLONY IN WYOMING. *Western Birds*; 17:136-138. 1986.
176. Findholt, S. L. STATUS AND DISTRIBUTION OF HERONS, EGRETS, IBISES AND RELATED SPECIES IN WYOMING. *Colonial Waterbirds*; 7:55-62. 1984.
177. Findholt, S. L.; and K. L. Diem. STATUS AND DISTRIBUTION OF AMERICAN WHITE PELICAN COLONIES IN WYOMING: AN UPDATE. *Great Basin Nat.*; 48:285-289. 1988.
178. Findholt, S. L.; and K. L. Berger. UPDATE ON THE STATUS AND DISTRIBUTION OF COLONIALY NESTING WATERBIRDS IN WYOMING. *Nongame Special Report, Wyoming Game and Fish Dept.* 40 pp. 1987.
179. Fitts-Cochrane, J. LONG-BILLED CURLEW HABITAT AND LAND USE RELATIONSHIPS IN WESTERN WYOMING. M.S. thesis; Univ. Wyo., Laramie. 136 pp. 1983.
180. Forbis, L. A.; T. G. Grubb; and W. E. Zeedyk. A VOLUNTEER BALD EAGLE NEST WATCH PROGRAM ON ARIZONA NATIONAL FORESTS. pp. 246-254; in: *Proc. of Bald Eagle Days*; J. M. Gerrard and T. N. Ingram eds; The Eagle Foundation, Apple River, IL. 1985.

181. Foresman, K. R. *SOREX HOYI IN IDAHO: A NEW STATE RECORD. Murrelet; 67:81-82. 1987.
182. Franklin, A. B. *BREEDING BIOLOGY OF THE GREAT GRAY OWL IN SOUTHEASTERN IDAHO AND NORTHWESTERN WYOMING. Condor: 90:689-696. 1988.
183. Fraser, J. D.; L. D. Frenzel; and J. E. Mathisen. THE IMPACT OF HUMAN ACTIVITIES ON BREEDING BALD EAGLES IN NORTH-CENTRAL ILLINOIS. J. Wildl. Manage.; 49:585-592. 1985.
184. Fraser, J. D.; L. D. Frenzell; and J. E. Mathisen. THE IMPACT OF HUMAN ACTIVITIES ON BREEDING BALD EAGLES IN NORTH-CENTRAL MINNESOTA. J. Wildl. Manage.; 49(3):585-592. 1985.

The impacts of human activities and eagle management practices on bald eagle nesting biology were studied on Chippewa National forest in north-central Minnesota. Nests built on developed shoreline were farther away from water than nests built on undeveloped shoreline. Breeding eagles flushed at 57-991 m at the approach of a pedestrian. Fixed-wing aircraft passing 20-200 m from nests did not flush incubating or brooding eagles. The authors found no evidence that, under present management policies, human activities have an important impact on bald eagle reproductive success on the Chippewa National Forest.

185. Freddy, D. J. DEER-ELK INVESTIGATIONS: SNOWMOBILE HARASSMENT OF MULE DEER ON COLD WINTER RANGES. Colo. Div. Wildl Project W-038-R-32/WP14/J11. 15 pp.. 1977.

Two semi-tame telemetered mule deer were experimentally harassed by one person, two persons, person plus a dog, and a snowmobile at various distances. Deer reactions to harassment were noted. Heart rate measured by telemetry was found to be sensitive measure of disturbance (Boyle and Samson 1983).

186. Freddy, D. J.; W. M. Bronaugh; and M. C. Fowler. RESPONSES OF MULE DEER TO DISTURBANCE BY PERSONS AFOOT AND SNOWMOBILES. Wildl. Soc. Bull.; 14:63-68. 1986.

The objectives of this study in north-central Colorado were to compare overt behavioral responses of adult female mule deer reacting to persons afoot or snowmobiles during controlled disturbance trials and to monitor their survival and fecundity. The tendency for flight distances to increase when deer exhibited multiple flight responses to persons afoot suggested that deer did not readily habituate to disturbance and these responses were longer in duration, involved running more frequently, and were greater in estimated energy expenditure. Minimizing all responses by deer would require persons afoot and snowmobiles to remain >334 m and > 470 m from deer, respectively. The authors concluded that their disturbance study did not markedly affect the mortality or fecundity of adult female deer.

187. French, J. M.; and J. R. Koplin. DISTRIBUTION, ABUNDANCE, AND BREEDING STATUS OF OSPREYS IN NORTHWESTERN CALIFORNIA. Pages 223-240 in: J. C. Ogden, ed. Trans. of the N. Am. Osprey Res. Conf.; 10-12 February 1972, Williamsburg, VA. U.S. Natl. Park Serv. Trans. Proc. Ser. 2. 1972.

Data are presented concerning abundance and reproduction of ospreys in California. Factors influencing fledgling productivity are discussed, including human disturbance. Logging and shooting were found to seriously affect nesting ospreys, but there was no indication that recreational activities including sightseeing, camping, fishing, and swimming were detrimental to breeding success of ospreys (Boyle and Samson 1983).

188. Fyfe, R. THE PEREGRINE FALCON IN NORTHERN CANADA. Pages 101-114 in: J. J. Hickey, ed. Peregrine falcon populations: their biology and decline. Univ. of Wisconsin Press, Madison. 1969.

Recent evidence suggests that the peregrine remains a common breeding bird in northern Canada, although a local decline was attributed to human disturbance. Human interference with peregrines near northern settlements is a possible decimating factor.

189. Fyfe, R. W.; and R. R. Olendorff. MINIMIZING THE DANGERS OF NESTING STUDIES TO RAPTORS AND OTHER SENSITIVE SPECIES. Canadian Wildlife Serv, Occ. Paper Number 23 (17pp). 1976.

Problems associated from human interference with the nests of sensitive bird species, principally raptors, are discussed. these include desertion of nests by frightened adults with consequent threats to young, and problems related to mishandling and photographing young in nests. Possible solutions to problems are outlined (Boyle and Samson 1983).

190. Garber, D. P. OSPREY NESTING ECOLOGY IN LASSEN AND PLUMAS COUNTIES, CALIFORNIA. M.S. thesis; Humboldt State Univ., Arcata. CA. 59 pp. 1972.

Nesting efforts of ospreys were studied in northwestern California. Major cases of nesting failure was high winds and eggshell breakage, but human disturbance was responsible for 33% of observed egg losses. In one case, campers caused adult osprey to abandon a nest with eggs. During fledgling counts young ospreys sometimes flew from nests, apparently for the first time. Such early flights may increase the incidence of injury and predation of fledglings (Boyle and Samson 1983).

191. Garton, E. O.; C. W. Bowen; and T. C. Foin, Jr. THE IMPACT OF VISITORS ON SMALL MAMMAL COMMUNITIES OF YOSEMITE NATIONAL PARK. Pages 44-50 in: T. C. Foin, Jr. ed. Visitor impacts on National Parks: The Yosemite ecological impact study. Univ. California, Davis, Inst. Ecol. Publ. 10. 1977.

Visitor use of meadow and forest sites in Yosemite National Park was related to the distribution and abundance of small mammals. Deer mouse populations apparently increase in response to human use of forested areas, while mountain vole populations showed no relationship to human use except for gross habitat alterations such as meadow draining. Data for other small mammals were insufficient to determine relationships with human use (Boyle and Samson 1983).

192. Gasoway, W. C.; R. O. Peterson; J. L. Davis; P. E. K. Shepard; and O. E. Burns. *INTERRELATIONSHIPS OF WOLVES, PREY, AND MAN IN INTERIOR ALASKA. Wildl. Monogr. No. 84. 50 pp. 1983.
193. Gavit, J. D. DISTURBANCE EFFECT OF FREE-RUNNING DOGS ON DEER PRODUCTION. M.S. thesis; Virginia Poly. Inst. and State Univ., Blacksburg. 53 ppp. 1973.
194. Gavrin, V. F. EFFECT OF ANXIETY FACTOR ON GAME FOWL PRODUCTIVITY. Pages 401-403 in: I. Kjerner and P. Bjurholm, eds. Proc. XIth Int. Cong. of Game Biologists, 3-7 September 1973, Stockholm, Sweden. National Swedish Environmental Protection Board, Stockholm. 1974.

Effects of stress on waterfowl and grouse was studied in the USSR. Recreational activities in bird habitats disturb daily activity patterns and alter the behavior of birds. Disturbance causes additional predation pressures and losses of young to starvation; disrupted timing of breeding lowers female fertility and increases the number of inferior birds in the population (Boyle and Samson 1983).

195. Geist, V. A BEHAVIORAL APPROACH TO THE MANAGEMENT OF WILD UNGULATES. Pages 413-424 in: E. Duffy and A. S. Watts, eds. The scientific management of animal and plant communities for conservation. Symp. British Ecol. Soc. 11. Blackwell Sci. Publ., Oxford. 1971.

196. Geist, V. BIGHORN SHEEP ECOLOGY. Wildl. Soc. News; 136:61. 1971.

In a letter to the editor, the author explains physiological and energetic concerns related to increased activity of bighorn sheep following removal of old rams from populations. Harassment of sheep and other animals by a combination of hunting and hiking/wildlife viewing may be fatal to sheep (Boyle and Samson 1983).

197. Geist, V. HARRASSMENT OF LARGE MAMMALS AND BIRDS: WITH A CRITIQUE OF THE RESEARCH SUBMITTED BY ARCTIC GAS STUDY LTD. ON THIS SUBJECT. Report to the Berger Commission 64pp. 1975.

198. Geist, V. IS BIG GAME HARASSMENT HARMFUL? Oilweek; 22(17): 12-13. 1971.

Harassment of North American big game is considered in terms of animal energy budgets and physical damage. Energy "costs" of harassment are calculated as energy expended above and beyond normal daily expenditures. Chronic harassment may result in reduced reproductive rates and increased mortality (Boyle and Samson 1983).

199. Geist, V. ON THE BEHAVIOR OF THE NORTH AMERICAN MOOSE IN BRITISH COLUMBIA. Behavior; 20:377-416. 1963.

Calf and yearling moose are sometimes quite tame when adults are absent. The sight of man at close range causes most animals to run; however, there is considerable variation among individual moose. Cites case where moose did not take flight even when one of the group was shot. Intense feeding often occurs after disturbance has passed (Ream 1980).

200. Genter, D. L. *STATUS OF THE SPOTTED BAT (EUDERMA MACULATUM) IN THE PRYOR MOUNTAINS OF SOUTHCENTRAL MONTANA. Report to USDA, U.S. For. Serv., Custer National Forest, Billings. 17 pp. 1988.
201. Genter, D. L.; and L. H. Metzgar. *SURVEY OF THE BAT SPECIES AND THEIR HABITAT USE IN GRAND TETON NATIONAL PARK. Page 65-69 in: Wyoming-National Park Service Research Center, 9th Annual Report. 1985.
202. Genter, D. L. *WINTERING BATS OF THE UPPER SNAKE RIVER PLAIN: OCCURENCE IN LAVA TUBE CAVES. Great Plains Nat.; 46:241-244. 1986.
203. George, J. L.; C. E. Braun; R. A. Ryder and E. Decker. RESPONSE OF WATERBIRDS TO EXPERIMENTAL DISTURBANCES. Proc. Issues Technol. Manage. Wildl. (Thorne Ecol. Inst.); No. 5, pp 52-59. 1991.
204. Gerrard, J. M.; and G. R. Bortolotti. *THE BALD EAGLE: HAUNTS AND HABITS OF A WILDERNESS MONARCH. Smithsonian Institution Press, Washington, DC. 177 pp. 1988.
205. Gese, E. M.; O. J. Rongstad; and W. R. Mytton. CHANGES IN COYOTE MOVEMENTS DUE TO MILITARY ACTIVITY. J. Wildl. Manage.; 53(2):334-339. 1989.

The authors investigated the response of coyotes to military activity on the Pinon Canyon Maneuver Site, Colorado, during 1984-86. Sixteen coyotes responded to military activity by expanding, contracting, abandoning, or not changing their home range during military maneuvers compared to before and after maneuvers. Three coyote abandoned their home ranges, with 1 animal returning to its original home range 1 week after maneuvers. Most coyotes that expanded their ranges during military maneuvers resumed their original home range after military maneuvers ceased. Responses appeared to be related to the amount of available cover, topography, and intensity of military activity in a coyote's home range. Coyote activity patterns during the day increased, while activity at sunrise,

sunset, and night remained the same during military activity.

206. Giles, J. W. BEAR FACTS. Am. For.; 69(7):26. 1963.

An incident in Yellowstone National Park is described in which a park visitor was bitten on the arm by a black bear. In a subsequent court case, it was ruled that the U. S. Government had used ordinary and reasonable care in providing for the safety of park visitors, and owed the visitor no compensation for the injury. The author suggests that park visitors should keep windows closed and doors locked while in bear country.

207. Giles, R. H. ,. Jr. THE FREE-RUNNING DOG. Virginia Wildl.; 21(6):6-7. 1960.

208. Gill, J. D.; R. M. DeGraff; and J. W. Thomas. FOREST HABITAT MANAGEMENT FOR NON-GAME BIRDS IN CENTRAL APPALACHIA. USDA; U.S. Forest Service; U. S. For. Serv. Res. Note NE-192. 6 pp. 1974.

Management objectives and procedures to facilitate enjoyment of nongame birds are discussed. Managing for people with slight to moderate knowledge of birds and to induce a high diversity of species to inhabit areas near trails and other human activity areas is recommended. Managed trails must also provide for the protection of bird habitats from trail users (Boyle and Samson 1983).

209. Glinski, R. L. BIRDWATCHING ETIQUETTE: THE NEED FOR A DEVELOPING PHILOSOPY. Am. Bird; 30:655-657. 1976.

Examples of disturbance to nongame birds by bird watchers are used to indicate a need to manage bird watching. Disturbance can cause lowered survival and reproduction of birds due to increased energy expenditures, behavior alteration, abandonment of nests, or loss of eggs and young to chilling, overheating, or predation. A behavioral code for bird

watchers is proposed to regulate personal activities (Boyle and Samson 1983).

210. Goldsmith, F. B. ECOLOGICAL EFFECTS OF VISITORS IN THE COUNTRYSIDE. Pages 217-231 in: A. Warren and F. B. Goldsmith, eds. Conservation in practice. Wiley and Sons, London. 1974.

Ecological effects of recreation are reviewed, including impacts on wildlife. Sections discuss carrying capacity, characteristics of ecosystems, succession, visitor distribution, effects of trampling, direct research on ecological effects of recreation, and management (Boyle and Samson 1983).

211. Gooders, J. WILDLIFE AND TOURISM. Birds Int.; 1:21-23, 27. 1975.

Wildlife tourism is described as a modern and expanding business. direct and indirect benefits of tourism to wildlife conservation are contrasted with impacts including disturbance to wildlife. The author suggests that tourism will continue to expand, and that steps should be taken to minimize disturbances to wildlife (Boyle and Samson 1983).

212. Goodrich, J. M.; and J. Berger. WINTER RECREATION AND HIBERNATING BLACK BEARS *URSUS AMERICANUS*. Biol. Conserv.; 67(2): 105-110. 1994.

213. Goodson, N. J. STATUS OF BIGHORN SHEEP IN ROCKY MOUNTAIN NATIONAL PARK. M.S. thesis; Colorado State Univ., Fort Collins. 190 pp. 1978.

During studies of bighorn sheep in Rocky Mountain National Park, Colorado, sheep interactions with people were noted. In areas where sheep were accustomed to seeing people, they tolerated people if approached gradually and not too closely; however, on several occasions sheep were driven from feeding areas or mineral licks by visitors. Sheep in backcountry areas were more wary (Boyle and Samson 1983).

214. Grace, E. S. INTERACTIONS BETWEEN MEN AND WOLVES AT AN ARCTIC OUTPOST ON ELLESMERE ISLAND. Can. Field Nat.; 90(2):149-156. 1976.

Reports records of wolf-man interactions from early years at the arctic weather station and compares with present wolf behavior. Wolves generally avoided humans and domestic dogs. Most wolves were seen at or near the settlement dump. Due to the negative effects of dumps on wolf behavior and ecology, the author suggests garbage be incinerated or fenced off (Ream 1980).

215. Graham, H. ENVIRONMENTAL ANALYSIS PROCEDURES FOR BIGHORN IN THE SAN GABRIEL MOUNTAINS. Trans. Desert Bighorn Counc.; 15:38-45. 1971.

Graphic analysis was used to evaluate bighorn habitat in California. Human use impacts were portrayed on overlays and compared to bighorn distributions and other habitat characteristics. Human recreational use has caused sheep to avoid certain areas. Light use has little effect on sheep distributions, but heavier use (500-900 visitor-days per summer season) causes bighorns to move from their historic range (Boyle and Samson 1983).

216. Graham, H. MULTIPLE USE COORDINATION ON THE SAN GORGONIO BIGHORN UNIT. Trans. Desert Bighorn Counc.; 10:71-77. 1966.

Multiple use management of a California national forest area containing bighorn sheep is discussed. The authors explain the rationale and methodology of multiple use, and describes various land uses and their coordination with bighorn management. Proposals for massive recreational developments have been rejected because of perceived incompatibility with preservation of key bighorn habitats (Boyle and Samson 1983).

217. Grahm, H. THE IMPACT OF MODERN MAN. Pages 288-309 in: G. Monson and L. Sumner, eds. The desert bighorn: Its life history, ecology, and management. Univ. of Arizona Press, Tuscon. 1980.

The history of man's relationship with bighorn sheep and current impacts of man on sheep are reviewed. Effects of hiking, horseback riding, motor vehicles, motorboats, ski lifts and tramways, aircraft, noises, and dogs are discussed. Human-caused habitat alterations are related to tolerance of sheep to intrusions (Boyle and Samson 1983).

218. Graul, W. D. *ADAPTIVE ASPECTS OF THE MOUNTAIN PLOVER SOCIAL SYSTEM. Living Bird; 12:69-94. 1973.

219. Graul, W. D. *BREEDING BIOLOGY OF THE MOUNTAIN PLOVER. Wilson Bull.; 87:6-31. 1975.

220. Graul, W. D. POPULATION SURVEYS OF SELECTED BIRD AND MAMMAL SPECIES IN COLORADO. Pages 84-129 in: Colorado Division of Wildlife, Wildl. Res. Rep., January 1981, Part 1, Project FW-22-R/WP01/J03. 1981.

Nongame bird and mammal studies in Colorado included investigations of the effects of human disturbance on great blue herons. Disturbance at heronries was quantified as to the type of intrusion, location of intrusion relative to nests, and reactions of herons to the intrusion. The birds remained sensitive to disturbance throughout the breeding season, but none permanently abandoned the colony following disturbance. Birds were usually most active at times when human use of the area was lowest (Boyle and Samson 1983).

221. Graul, W. D.; and L. E. Webster. *BREEDING STATUS OF THE MOUNTAIN PLOVER. Condor; 78:265-267. 1976.

222. Gray, J. R. KINDS AND COSTS OF RECREATIONAL POLLUTION IN THE SANDIA MOUNTAINS. New Mexico State Univ., Las Cruces, Agric. Exp. Sta. Bull. 651. 57 pp. 1977.

Environmental costs of recreation in the Sandia Mountains, New Mexico, were quantified by surveying recreationists, identifying associated pollutants and environmental impacts, and calculating costs of their control. Wildlife harassment, primarily by hikers, was among impacts that tended to restrict activities most in a cost analysis model. Nature study and hunter groups were determined as having the highest cost per hour (Boyle and Samson 1983).

223. Greater Yellowstone Coordinating Committee. AN AGGREGATION OF NATIONAL PARK AND NATIONAL FOREST MANAGEMENT PLANS. A cooperative project of the NPS and NFS. 1987.

224. Greater Yellowstone Bald Eagle Working Team. A BALD EAGLE MANAGEMENT PLAN FOR THE GREATER YELLOWSTONE ECOSYSTEM. Wyoming Game and Fish Dept., Cheyenne. 82 pp. 1983.

225. Greater Yellowstone Bald Eagle Working Team. SIX-YEAR SUMMARY PRODUCTION REPORT FOR THE GREATER YELLOWSTONE ECOSYSTEM. Compiled and edited by Bob Jones and Russ McFarling, U.S. Bur. Land Manage., Idaho Falls, ID. 1989.

226. Grier, J. W. BALD EAGLE BEHAVIOR AND PRODUCTIVITY RESPONSES TO CLIMBING TO NESTS. J. Wildl. Manage.; 33:961-966. 1969.

Data are presented concerning behavior and productivity of bald eagles in response to climbing to nests in Ontario. No evidence was found of changes in bald eagle productivity resulting from single climbs to nests when young were from 2 to 11 weeks old.

227. Grier, J. W.; J. B. Elder; F. J. Gramlich; N. F. Green; J. V. Kussman; J. E. Mathisen; and J. P. Mattsson. NORTHERN STATES BALD EAGLE RECOVERY PLAN. USDI; Fish and Wildlife Service. 1983.

228. Groves, C. R. *DISTRIBUTION OF THE WOLVERINE IN IDAHO AS DETERMINED BY MAIL QUESTIONNAIRE. Northw. Sci.; 62(4): 181-185. 1988.

229. Grubb, T. G. NESTING BALD EAGLE ATTACK RESEARCHER. Auk; 93: 842-843. 1976.

While studying bald eagles on the Kodiak National Wildlife Refuge, Alaska, a researcher was attacked by a pair of eagles. While climbing a tree to reach an eagle nest, the researcher was struck with some force on the back by one of the eagles; both birds repeatedly flew very close but did not strike again (Boyle and Samson 1983).

230. Grubb, T. G.; and R. M. King. ASSESSING HUMAN DISTURBANCE OF BREEDING BALD EAGLES WITH CLASSIFICATION TREE MODELS. J. Wildl. Manage.; 55(3):500-511. 1991.

The researchers recorded 4,188 events of human activity and associated bald eagle response in the vicinity of 13 central Arizona nest sites during 1983-1985. A hierarchical classification of 9 dependent parameters and 3 independent parameters was developed to quantify pedestrian, aquatic, vehicle, noise (gunshot/sonic boom), and aircraft disturbance groups. Type and frequency of response varied inversely with the distance from an eagle to the disturbance. Bald eagles were more often flushed from perches than nests and were most easily disturbed when foraging. Pedestrian was the most disturbing human activity, whereas aircraft was the least. A classification tree (CART) model was developed for pooled and group disturbances to evaluate response severity and to formulate disturbance-specific management criteria...The CART models ranked distance to disturbance as the most important classifier of eagle response, followed in decreasing order of discriminatory value by duration of disturbance, visibility, number of units per event, position relative to affected eagle, and sound. This procedure offers improved specificity in human disturbance assessment.

231. Grubb, T. G.; W. W. Bowerman; J. P. Geisy; and G. A. Dawson. RESPONSES OF BREEDING BALD EAGLES, *HALIAEETUS LEUCOCEPHALIS*, TO HUMAN ACTIVITIES IN NORTHCENTRAL MICHIGAN. *Canadian Field-Nat.*; 106(4):443-453. 1992.

The authors recorded 714 events of potentially disturbing human activity near six pairs of Bald Eagles breeding in northcentral Michigan in 1990. Vehicles and pedestrians elicited the highest response frequencies, but aircraft and aquatic activities were the most common. Magnitude of response was inversely proportional to median distance-to-disturbance. Seventy-five percent of all alert and flight responses occurred when activity was within 500m and 200m, respectively. Adults responded more frequently than nestlings, and at greater distance-to-disturbance when perched away from nests. May was the peak month for human activity, most of which occurred on weekends (60%) and afternoon (72%). Classification tree (CART) models are used to assess disturbance-specific response frequencies and to formulate management considerations.

232. Guth, R. W. FOREST AND CAMPGROUND BIRD COMMUNITIES OF PENINSULA STATE PARK, WISCONSIN. *Passenger Pigeon*; 40: 489-493. 1978.

A study in Door County, Wisconsin, compared bird populations of mature forests, forest edge, and altered campground sites. Bird density and species diversity were least in forest sites, and greatest in campgrounds. Birds in campgrounds represented a greater percentage of common and widespread species, whereas several rare forest species were absent (Boyle and Samson 1983).

233. Guth, R. W. THE JUNK FOOD GUILD: BIRDS AND MAMMALS ON PICNIC GROUNDS AND IN RESIDENTIAL AREAS. *Ill. Audubon Bull.*; 189:3-7. 1979.

Birds and mammals of the junk food guild benefit from human recreation by finding scraps of food in picnic grounds of parks and forest preserves. Experiments in urban areas near Chicago, Illinois, revealed aspects of

foraging behavior and food selection by residential area birds (Boyle and Samson 1983).

234. Gutzwiller, K. J. ASSESSING RECREATIONAL IMPACTS ON WILDLIFE: THE VALUE AND DESIGN OF EXPERIMENTS. Trans. N. Am. Wildl. Nat. Res. Conf.; 56:248-255. 1991.
235. Gutzwiller, K. J. SERIAL MANAGEMENT EXPERIMENTS: AN ADAPTIVE APPROACH TO REDUCE RECREATIONAL IMPACTS ON WILDLIFE. Trans. N. Am. Wildl. and Nat. Resour. Conf.; 58:528-536. 1993.
236. Haber, G. C. EIGHT YEARS OF WOLF RESEARCH AT MCKINLEY PARK. Alaska; 39(4):43-45, 59, 53-56. 1973.

These popular articles summarize research results and observations concerning wolves in Mount McKinley National Park, Alaska. Wolf social systems, behavior, and relationships to prey species and humans are discussed.

237. Hamerstrom. F.; D. D. Berger; and F. N. Hamerstrom. THE EFFECT OF MAMMALS ON PRAIRIE CHICKENS ON BOOMING GROUNDS. J. Wildl. Manage.; 29:536-542. 1965.

Studies in Wisconsin examined reactions of greater prairie chickens to mammalian predators and humans. Prairie chickens were disturbed most by people, including farmers, fishermen, and bird watchers. Persons on foot walking towards or near the booming ground appeared to cause birds to flush from a greater distance than from any other mammal. Birds were disturbed more by dogs and livestock than by native foxes and deer (Boyle and Samson 1983).

238. Hamerstrom, F. THINK WITH A GOOD NOSE NEAR A NEST. Raptor Res. News; 4:79-80. 1970.

The author suggests the possibility that scent trails left by humans visiting raptor nests may attract predators. Methods to reduce nest predation by human disturbance are listed.

239. Hammitt, W. E.; J. N. Dulin; and G. R. Wells. DETERMINANTS OF QUALITY WILDLIFE VIEWING IN GREAT SMOKY MOUNTAINS NATIONAL PARK. Wildl. Soc. Bull.; 21:21-30. 1993.

Factors affecting the quality of wildlife viewing for 384 visitors to Cades Cove, Great Smoky Mountains National Park, were surveyed. Wildlife visibility potential, visual encounters with wildlife, visitor expectation and preference standard toward visual encounters, importance of type and number of animals seen, and viewer behavior were regressed on quality of wildlife viewing during an 18 km auto tour. Respondents rated quality of viewing high, with most visitors seeing 5 or more types of wildlife, and nearly everyone seeing white-tailed deer. Expectations toward the the variety and total numbers of animals seen, preference standards toward seeing black bears, and the viewing behaviors of stopping the car and using binoculars to enhance viewing were the best predictors of a quality wildlife viewing experience.

240. Hammond, M. C.; and W. R. Forward. EXPERIMENTS ON CAUSES OF DUCK NEST PREDATION. J. Wildl. Manage.; 20:243-247. 1956.

Sources of bias in duck nesting studies are examined, including the possibility of increased nest predation due to human disturbance (Boyle and Samson 1983).

241. Hancock, D. DAVID HANCOCK REPORTS ON THE BALD EAGLE RESEARCH PROJECT. Can. Audubon; 28:88-92. 1966.

This nontechnical article describes observations from a study of bald eagles in British Columbia. Human visitation to nests caused little mortality the year of the visits, but in the following year nests previously visited showed a 65% reduction in number of young produced. More research is needed on the effects of nest disturbance to understand the impacts of recreational activities and biological research on nesting eagles (Boyle and Samson 1983).

242. Hand, J. C. HUMAN DISTURBANCE OF THE WESTERN GULL, *LARUS OCCIDENTALIS LIVENS*, COLONIES AND POSSIBLE AMPLIFICATION BY INTRASPECIFIC PREDATION. Biol. Conserv.; 18:59-63. 1980.

Human disturbances are affecting reproduction of western gulls at several colonies in the Gulf of California. Breeding adults that lose chicks or eggs apparently practice conspecific predation, amplifying the effects of human disturbance. These combined effects may pose a threat to the survival of this endemic population (Boyle and Samson 1983).

243. Hanley, S. E. WILDLIFE MANAGEMENT IN YELLOWSTONE NATIONAL PARK, 1962-1976. M.S. thesis; Univ. Wyo., Laramie. 130 pp. 1992.

244. Hanson, D. OF PARACHUTES AND PEREGRINES. Audubon; 82(6):62-65. 1980.

This popular article describes recent National Park Service actions regarding the management of skydivers in Yosemite National Park. Skydiving off of 3,600-foot El Capitan, an overhanging cliff, threatened the Sierra Nevada's only known pair of nesting peregrine falcons. An attempt to manage skydiving through a legalized permit system was recinded after several serious injuries occurred and illegal jumping continued (Boyle and Samson 1983).

245. Harrington, F. H.; and L. D. Mech. *WOLF HOWLING AND ITS
ROLE IN TERRITORIAL MAINTENANCE. Behavior; 69(3-4):207-
248. 1978.
246. Hartmata, A. R. BALD EAGLE MOVEMENT AND HABITAT USE
COMPLETION REPORT. Pages 10-39 in: B. Oakleaf, D.
Belitsky, and S. Ritter, eds. Endangered and nongame
bird and animal investigations. Ann. Completion
Report. Period covered: April 15, 1986 to April 14,
1987. Wyoming Game and Fish Dept., Cheyenne. 189 pp.
1987.
247. Hartmata, A. R. *A COMPREHENSIVE ECOLOGICAL STUDY OF BALD
EAGLES IN THE GREATER YELLOWSTONE ECOSYSTEM. Wyoming
Game and Fish Dept., Cheyenne.
248. Hash, H. S. *WOLVERINE. Pages 574-585 in: M. Novak, J.
Baker, M. Obbard, and B. Malloch, eds. Wild furbearer
management and conservation in North America. Ministry
of Natural Resources, Ontario. 1987.
249. Haug, E. A. *OBSERVATIONS ON THE BREEDING ECOLOGY OF THE
BURROWING OWLS IN SASKATCHEWAN. M.S. thesis; University
of Saskatchewan, Saskatoon. 1985.
250. Havera. S. P.; L. R. Boens; M. M. Georgi; and R. T. Shealy.
HUMAN DISTURBANCE OF WATERFOWL ON KEOKUK POOL,
MISSISSIPPI RIVER. Wildl. Soc. Bull.; 20:290-298. 1992.

Human disturbance resulting from barge traffic,
outboard motor boats, hunters, and fishermen seemed to
be the most important factors causing duck movements on
the Keokuk Pool, Iowa.
251. Hayman, P.; J. Marchant; and T. Prater. *SHOREBIRDS: AN
IDENTIFICATION GUIDE. Houghton Mifflin, Boston. 412
pp. 1986.
252. Hayward, G. D. *HABITAT USE AND POPULATION BIOLOGY OF BOREAL
OWLS IN THE NORTHERN ROCKY MOUNTAINS, U.S.A. Ph.D.
Diss. University of Idaho, Moscow. 113 pp. 1989.

253. Hayward, G. D.; P. H. Hayward; and E. O. Garton. *HABITAT USE AND DISTRIBUTION OF THE BOREAL OWL IN CENTRAL IDAHO: ANNUAL PROGRESS REPORT. Dept. of Fish and Wildlife Resources, College of Forestry, Wildlife, and Range Sciences, Univ. Idaho, Moscow. 10 pp. 1987.
254. Hayward, G. D.; P. H. Hayward; and E. O. Garton. *MOVEMENTS AND HOME RANGE USE BY BOREAL OWLS IN CENTRAL IDAHO. In: R. W. Nero, C. R. Knapton, and R. J. Hamre, eds. Biology and conservation of northern forest owls: symposium proceedings. USDA, U.S. For. Serv. Gen. Tech Rep. RM-142, Rocky Mountain Forest and Range Exp. Sta., Fort Collins. 309 pp. 1987.
255. Hayward, G. D.; P. H. Hayward, E. O. Gaton; and R. Escano. *REVISED BREEDING DISTRIBUTION OF THE BOREAL OWL IN THE NORTHERN ROCKY MOUNTAINS. Condor; 89:431-432. 1987.
256. Heinrich, B.; B. Oakleaf; D. Flath; and W. Melquist. *A COOPERATIVE PROPOSAL FOR REINTRODUCTION OF PEREGRINE FALCONS IN ADJACENT AREAS OF IDAHO, MONTANA, AND WYOMING. Unpub. proposal. 19 pp. 1985.
257. Hendee, J. C.; and D. R. Potter. HUMAN BEHAVIOR AND WILDLIFE MANAGEMENT: NEEDED RESEARCH. Trans. N. Am. Wildl. Nat. Resourc. Conf.; 36:383-396. 1971.

Broad problem areas and specific questions about human behavior aspects of wildlife management are identified. Research should be directed toward various aspects of hunter behavior, nonconsumptive uses of wildlife, wildlife economics, and political-legal issues. As nonconsumptive use of wildlife increases, managers are challenged to both gain support from and supply satisfaction to appreciative users (Boyle and Samson 1983).
258. Henry, J. YELLOWSTONE WINTER GUIDE. Roberts Rinehart Publ., Niwot, CO. 95 pp. 1993.

259. Hensen, P.; and T. A. Grant. *THE EFFECTS OF HUMAN DISTURBANCE ON TRUMPETER SWAN BREEDING BEHAVIOR. Wildl. Soc. Bull.; 19:248-257. 1991.

260. Herrero, S. HUMAN INJURY INFLICTED BY GRIZZLY BEARS. Science; 170:593-598. 1970.

Grizzly bear attacks on humans in National Parks of North America are examined. Hiking, camping, or provocation of the bear preceded attacks in 98% of cases. Opinion surveys indicated that the public favored more effective management of people and bears, rather than elimination of bears, as a solution to man-bear problems (Boyle and Samson 1983).

261. Hickey, J. J. *PEREGRINE FALCON POPULATIONS: THEIR BIOLOGY AND DECLINE. University of Wisconsin Press, Madison. 596 pp. 1969.

262. Hicks, L. L.; and J. M. Elder. HUMAN DISTURBANCE OF SIERRA NEVADA BIGHORN SHEEP. J. Wildl. Manage.; 43(4):909-915. 1979.

Direct observations, pellet transects, and hiker interviews were used to assess use overlap and nature of interactions between humans and bighorn sheep in California. Distance, juxtaposition, and herd size and composition were important factors in reaction of sheep to humans. Bighorn-human encounters were not adversely affecting the bighorn population; nevertheless, limitation of human use of the study area is recommended (Boyle and Samson 1983).

263. Higgins, K. F. *SHOREBIRD AND GAME BIRD NESTS IN NORTH DAKOTA CROPLANDS. Wildl. Soc. Bull.; 3:176-179. 1975.

264. Higgins, K. F.; and L. M. Kirsch. *SOME ASPECTS OF THE BREEDING BIOLOGY OF THE UPLAND SANDPIPER IN NORTH DAKOTA. Wilson Bull.; 87:96-102. 1975.

265. Higgins, K. F.; H. F. Dubbert; and R. B. Oetting. *NESTING OF THE UPLAND PLOVER ON THE MISSOURI COUTEAU. *Prairie Nat.*; 1:45-48. 1969.
266. Hinman, R. THE IMPACT OF OIL DEVELOPMENT ON WILDLIFE POPULATIONS IN NORTHERN ALASKA. *Proc. Annu. Conf. West. Assoc. State Game Fish Comm.*; 54:156-164. 1974.

Potential impacts of oil and gas development on wildlife in northern Alaska are discussed. One major problem has been animal-man confrontations, largely involving bears. Inadvertent and deliberate harassment of animals by aircraft may have important effects on big game and nesting raptors (Boyle and Samson 1983).
267. Hoak, J. H.; J. L. Weaver; and T. W. Clark. *WOLVERINES IN NORTHWESTERN WYOMING. *Northw. Sci.*; 56:156-161. 1982.
268. Hoffman, R. S. *NOTES ON SOREX IN THE NORTHERN ROCKY MOUNTAIN ALPINE ZONE. *J. Mammal.*; 41:230-234. 1960.
269. Hoffmann, R. S.; and J. G. Owen. *SOREX TENELLUS AND SOREX NANAUS. *Mammalian species No.* 131:1-4. 1980.
270. Hoffmann, R. S.; P. L. Wright; and F. E. Newby. *THE DISTRIBUTION OF SOME MAMMALS IN MONTANA. *J. Mammal.*; 50:579-604. 1969.
271. Hofmann, R. S.; and R. D. Fisher. *ADDITIONAL DISTRIBUTIONAL RECORDS OF PREBLES SHREW. *J. Mammal.*; 59:883-884. 1978.
272. Holmes, T. L.; R. L. Knight; L. Stegall; and G. R. Craig. RESPONSES OF WINTERING GRASSLAND RAPTORS TO HUMAN DISTURBANCE. *Wildl. Soc. Bull.*; 21:461-468. 1993.

The authors measured the flushing responses and flushing distances of 6 species of diurnal raptors (American kestrels, merlins, prairie falcons, rough-legged hawks, ferruginous hawks, and golden eagles) exposed to walking and vehicle disturbances during

winter in northern Colorado. Walking disturbances resulted in more flushes than vehicle disturbances for all species except prairie falcons. Although flush distance did not vary with disturbance type for the three falcon species, rough-legged hawks and golden eagles flushed at greater distances for walking disturbances and ferruginous hawks flushed at greater distances for vehicle disturbances. Merlins and prairie falcons perched along paved roads had shorter flush distances to walking disturbances than individuals perched along gravel roads. Rough-legged hawks perched nearer to the road flushed at greater distances than those farther away. American kestrel, prairie falcons, and ferruginous hawks perched closer to the ground had greater flush distances than those perched higher. Dark-morph ferruginous and rough-legged hawks flushed at greater distances than light morphs. For walking disturbances, a linear relationship existed between flight distance and body mass, with lighter species flushing at shorter distances; however, this trend did not hold for vehicle disturbances.

273. Holyrod, J. C. OBSERVATIONS OF ROCKY MOUNTAIN GOATS ON MOUNT WARDLE, KOENAY NATIONAL PARK, BRITISH COLUMBIA. Can. Field-Nat.; 81:1-22. 1967.

Behavior of mountain goats in British Columbia is described, including reactions to man. Goat responses to human presence varied according to season, herd size, and other circumstances. Goats were rarely aggressive toward the author, although two incidents are described in which a goat appeared to threaten him (Boyle and Samson 1983).

274. Hood, R. E.; and J. M. Inglis. BEHAVIORAL RESPONSES OF WHITE-TAILED DEER TO INTENSIVE RANCHING OPERATIONS. J. Wildl. Manage.; 38(3):488-498. 1974.

275. Hooper, R. G. NESTING HABITS OF COMMON RAVENS IN VIRGINIA. Wilson Bull.; 89:233-242. 1977.

In a study of raven nesting habitats in Virginia, relationships of nesting ravens in response to human pressure was variable depending on the situation. Human activity should be restricted near active nests, despite the observed tenacity of some nesting pairs. Most birds would not be affected by recreation activity farther than 200 meters from nests (Boyle and Samson 1983).

276. Hoover, R. L.; and D. L. Wills, eds. *MANAGING FORESTED LANDS FOR WILDLIFE. Colorado Division of Wildlife in cooperation with USDA Forest Service, Rocky Mountain Region, Denver, CO. 459 pp. 1984.

277. Horejsi, B. SOME THOUGHTS AND OBSERVATIONS ON HARASSMENT OF BIGHORN SHEEP. Pages 149-155 in: Proc. of the Biennial Symposium of the Northern Bighorn Sheep Council, 10-12 February 1976, Jackson, WY. 1976.

Harassment and its possible effects on bighorn sheep are discussed. Active harassment results in visible responses by sheep, while passive harassment produces no visible response but may have psychological and physiological effects on sheep. Harassment has significant impacts on individuals and populations, leading to a variety of conditions which reduce fitness. Minimizing harassment of sheep should be given top priority among management objectives (Boyle and Samson 1983).

278. Hornocker, M. G. *AN ANALYSIS OF MOUNTAIN LION PREDATION UPON MULE DEER AND ELK IN THE IDAHO PRIMITIVE AREA. Wildl. Monogr. 21:1-39. 1970.

279. Hornocker, M. G. WINTER TERRITORIALITY IN MOUNTAIN LIONS. J. Wildl. Manage.: 33:457-464. 1969.

280. Hornocker, M. G.; and H. S. Hash. *ECOLOGY OF THE WOLVERINE IN NORTHWESTERN MONTANA. Can. J. Zool.; 59:1286-1301. 1981.

281. Houston, C. S. HAZARDS FACED BY COLONIAL BIRDS. Bluejay; 20: 74-77. 1962.

Several nesting colonies of birds in Saskatchewan and reasons for declines or destruction of bird populations are described. Human disturbances including boating, taking of eggs, and recreation associated with resorts were responsible for population declines in several instances. Disturbance may lead to mortality through accidental breaking of eggs by fleeing adults, or exposure of eggs and young to heat, cold, or predation (Boyle and Samson 1983).

282. Houston, D. B. ECOSYSTEMS OF NATIONAL PARKS. Science; 172: 648-651. 1971.

Management of U. S. National Parks is aimed at preserving park ecosystems in as pristine a condition as possible, and primarily involves preventing or compensating for human influences. So-called nonconsumptive uses such as sightseeing may in fact alter energy and geothermal pathways, disturbing park vegetation and wildlife. Managers must realize that these areas have a finite capacity for absorbing human disturbances (Boyle and Samson 1983).

283. Houston, J. DOGS VS. DEER. Colo. Outdoors; 17(1):22-23. 1968.

284. Hoyt, S. F. *THE ECOLOGY OF THE PILEATED WOODPECKER. Ecology; 38:246-256. 1957.

285. Huff, D. E.; and P. J. Savage. A CORRELATION OF DEER MOVEMENTS WITH SNOWMOBILE ACTIVITY IN MINNESOTA DURING WINTER. Proc. Midwest Fish Wildl. Conf.; 34:42-49. 1972.

Studies of telemetered white-tailed deer in Minnesota compared deer activities between areas of high and no snowmobile use. The size of deer home ranges was much reduced at the high use area, and snowmobile use appeared to force deer into less preferred habitats where nighttime radiant heat loss was greater (Boyle and Samson 1983).

286. Interagency Grizzly Bear Committee. *GRIZZLY BEAR COMPENDIUM. Interagency Grizzly Bear Committee, Missoula. 540 pp. 1987.
287. Interagency Grizzly Bear Committee. *INTERAGENCY GRIZZLY BEAR GUIDELINES. Interagency Grizzly Bear Committee, Missoula. 100 pp. 1986.
288. Isakovic, I. EFFECTS OF LAND USE AND OUTDOOR RECREATION ON GAME POPULATIONS. Pages 351-356 in: I. Kjermer and P. Bjurholm, eds. Proc. Xith Int. Cong. of Game Biologists, 3-7 September 1973, Stockholm. 1974.

An overview of man's effect on game populations through land use and recreation is provided. Recreationists fleeing from polluted urban environments make demands on nature that must be harmonized with the capacity of the land to absorb them. Plans to control impacts of tourism must be worked out, especially in areas where it is no longer possible to reserve large areas of land for protection (Boyle and Samson 1983).

289. Jackson, L. W.; R. Monson; and L. A. Raviile. OBSERVATIONS OF WILD CANIDS CHASING DEER. N.Y. Fish and Game J.; 20(2):168-169. 1973.

Two incidents are described in which wild canids (coydogs) chased and attacked deer. In one instance the canid killed an adult (6-year-old) doe by attacking her throat from the right side. In the second instance an adult buck was pursued for at least 3 miles by a wild canid and probably would have been killed if the canid had not been shot. On both occasions the canids appeared to pursue and/or attack from the right side of the fleeing deer (Neil et al. 1975).

290. Jacobson, S. K.; and A. F. Lopez. BIOLOGICAL IMPACTS OF ECOTOURISM: TOURISTS AND NESTING TURTLES IN TORTUGUERO NATIONAL PARK, COSTA RICA. Wildl. Soc. Bull.; 22:414-419. 1994.

Presence and behavior of tourists on the beach during green turtle nesting season resulted in disturbance of nesting turtles at Tortuguero National Park, Costa Rica. Tourist visitation was concentrated on weekends, correlating with the times that a third fewer turtles came to the beach. However, specific nesting behaviors, including successful nesting, incomplete nesting, and females emerging on the beach but returning to the ocean without digging a nest, did not differ on segments of the beach exposed to different levels of human disturbance. A tour guide program was developed to control tourist activity on the beach.

291. Janssen, R. NOISE AND ANIMALS: PERSPECTIVES OF GOVERNMENT AND PUBLIC POLICY. Pages 287-301 in: J. L. Fletcher and R. G. Busnel, eds. Effects of noise on wildlife. Academic Press, New York. 1978.

Impacts of human-caused noise on wildlife and domesticated animals must be determined so that proper decisions can be made by policy makers. An animal-response model to quantify the effects of noise on animals is presented. Wildlife exposures to noise are generally involuntary and come from mobile sources such

as airplanes and recreational vehicles (Boyle and Samsom 1983).

292. Jehl, J. R. ,. Jr. STUDIES OF A DECLINING POPULATION OF BROWN PELICANS IN NORTHWESTERN BAJA CALIFORNIA. Condor; 75:69-79. 1973.

Large-scale reproductive failures of Baja California brown pelican colonies were found during studies from 1969 through 1971. Thin-shelled eggs are the major cause of reproductive failure, but human disturbance is also important. Tourists in yachts and other pleasure craft visit some colonies, usually inadvertently disturbing breeding pelicans. The Mexican and United States governments could improve the chances for the bird's survival by limiting access to breeding colonies (Boyle and Samson 1983).

293. Jenni, D. A. A STUDY OF THE ECOLOGY OF FOUR SPECIES OF HERONS DURING THE BREEDING SEASON AT LAKE ALICE, ALACHUA COUNTY, FLORIDA. Ecol. Monogr.; 39:245-270. 1969.

The effects of the investigator on herons were evaluated during studies of heron ecology in Florida. Some losses occurred from flushing adults from nests with subsequent loss of young, but indirect effects may have been more important. Nestlings often regurgitated when disturbed, and the youngest nestlings frequently died of starvation. However, production data and other observations suggest that the impact of the investigator on heron survival was not great (Boyle and Samson 1983).

294. Johnsgard, P. A. *NORTH AMERICAN OWLS. Smithsonian Institution Press, Washington, DC. 295 pp. 1988.

295. Johnsgard, P. A. *BIRDS OF THE GREAT PLAINS: BREEDING SPECIES AND THEIR DISTRIBUTIONS. University of Nebraska Press, Lincoln. 539 pp. 1979.

296. Johnsgard, P. A. *THE BIRDS OF THE ROCKY MOUNTAINS. Colorado Associated University Press, Boulder. 504 pp. 1986.
 297. Johnsgard, P. A. *NORTH AMERICAN OWLS. Smithsonian Institution Press, Washington, DC. 295 pp. 1988.
 298. Johnsgard, P. A. *THE PLOVERS, SANDPIPERS, AND SNIPES OF THE WORLD. University of Nebraska Press, Lincoln. 493 pp. 1981.
 299. Johnson, R. F. ,. Jr. MORTALITY FACTORS AFFECTING A WHITE PELICAN POPULATION, CHASE LAKE NATIONAL WILDLIFE REFUGE, NORTH DAKOTA. M.S. thesis; Michigan Technological University, Houghton. 74 pp. 1976.
- Mortality factors responsible for low fledgling rates of white pelicans in North Dakota were studied. Nest abandonment related to water conditions and sibling rivalry were major causes of poor reproduction. Predation, accidents, and physical stress do not cause significant mortality in an undisturbed situation, but may become significant with extensive and repeated human disturbance (Boyle and Samson 1983).
300. Jonkel, C. WINTER DISTURBANCE AND GRIZZLY BEARS. Border Grizzly Proj., Univ. Mont., Missoula, Spec. Rep. No. 46. 1980.
 301. Jonkel, C. J.; and I. T. McCowan. *THE BLACK BEAR IN THE SPRUCE-FIR FOREST. Wildl. Monogr.; 27:1-57. 1971.
 302. Jope, K. L. IMPLICATIONS OF GRIZZLY BEAR HABITUATION TO HIKERS. Wildl. Soc. Bull; 13:32-37. 1985.
 303. Junge, J. A.; and R. S. Hoffman. *AN ANNOTATED KEY TO THE LONG-TAILED SHREWS OF THE UNITED STATES AND CANADA WITH NOTES ON MIDDLE AMERICAN SOREX. Univ. Kan. Nat. Hist. Occ. Pap.; 94:1-48. 1981.

304. Kahl, R. BOATING DISTURBANCE OF CANVASBACKS DURING MIGRATION AT LAKE POYGAN, WISCONSIN. Wildl. Soc. Bull.; 19:242-248. 1991.

This study sought to discover why the use of Lake Poygon, Wisconsin, had declined as a staging area for canvasback ducks. Results of the study indicated that boating activity was a significant factor for this apparent underutilization. Management recommendations are discussed.

305. Kaiser, M. S.; and E. K. Fritzell. EFFECTS OF RIVER RECREATIONISTS ON GREEN-BACKED HERON BEHAVIOR. J. Wildl. Manage.; 48(2):561-567. 1984.

The authors studied the effects of river recreationists on green-backed heron behavior in southeastern Missouri. They determined that feeding behavior of green-backed herons was adversely affected by human activity as evidenced by the observed reduction of foraging bouts.

306. Keating, K. A.; L.R. Irby; and W. F. Kasworm. MOUNTAIN SHEEP WINTER FOOD HABITS IN THE UPPER YELLOWSTONE VALLEY. J. Wildl. Manage.; 49(1):156-161. 1985.

307. Keith, L. B. *POPULATION DYNAMICS OF WOLVES. Pages 66-77 in: L. N. Carbyn, ed. Wolves in Canada and Alaska: their status, biology, and management. Can. Wildl. Serv. Rep. No, 45, Ottawa. 135 pp. 1981.

308. Keller, V. VARIATIONS IN THE RESPONSE OF GREAT CRESTED GREBES, PODICEPS CRISTATUS, TO HUMAN DISTURBANCE-A SIGN OF ADAPTATION? Biol. Conserv.; 49:31-45. 1989.

309. Kemp, H. TAPPING INTO THE FISH AND WILDLIFE EXPLOSION: COMMERCIAL ON-LINE DATA SOURCES. USDI, U. S. Fish Wildl. Ser. Leaflet 16, Washington, DC. 1992.

310. Klein, M. L. WATERBIRD BEHAVIORAL RESPONSES TO HUMAN DISTURBANCES. Wildl. Soc. Bull.; 21:31-39. 1993.

The author subjected waterbirds to experimental disturbance at the J. N. "Ding" Darling National Wildlife Refuge, located off the southern gulf coast of Florida, to investigate the effects of human actions on their behavior. Approaching the birds on foot was the most disruptive activities of refuge visitors. Photographers were most likely to engage in this activity. Visitors who spoke with refuge staff early during their visit caused the least disturbance. The author conclude that educational programs, coupled with the use of observation blinds or guided tours, could help reduce bird disturbance.

311. Klein, T. LOON MAGIC. Paper Birch Press, Ashland, WI. 130 pp. 1985.

312. Knight, R. L. RESPONSES OF WINTERING BALD EAGLES TO BOATING ACTIVITY. J. Wildl. Manage.; 48(3):999-1004. 1984.

The author examined flushing responses and flight distances of wintering bald eagles disturbed by a canoe in northwestern Washington. Management implications are discussed.

313. Knight, R. L.; and D. N. Cole. EFFECTS OF RECREATIONAL ACTIVITY ON WILDLIFE IN WILDLANDS. Trans. N. Am. Wildl. and Nat. Resour. Conf.; 56:238-247. 1991.

314. Knight, R. L.; and L. L. Eberhardt. *POPULATION DYNAMICS OF YELLOWSTONE GRIZZLY BEARS. Ecology; 66:323-334. 1985.

315. Knight, R. L.; B. M. Blancard; and L. L. Eberhardt. MORTALITY PATTERNS AND POPULATION SINKS FOR YELLOWSTONE GRIZZLY BEARS, 1973-1985. Wildl. Soc. Bull.; 16:121-125. 1988.

This study determined that the extensive movements of grizzly bears and dispersion of population sinks in time in space suggest there are no true refuges for Yellowstone grizzly bears. Increasing human use and recreational activities in the Yellowstone area will increase this problem. For the present, available food for bears at population sinks is the greatest threat to survival of the Yellowstone grizzly population.

316. Knight, R. L.; J. Beecham; B. Blanchard; L. Eberhardt; L. Metzgar; C. Serveen; and F. Talbot. *REPORT OF THE YELLOWSTONE GRIZZLY BEAR POPULATION TASK FORCE. Submitted to the Interagency Grizzly Bear Committee. Unpub. 9 pp. 1988.
317. Knopf, F. L. *SCHEDULE OF PRESUPPLEMENTAL MOLT OF WHITE PELICANS WITH NOTES ON THE BILL HORN. Condor; 77(3): 356-359. 1975.
318. *Knopf, K. L. SPATIAL AND TEMPORAL ASPECTS OF COLONIAL NESTING OF WHITE PELICANS. Condor; 81(4):353-363. 1979.
319. Knowles, C. J.; C. J. Stoner; and S. P. Geib. *SELECTIVE USE OF BLACK-TAILED PRAIRIE DOG TOWNS BY MOUNTAIN PLOVERS. Condor; 84:71-74. 1982.
320. Kolenosky, G. B.; and S. M. Strathearn. *BLACK BEAR. Pages 445-454 in: M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Nat. Resources, Ontario. 1987.
321. Korschgen, C. E.; and R. B. Dahlgren. HUMAN DISTURBANCES OF WATERFOWL: CAUSES, EFFECTS, AND MANAGEMENT. USDI, U.S. Fish Wildl. Ser. Leaflet 13.2.15. 1992.

322. Korschgen, C. E.; L. S. George; and W. L. Green. DISTURBANCE OF DIVING DUCKS BY BOATERS ON A MIGRATIONAL STAGING AREA. Wildl. Soc. Bull.; 13:290-296. 1985.

Disturbances of diving ducks, especially canvasbacks, by recreational boaters were studied on a major staging area on the Upper Mississippi River. Diving ducks were estimated to have left the staging area 19 times during the fall because of human disturbance. The authors state that although the energetic costs of the disturbances are unknown, it could be expected that they may have detrimental effects should the canvasback population significantly increase and require more food, American wildcelery winterbud production significantly decrease, disturbances become more frequent, or other migration areas deteriorate.

323. Krausman, P. R.; B. D. Leopold; and D. L. Scarbrough. DESERT MULE DEER RESPONSE TO AIRCRAFT. Wildl. Soc. Bull.; 14: 68-70. 1986.

Responses of desert mule deer to aircraft overflights in Arizona rarely involved changing habitat. The authors conclude that the desert mule deer in southcentral Arizona appear to have habituated to low-flying aircraft and that reliable habitat-use information can be obtained from aircraft.

324. Kruttsch, P. H. *NOTES ON THE HABITS OF THE BAT MYOTIS CALIFORNICUS. J. Mammal.; 35:539-545. 1954.

325. Kuchel, C. R. SOME ASPECTS OF THE BEHAVIOR AND ECOLOGY OF HARLEQUIN DUCKS BREEDING IN GLACIER NATIONAL PARK. M.S. thesis; University of Montana, Missoula. 163 pp. 1977.

326. Kuck, L.; G. L. Hompland; and E. H. Merrill. ELK CALF RESPONSE TO SIMULATED MINE DISTURBANCE IN SOUTHEAST IDAHO. J. Wildl. Manage.; 49(3):751-757. 1985.

Impacts of human presence and simulated surface-mining activities on elk calf movements, habitat selection patterns, and survival were assessed using a controlled experiment in southeast Idaho. Compared to undisturbed calves, disturbed calves moved greater distances, used larger areas, showed greater use of coniferous forests, and lacked selection for favorable physiographic parameters. Cow/calf pairs readily abandoned their traditional calf-rearing area under human and simulated mining disturbance, although no calf abandonment was documented. Winter survival between groups and between years was similar.

327. Kunz, T. H.; and R. A. Martin. *PLECOTUS TOWNSENDII. Mammalian Species No. 175:1-6. 1982.

328. Kuyt, E. CLUTCH SIZE, HATCHING SUCCESS, AND SURVIVAL OF WHOOPING CRANE CHICKS, WOOD BUFFALO NATIONAL PARK, CANADA. Pages 126-129 in: J. C. Lewis and H. Masatomi, eds. Crane research around the world. International Crane Foundation, Baraboo, WI. 1981.

329. Lavigne, G. R. WINTER RESPONSE OF DEER TO SNOWMOBILES AND SELECTED NATURAL FACTORS. M.S. thesis, University of Maine, Orono. 68 pp. plus supplement. 1976.

Snowmobile trails enhanced deer mobility during periods of deep snow in Maine, and probably reduced deer energy expenditures in winter; deer used snowmobile trails more extensively near major bedding area. Disturbance by snowmobiles did not cause deer to abandon preferred bedding and feeding sites. Deer responses to snowmobiles varied from running out of sight to staying in place, depending on conditions of the encounter (Boyle and Samson 1983).

330. Leedy, D. H. AN ANNOTATED BIBLIOGRAPHY ON PLANNING AND MANAGEMENT FOR URBAN-SUBURBAN WILDLIFE. USDI, U.S. Fish Wildl. Ser. FWS/OBS-79/25. 265 pp. 1979.

*Annotated Bibliography.

331. Leedy, D. H. HIGHWAY-WILDLIFE RELATIONSHIPS. VOL. 1. A STATE-OF-THE-ART REPORT. Fed. Hwy. Admin., Office Res. Develop. FHWA-RD-76-5. 417 pp. 1975.

*Annotated Bibliography.

332. Leedy, D. H.; T. M. Franklin; and C. E. Hekimian. HIGHWAY-WILDLIFE RELATIONSHIPS. VOL. 2. AN ANNOTATED BIBLIOGRAPHY. Fed. Hwy. Admin., Office Res. Develop. FHWA-RD-76-5. 417 pp. 1975.

*Annotated Bibliography.

333. Leonard, M. I.; and M. B. Barton. *HABITAT USE BY SPOTTED BATS (EUDERMA MACULATUM): ROOSTING AND FORAGING BEHAVIOR. Can. J. Zool.; 61:1487-1491. 1983.

334. LeResche, R. E. BEHAVIOR AND CALF SURVIVAL IN ALASKA MOOSE. M.S. thesis; Univ Alaska, Fairbanks 85 pp. 1966.

Reactions of moose to human disturbance ranged from flight, through slowly drifting away, to seeming disinterest. Cows with calves were the most wary (Ream 1980).

335. Levenson, H.; and J. R. Koplin. EFFECTS OF HUMAN ACTIVITY ON PRODUCTIVITY OF NESTING OSPREYS. J. Wildl. Manage.; 48(4):1374-1377. 1984.

The authors in this study evaluated the effects of human activity on the productivity of ospreys nesting in northwestern California during the early 1970s. The major form of intense human activity in the study is

logging and the authors concluded that logging operations should be designed to minimize disruption of nesting ospreys, possibly by delaying operations in the area until young have fledged.

336. Liddle, M. J. A SELECTIVE REVIEW OF THE ECOLOGICAL EFFECTS OF HUMAN TRAMPLING ON NATURAL ECOSYSTEMS. Biol. Conserv.; 7(1):17-36. 1975.

337. Liddle, M. J.; and H. R. A. Scorgie. THE EFFECTS OF RECREATION ON FRESHWATER PLANTS AND ANIMALS: A REVIEW. Biol. Conserv.; 17:183-206. 1980.

Impacts of recreation on freshwater plants and animals are reviewed. Impacts of boating include wash, pollution from outboard motors, and sewage. Shore-based activities such as swimming can result in trampling and pollution from sewage and various chemicals. Effects of management for recreation are also reviewed (Boyle and Samson 1983).

338. Lieb, J. W. ELK DROWNING. Murrelet; 55(3):39-40. 1974.

A bull elk, unfamiliar with inland escape routes through cliffs, fled from researcher into the ocean and drowned. Also cites another similar case. Suggests that frightened animals that are not familiar with alternative escape routes may flee into water. People should avoid disturbing frightened elk near large or rough bodies of water when inland escape appears blocked (Ream 1980).

339. Lieb, J. W. SOCIAL BEHAVIOR IN ROOSEVELT ELK COW GROUPS. M.S. thesis; Humbolt State Univ., Arcadia, CA. 1973.

In Prairie Creek Redwoods Park, increasing human disturbance during the early summer caused increased aggression among members of cow elk groups. This may be due to a decrease in tolerance by elk for each other under insecure conditions. Rutting bulls reacted aggressively towards approaching humans in 13 of 17 cases of human disturbance. Suggests that human

disturbance should be controlled, especially during the reproductive portions of the year (Ream 1980).

340. Lieb, J. W.; and A. S. Mossman. FINAL PROGRESS REPORT ON ROOSEVELT ELK IN PRAIRIE CREEK REDWOODS STATE PARK. Calif. Dep. Parks and Recreat.; Interagency Agreement 4-050094-025, 8 pp. 1966.

In response to human disturbance, elk moved from primary to secondary forage areas and cows with young calves moved away from the central parts of their home ranges. Play and rutting activity were disrupted by human disturbance. Recommends reducing human disturbance at certain locations in order to retain elk herds in these areas, posting signs explaining why visitors should not disturb elk (especially during rutting and calving), and enforcement of regulations (including elimination of poaching)(Ream 1980).

341. Light, J. T. ,. Jr. AN ECOLOGICAL VIEW OF BIGHORN HABITAT ON MT. SAN ANTONIO. Trans. N. Am. Wild Sheep Conf.; 1:150-157. 1971.

Ecological analysis of a California sheep range revealed relationships between bighorn habitat use and human disturbance associated with a ski resort and a summer cabin. It was found that bighorn use did not occur where human use was heavy and sheep were forced into less satisfactory habitats (Boyle and Samson 1983).

342. Lime, D. W.; and C. T. Cushwa. WILDLIFE ESTHETICS AND AUTO CAMPERS IN THE SUPERIOR NATIONAL FOREST. U.S. For, Serv. Res. Pap. NC-32. 8 pp. 1969.

Auto campers in Minnesota were interviewed to determine the importance of wildlife esthetics to National Forest visitors. Although wildlife was described as esthetically important to many of the auto campers surveyed, it was not the prime motivational factor in attracting them to the National Forest. Most visitors sought a remote setting affording them a maximum

contrast to the usual urban environment (Boyle and Samson 1983).

343. Lime, D. W.; D. H. Anderson; and L. D. Mech. INTERPRETING WILDLIFE THROUGH GUIDED EXPEDITIONS. J. Interpret 3(2): 10-16. 1978.

Guided expeditions were initiated in the Superior National Forest of Minnesota. People participating in wolf-howling safaris and wildlife-sign safaris had fun (in spite of only indirect encounters with wildlife) and at the same time learned about wildlife. This concept could be a useful method of public education about wildlife (Ream 1980).

344. Lindzey, F. *MOUNTAIN LION. Pages 657-668 in: M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario. 1987.

345. Lochmiller, R. L. BIRDING! Va. Wildl.; 39(12):10-11. 1978.

This popular article describes bird watching activities and outlines ways to minimize disturbance of birds. Avoiding the use of recorded bird calls of rare birds, keeping a good distance from nests, avoiding handling of young, and avoiding large groups in critical habitats are suggested (Boyle and Samson 1983).

346. Lockman, D. C.; R. Wood; H. Smith; B. Smith; and H. Burgess. ROCKY MOUNTAIN TRUMPETER SWAN POPULATION-WYOMING FLOCK. 1982-86 Progress Report. Wyoming Game and Fish Dept., Cheyenne. 74 pp. 1987.

347. Long, C. A. *MICROSOREX HOYI AND MICROSOREX THOMPSONI. Mammalian Species No. 33:1-4. 1974.

348. Lopez, B. H. *OF WOLVES AND MEN. Charles Schribner's Sons, New York. 304 pp. 1978.

349. MacArthur, R. A.; R. H. Johnson; and V. Geist. FACTORS INFLUENCING HEART RATE IN FREE-RANGING BIGHORN SHEEP: A PHYSIOLOGICAL APPROACH TO THE STUDY OF WILDLIFE HARASSMENT. Can. J. Zool.; 57:2010-2021. 1979.

Heart rates of unrestrained female bighorn sheep were measured by telemetry in Alberta. In all ewes studied heart rate varied positively with activity level and inversely with distance from a road. Responses to other stimuli varied. Findings are discussed in relation to ecology and bioenergetics of bighorn sheep (Boyle and Samson 1983).

350. MacArthur, R. A.; V. Geist; and R. H. Johnson. CARDIAC AND BEHAVIORAL RESPONSES OF MOUNTAIN SHEEP TO HUMAN DISTURBANCE. J. Wildl. Manage.; 46:351-358. 1982.

351. MacCarter, D. L. REPRODUCTIVE PERFORMANCE AND POPULATION TRENDS OF OSPREYS OF FLATHEAD LAKE, MONTANA. M.S. thesis; Humboldt State Univ., Arcata, CA. 80 pp. 1972.

Human disturbance is discussed as a possible influence on osprey reproduction success at Flathead Lake, Montana. The greatest potential disturbance was from researchers climbing to nests, but there was no apparent losses of eggs or chicks due to research activities. Recreation activities associated with summer resorts take place primarily after osprey eggs are hatched; disturbance did not appear to be an important factor (Boyle and Samson 1983).

352. MacInnes, C. D.; and R. K. Mista. PREDATION ON CANADA GOOSE NESTS AT McCONNELL RIVER, NORTHWEST TERRITORIES. J. Wildl. Manage.; 36:414-422. 1972.

Predation by jaegers and gulls on nests of Canada geese was increased by human disturbance of nests. Partial clutch losses, responsible for 55% of all observed losses, probably did not occur in the absence of disturbance by humans. Predation losses of eggs would have been small (about 10%) without human disturbance (Boyle and Samson 1983).

353. Mainini, B.; P. Neuhaus; and P. Ingold. BEHAVIOR OF MARMOTS UNDER THE INFLUENCE OF DIFFERENT HIKING ACTIVITIES. Biol. Conserv.; 64:161-1664. 1993.

In the region of first near Grindelwald (Swiss alps) alpine marmots reacted differently to various forms of hiking tourism. The smallest reaction was recorded when hikers kept to trails. The reaction increased with cross-country hiking and was even greater when the main burrows of the animals were crossed. The severest reaction was seen in experiments with dogs on long leashes. It can be concluded that the predictability and potential threat (dogs) are decisive factors in the reactions of marmots to different forms of hiking.

354. Manfredo, M. J.; and R. A. Larson. MANAGING FOR WILDLIFE VIEWING RECREATION EXPERIENCES: AN APPLICATION IN COLORADO. Wildl. Soc. Bull.; 21:226-236. 1993.

355. March, D.; and C. Adams. A FRONT RANGE CONCEPT: THE NEED FOR THE NODDLES-RAMPART-SOUTH PLATTE RECREATION AREA. Wildlife-2000, Aurora, CO. 112 pp. plus appendicies. 1973.

Results of a comprehensive study of wildlife, motorized recreation vehicles, and forest management in central Colorado are reported. Impacts of off-road vehicles on wildlife are severe, especially when engine noise is loud. Human recreational activities have accelerated habitat change which threaten vital watersheds and the wildlife which inhabit them (Boyle and Samson 1983).

356. Markham, B. J.; and S. H. Brechtel. STATUS AND MANAGEMENT OF THREE COLONIAL WATERBIRD SPECIES IN ALBERTA. Pages 55-64 in: Proc. 1978 Conf. of the Colonial Waterbird Group, 20-23 October 1978, New York, NY. 1978.

Present status and management of the white pelican, double-crested comorant, and great blue heron in Alberta are described. A major management problem is human disturbance of breeding colonies. Harassment causing adults to leave nests can result in nest desertion, abandonment of colonies, and increased

mortality of young from predation or exposure. Protective legislation and a public education program have been enacted to limit human disruption of colonies (Boyle and Samson 1983).

357. Mathisen, J. E. EFFECTS OF HUMAN DISTURBANCE ON NESTING BALD EAGLES. J. Wildl. Manage.; 32:1-6. 1968.

Bald eagle nesting success in Minnesota was studied in relation to intensity of several forms of human disturbance, including recreational activities. Human disturbance did not appear to significantly affect nest occupancy or nesting success (Boyle and Samson 1983).

358. Mattson, D. J.; B. M. Blanchard; and R. L. Knight. YELLOWSTONE GRIZZLY BEAR MORTALITY, HUMAN HABITUATION, AND WHITEBARK PINE SEED CROPS. J. Wildl. Manage.; 56(3):432-442. 1992.

The authors analyzed relationships between Yellowstone grizzly bear mortality and frequency of human habituation among bears and size of the whitebark pine seed drop. During years of large seed drops, bears used areas within 5 km of roads and 8 km of developments half as intensively as during years of small seed drops because whitebark pine's high elevation distribution is typically more remote from human facilities. On average, management trappings of bears was 6.2 times higher, mortality of adult females 2.3 times higher, and mortality of subadult males 3.3 times higher during years of small seed drops. The authors hypothesize that high mortality of adult females and subadult males during small seed drop years was a consequence of their tendency to range closest (of all sex-age cohorts) to human facilities; they also had a higher frequency of human habituation compared with adult males. The authors conclude that destruction of habituated bears that use native foods near humans results in a decline in the overall ability of bears to use available habitat; and that the number and extent of human facilities in occupied grizzly bear habitat needs to be minimized unless habituated bears are preserved and successful ways to manage the associated risks to humans are developed.

359. McClelland, B. R. *RELATIONSHIPS BETWEEN HOLE-NESTING BIRDS, FOREST SNAGS, AND DECAY IN WESTERN LARCH-DOUGLAS FIR FORESTS OF THE NORTHERN ROCKY MOUNTAINS. Ph.D. Diss; University of Montana, Missoula. 496 pp. 1977.
360. McClellan, B. N.; and D. M. Shackleton. IMMEDIATE REACTIONS OF GRIZZLY BEARS TO HUMAN ACTIVITIES. Wildl. Soc. Bull.; 17:269-274. 1989.

This study evaluated the responses of grizzly bears to human activities such as people on foot either next to or away from a parked vehicle, moving vehicles, heavy industrial equipment, fixed-wing aircraft, and helicopters. Bears responded more strongly to people on foot in remote areas than to any other stimuli. Management implications are discussed.

361. McCord, C. M. and J. E. Cardoza. *BOBCAT AND LYNX. Pages 728-766 in: J. A. Chapman and G. A. Feldhamer, eds. Wild mammals in North America: biology, management, and economics. John Hopkins Univ. Press, Baltimore. 1982.
362. McGarigal, K.; R. G. Anthony and F. B. Issacs. INTERACTIONS OF HUMANS AND BALD EAGLES ON THE COLUMBIA RIVER ESTUARY. Wildlife Monograph; No. 15; 47p. 1991.
363. McIntyre, J. M. W. BIOLOGY AND BEHAVIOR OF THE COMMON LOON WITH REFERENCE TO ITS ADAPTABILITY IN A MAN-ALTERED ENVIRONMENT. Ph.D Diss. Univ. of Minnesota, St. Paul. 243 pp. 1975.

Loons are subject to hazards from pollutants and increased recreational use because of their aquatic habits and conflict with man for habitat. Biological factors of loons were studied to assess their ability to adapt to these environmental changes. Their potential for maintaining stable populations in Minnesota are described based on the research results (Boyle and Samson 1983).

364. McMillan, J. F. SOME OBSERVATIONS ON MOOSE IN YELLOWSTONE NATIONAL PARK. *Am. Midl. Nat.*; 52(2):392-399. 1954.

In areas of heavy tourist pressure, moose develop considerable tolerance for human disturbance, moving slowly and returning soon. In a control area visitor disturbance caused moose to run from area and not return until at least the next day (Ream 1980).

365. McReynolds, H. E.; and R. E. Radtke. THE IMPACT OF MOTORIZED HUMANS ON THE WILDLIFE OF FORESTED LANDS. Pages 102-117 in: C. M. Kilpatrick. ed. *Wildlife and people. Proc. of the 1978 John S. Wright Forestry Conf.*, 23-24 February 1978, Purdue Univ., West Lafayette, IN. 1978.

Effects of off-road vehicles on wildlife of forested lands are reviewed. Cases for and against the use of snomobiles, motorcycles, and four-wheel drive vehicles in forests are presented. Few reliable data on off-road vehicle impacts on wildlife are available, but it is probable that indirect effects and unintentional harassment of wildlife have produced the greatest damage (Boyle and Samson 1983).

366. Meagher, M. *THE BISON OF YELLOWSTONE NATIONAL PARK. *Natl. Park Serv. Sci. Monogr.* 1:1-161. 1973.

367. Meagher, M. EVALUATION OF BOUNDARY CONTROL FOR BISON OF YELLOWSTONE NATIONAL PARK. *Wildl. Soc. Bull.*; 17:15-19. 1989.

Efforts made since 1976 to contain bison within the boundaries of Yellowstone National Park have proved to be ineffective. This paper evaluates several tactics to minimize the potential conflict of bison leaving the park. Hazing and herding activities demonstrated that bison can be moved only where they want to go. Attempts to block travel routes and harassment with various devices sometimes treated immediate problems at the locations involved, but did not change the overall direction of bison movement down the Yellowstone River. Further, these tactics apparently caused major shifts to other travel routes or sometimes displaced a

conflict from 1 site to another. The author concludes that, in general, success (if any) in localized displacement of bison by human efforts will decrease and hazards to personnel will increase with these management approaches. Cropping of bison by public hunting outside the park will not change their movements, but may lessen local conflicts.

368. Mech, L. D. *CANIS LUPUS. Mammalian Species No. 37. 6 pp. 1974.
369. Mech, L. D. *THE WOLF-THE ECOLOGY AND BEHAVIOR OF AN ENDANGERED SPECIES. Natural History Press, Doubleday, New York. 384 pp. 1970.
370. Mech, L. D. THE WOLVES OF ISLE ROYALE. Fauna of the National Parks of the U.S.; Fauna Series No. 7, U.S. Govt. Printing Office, Washington, DC 219 pp. 1966.

Gives occasional insights into the responses of wolves to the researcher on the ground, and to the aircraft used for observations. The researcher was not threatened by wolves, even when he examined recent kills. the wolves became habituated to the airplane used for observations and usually did not run even when repeatedly buzzed as low as 40 feet (Ream 1980).
371. Mech, L. D.; S. H. Fritts; G. L. Radde; and W. J. Paul. WOLF DISTRIBUTION AND ROAD DENSITY IN MINNESOTA. Wildl. Soc. Bull.; 16:85-87. 1988.
372. Mech, L. D.; T. J. Meier; and J. W. Burch. DENALI PARK WOLF STUDIES: IMPLICATIONS FOR YELLOWSTONE. Trans. N. Am. Wildl. Nat. Res. Resour. Conf.; 56:86-90. 1991.
373. Mech, L. D. WOLF POPULATION SURVIVAL IN AN AREA OF HIGH ROAD DENSITY. Am. Midl. Nat.; 121:387-389. 1989.
374. Melquist, W. E.; and M. G. Hornocker. *ECOLOGY OF RIVER OTTERS IN WEST CENTRAL IDAHO. Wildl. Monogr. No. 83:1-60. 1983.

375. Melquist, W. E.; and A. Dronkert. *RIVER OTTER. Pages 625-641 in: M. Novak; J. A. Baker; M. E. Obbard; and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources. Ontario. 1987.

376. Melvin, S. M.; A. Hecht; and C. R. Griffin. PIPING PLOVER MORTALITIES CAUSED BY OFF-ROAD VEHICLES ON ATLANTIC COASTAL BEACHES. Wildl. Soc. Bull.; 22:409-414. 1994.

This article describes 14 incidents of piping plover mortality caused by ORVs in Massachusetts and New York from 1989 through 1993. The incidents demonstrate that ORV use, even at levels of 5-10 vehicle passes per day, is a threat to unfledged piping plover chicks and adults during brood-rearing periods. Management implications are discussed.

377. Mickelson, P. G. BREEDING BIOLOGY OF CACKLING GEESE AND ASSOCIATED SPECIES ON THE YUKON-KUSKOKWIM DELTA, ALASKA. Wildl. Monogr.; 45. 35pp. 1975.

From this study on cackling Canada geese, brant, emperor geese, white-fronted geese, and spectacled eiders, it was estimated that losses to avian predators (mostly glaucous gulls) were doubled by the presence of the researcher. Human presence and the sound of boats caused parents to temporarily desert nests and young, leaving them vulnerable to predators (Boyle and Samson 1983).

378. Miller, F. L. INTERACTIONS BETWEEN MEN, DOGS AND WOLVES ON WESTERN QUEEN ELIZABETH ISLANDS, NORTHWEST TERRITORIES, CANADA. Musk-Ox; 22:70-72. 1978.

Observations of wolves with humans and dogs at remote sites in northern Canada and the implications for the survival of wolves are discussed. Many arctic wolves are fearless of man, and while wolves pose no danger to humans they are sometimes shot out of fear and ignorance when they approach humans. Recent declines in prey species and expanding developments contribute

to wolves feeding on garbage, increasing the frequency of interactions with man (Boyle and Samson 1983).

379. Moen, A. N. ENERGY CONSERVATION OF THE WHITE-TAILED DEER IN THE WINTER. *Ecology*; 57(1):102-198. 1976.

Analyzes energy-conserving behavioral adaptations of white-tailed deer in northwestern Minnesota during winter. Energy conservation of up to 1,000 Kcal/day for a 60 kg deer can result from reduced activity levels (seeking level land and lesser snow depth, walking slowly, etc.). Winter harassment by dogs or snowmobile traffic is detrimental to these adaptations (Ream 1980).

380. Moen, A. N. SEASONAL CHANGES IN HEART RATES, ACTIVITY METABOLISM, AND FORAGE INTAKE OF WHITE-TAILED DEER. *J. Wildl. Manage.*; 42(4):715-738. 1978.

White-tailed deer exhibited seasonal rhythms in heart rates, activities, and metabolism, with the lowest ecological metabolism occurring in the winter and highest in the summer. This rhythm is an adaptation for energy conservation; resource needs are lower when range resources are reduced. As metabolism rises in March and April, the intake of dormant forage should also rise until more digestible spring growth is available. The timing of the arrival of spring seems to be an important factor in population dynamics, with its effect being more pronounced 2 years later when the fawns should become members of the breeding population.

381. Morgantini, L. E.; and R. J. Hudson. HUMAN DISTURBANCE AND HABITAT SELECTION IN ELK. in: *Symposium on Elk Ecology and Management*, pp 132-139; Laramie, WY. 1978 Apr 3.

Habitat selection by elk was not simply related to weather conditions or available food. Passive harassment resulting from human activities (vehicular and hunting) reduced elk use of open grassland (transected by roads) and caused overgrazing of marginal areas (away from roads). This may be

especially hard on elk during severe winters when energy budgets are stressed (Ream 1980).

382. Morrison, J. HOUNDS OF HELL. Georgia Game and Fish; 3(12): 13-19. 1968.

383. Mueller, A. J.; and P. O. Glass. DISTURBANCE TOLERANCE IN A TEXAS WATERBIRD COLONY. Colonial Waterbirds; 11:119-122. 1988.

384. Munthe, K.; and J. H. Hutchison. A WOLF-HUMAN ENCOUNTER ON ELLESMERE ISLAND, CANADA. J. Mammal.; 59:876-878. 1978.

A wolf-human encounter in the Canadian arctic is described. Two scientists engaged in fieldwork on Ellesmere Island were approached by six wolves; while the wolves stood a few meters away the scientists threw clods of mud and a backpack at the wolves. One animal leapt toward one of the persons, grazing her cheek but not injuring her; afterward the wolves retreated. The second substantiated in the literature of unprovoked wolf aggression towards humans (Boyle and Samson 1983).

385. Murphy, J. R. AGGRESSIVE BEHAVIOR OF A BALD EAGLE. Auk; 79: 712-713. 1962.

A deliberate attack upon a human by a bald eagle is reported. While photographing a bald eagle nest in Yellowstone National Park, a naturalist suffered a superficial laceration, presumably a scratch by a talon, when one of the nesting eagles swooped near him. The attack is interpreted as an act of territorial defense, although reports of eagle attacks are rare (Boyle and Samson 1983).

386. Murphy, J. R. NEST SITE SELECTION BY THE BALD EAGLE IN YELLOWSTONE NATIONAL PARK. Utah Acad. Sci. Arts Let. Proc. ; 42:261-264. 1965.

Along with proximity to water and food sources, human disturbance is suggested as an important factor determining bald eagle nest site selection in Yellowstone National Park. Instances of apparent disruption of bald eagle nesting by human intrusions are cited.

387. National Park Foundation. NATIONAL PARKS FOR THE 21TH CENTURY--THE VAIL AGENDA. Report and recommendations to the Director of the National Park Service. Capital City Press, Montpelier, VT. 1992.

388. Neil, P. H.; R. W. Hoffman; and R. B. Gill. EFFECTS OF HARASSMENT ON WILD ANIMALS--AN ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES. Colorado Division of Wildlife; Special Rep. No. 37, Denver. 21 pp. 1975.

Annotated Bibliography: This is a compilation of 68 annotated references dealing with the many forms of harassment of wild mammals and birds in their natural habitats. Emphasis in this bibliography is principally on the effects of off-the-road vehicles, free-roaming pets, urbanization and other habitat alterations, and hunting.

389. Nelson, M. E.; and L. D. Mech. RELATIONSHIP BETWEEN SNOW DEPTH AND GRAY WOLF PREDATION ON WHITE-TAILED DEER. J. Wildl. Manage.; 50(3):471-474. 1986.

Survival of 203 yearling and adult white-tailed deer was monitored for 23,441 deer days from January through April 1975-85 in northeastern Minnesota. Gray wolf predation was the primary mortality cause, and from year to year during this period, the mean predation rate ranged from 0.000 to 0.029. The sum of weekly snow depths/month explained 51% of the variation in annual wolf predation rate, with the highest predation during the deepest snow.

390. Nero, R. W. *THE GREAT GRAY OWL: PHANTOM OF THE NORTHERN FOREST. Smithsonian Institution Press,. 0167.

391. Neumann, P. W.; and H. G. Merriam. ECOLOGICAL EFFECTS OF SNOWMOBILES. Can. Field-Nat.; 86:207-212. 1972.

Studies in Ontario showed that snowmobiles caused significant changes in snow structure and wildlife behavior. Snowmobile use affected snowshoe hare and red fox mobility and distribution, and caused significant damage to browse plants (Boyle and Samson 1983).

392. Newby, F. E.; and P. L. Wright. *DISTRIBUTION AND STATUS OF THE WOLVERINE IN MONTANA. J. Mammal.; 36:248-253. 1955.

393. Newby, F. E.; and J. J. McDougal. *RANGE EXTENSIONS OF THE WOLVERINE IN MONTANA. J. Mammal.; 45:485-487. 1964.

394. Newton, I. *POPULATION ECOLOGY OF RAPTORS. Buteo Books, Vermillion, SD (397pp). 1979.

395. Noake, D. W. CAMPING AS A FACTOR IN THE ECOLOGICAL IMPACT OF TOURISM AND RECREATION. Pages 224-229 in: Towards a new relationship of man and nature in temperate lands. Part 1: Ecological impact of recreation and tourism upon temperate environments. IUCN Tenth Technical Meeting, 26-30 June 1966, Lucerne, Switzerland. IUCN Publ. New Serv. 7, Morges, Switzerland. 1967.

Camping has become a major part of tourism and recreation in recent years. Many modern campers seek only inexpensive vacations or overnight accommodations, harboring little interest in nature. Terrain damage, soil and water pollution, and disruption of peripheral natural habitats are frequent results of excessive camping pressure. Wildlife can be exposed to harmful substances in trash and debris left at campsites, or suffer harassment from campers or their pets (Boyle and Samson 1983).

396. Norris, R. A. *COMPARATIVE BIOSYSTEMATICS AND LIFE HISTORY OF THE NUTHATCHES, SITTA PYGMAEA AND SITTA PUSILLA. Univ. Calif. Publ. Zool; 56:119-300. 1958.

397. Norris-Elye, L. T. S. THE BLACK BEAR AS PREDATOR OF MAN. J. Mammal.; 32:222-223. 1951.

An instance of an apparently unprovoked attack by a black bear upon 3 small children in Manitoba is described. While the children were left unattended in a cabin. the bear entered and carried a seven-year-old girl into nearby bushes, where it killed her and fed on parts of the body. The bear remained in the area until killed (Boyle and Samson 1983).

398. Nyran, R. B.; and M. C. Jansson. PERCEPTION OF WILDLIFE HAZARD IN NATIONAL PARK USE. Trans. N. Am. Wildl. Nat. Resour. Cong.; 38:281-295. 1973.

Increased visitation to North American National Parks is resulting in more people-wildlife encounters, thus generating crucial management problems. Park management policies are subject to public opinions, which in turn depend on public perceptions. Results of a study to determine visitor perceptions of wildlife hazard in western National Parks are reported and management implications are discussed (Boyle and Sampson 1983).

399. O'Farrell, M. J. *STATUS REPORT: EUDERMA MACULATUM. Report to USDI, U.S. Fish Wildl. Serv., Albuquerque. 28 pp. 1981.

400. O'Farrell, M. J.; and E. H. Studier. *MYOTIS THYSANODES. Mammalian Species No. 137. 5 pp. 1980.

401. O'Farrell, M. J.; and E. H. Studier. *REPRODUCTION, GROWTH AND DEVELOPMENT IN MYOTIS THYSANODES AND M. LUCIFUGUS (CHIROPTERA: VESPERTILIONIDAE). Ecology; 54:18-30.

402. Okarma, H.; and P. Koteja. BASAL METABOLIC RATE IN THE GRAY WOLF IN POLAND. J. Wildl. Manage.; 51(4):800-801. 1987.

Basal metabolic rate (BMR) was measured in 12 gray wolves in winter. The BMR averaged 8.08 liters oxygen/hour; resting metabolic rate after feeding was about 45% higher. The authors suggest that the factorial metabolic scope value in the wolf is at least 3X higher than an average for various mammals and may constitute an adaptation to the predatory way of life.

403. Olendorff, R. R. THE ECOLOGY OF THE NESTING BIRDS OF PREY OF NORTHEASTERN COLORADO. U.S. IBP Grassl. Biome Tech. Rep. 211. Natural Resource Ecology Laboratory, Colorado State University, Fort Collins. 223 pp. 1973.

In this detailed report on the biology of nesting raptors on a shortgrass prairie region of Colorado, dangers of raptor nesting studies to eggs and young are discussed including trampling, cooling and overheating of eggs, predation, desertion, missed feedings, mishandling of young, and premature fledging. Effects of land use on nesting Swainson's hawks were evaluated; lands posted against trespassing showed increased hawk fledging success (Boyle and Samson 1983).

404. Olenick, B. E. *REPRODUCTIVE SUCCESS OF BURROWING OWLS USING ARTIFICIAL NEST BURROWS IN SOUTHEASTERN IDAHO. Eys; 10:38. 1987.

405. Olsen, D. L.; D. R. Blankenship; R. C. Erickson; R. Drewien; H. D. Irby; R. Lock; and L. S. Smith. WHOOPING CRANE RECOVERY PLAN. USDI, U. S. Fish and Wildlife Service; Washington, DC. 206 pp.

This recovery plan presents information on the history, biology, and status of the whooping crane, and detailed management plans aimed at restoring the whooping crane to nonendangered status. Among factors believed responsible for the near extinction of the species are various forms of indirect and direct human disturbance. Whoopers seem to tolerate some disturbance, but only

for short periods of time and if no obvious threats occur (Boyle and Samson 1983).

406. Olson, S. T.; and W. Marshall. THE COMMON LOON IN MINNESOTA. Occasional Paper #5, Minnesota Mus. Nat. History, Univ. Minnesota Press, Minneapolis. 77 pp. 1952.
407. Olson, S. L.; and W. D. Edge. *NEST SITE SELECTION BY MOUNTAIN PLOVERS IN NORTHCENTRAL MONTANA. J. Range Manage.; 38:280-282. 1985.
408. O'Malley, J. B. E.; and R. M. Evans. KLEPTOPARASITISM AND ASSOCIATED FORAGING BEHAVIORS IN AMERICAN WHITE PELICANS. Colonial Waterbirds; 6:126-129.
409. Otvos, I. S. *ARTHROPOD FOOD OF SOME FOREST-INHABITING BIRDS. Can. Entomol.; 117:971-990. 1985.
410. Packard, J.; and L. D. Mech. *POPULATION REGULATION IN WOLVES. Pages 135-150 in: M. N. Cohen, R. S. Malpass, and H. G. Klein, eds. Biosocial mechanisms of population regulation. Yale University Press, New Haven. 406 pp. 1980.
411. Palmer, D. A. *HABITAT SELECTION, MOVEMENTS AND ACTIVITY OF BOREAL AND SAW-WHET OWLS. M.S. thesis; Colorado State Univ., Fort Collins. 101 pp. 1986.
412. Park, E. *THE WORLD OF THE OTTER. J. B. Lippencott, Philadelphia. 159 pp. 1971.
413. Parker, K. L.; C. T. Robbins; and T. A. Hanley. ENERGY EXPENDITURES FOR LOCOMOTION BY MULE DEER AND ELK. J. Wildl. Manage.; 48(2):474-488. 1984.

Energy expenditures for several activities were measured using indirect calorimetry with 5 mule deer and 8 elk. The average energetic increment of standing over lying was 25%. Net energy costs (kcal/kg/km) of horizontal locomotion without snow decreased as a

function of increasing body weight. The average cost per kilogram for each vertical meter climbed on a 14.3 degree incline was 5.9 kcal. Efficiency of upslope locomotion averaged 40-45% for the two species; downslope efficiency decreased with increasing body size. Energy expenditures for locomotion in snow increased curvilinearly as a function of snow depth and density. To further understand the energetics of locomotion in snow, foot loading and leg length were measured. Management implications, based on the costs of locomotion for mule deer and elk when disturbed by winter recreationists and when traversing the slash deposition of logging operations are discussed.

414. Pelton, M. R. *BLACK BEAR (URSUS AMERICANUS). Pages 504-514 in: J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. John Hopkins University Press, Baltimore. 1982.
415. Penland, S. T. THE NATURAL HISTORY AND CURRENT STATUS OF THE CASPIAN TERN IN WASHINGTON STATE. M.S. thesis; University of Puget Sound, Tacoma, WA. 101 pp. 1976.

Status, distribution, and aspects of the biology were studied in Washington State. Human activity, affecting terns directly and indirectly, appear to be the greatest hazard to tern survival. Nest abandonment in response to disturbance was observed; mortality of eggs and especially chicks due to human presence can seriously impair the breeding success of the colony. Management recommendations are suggested (Boyle and Samson 1983).
416. Perkins, M. *THE PLIGHT OF PLECOTUS. Bats; 2:1-3. 1985.
417. Perry, M. C.; and R. H. Giles. STUDIES OF DEER-RELATED DOG ACTIVITY IN VIRGINIA. Proc. S. E. Assoc. Game and Fish Comm. Conf.; 24:64-73. 1970.
418. Peters, R. P.; and L. D. Mech. *SCENT-MARKING IN WOLVES. American Scientist: 63:628-637. 1975.

419. Peterson, R. O. MANAGEMENT IMPLICATION OF WOLF-MOOSE RESEARCH, ISLE ROYALE NATIONAL PARK, MICH. Rept. to the Natl. Park Serv. 14 pp. 1977.

Wolves of Isle Royale tend to avoid contact with humans. Wolf use of park trails declines after visitors arrive in the spring. Selection of den and rendezvous sites indicates pronounced avoidance of humans. Management suggestions include limiting visitation, enlarging existing backcountry campsites rather than establishing new campgrounds, no further trail development, and discouragement of winter visitor use (Ream 1980).

420. Phillips, R. L.; T. P. McEneaney; and A. E. Beske. POPULATION DENSITIES OF BREEDING GOLDEN EAGLES IN WYOMING. Wildl. Soc. Bull.; 12:269-273. 1984.

The authors located 320 pairs of golden eagles in a 19,395 square km sample area. They also estimated that at least 80% of Wyoming contains good golden eagle nesting habitat which is probably, at the present, saturated with breeding eagles. They conclude that golden eagle populations in Wyoming should remain relatively stable in the foreseeable future.

421. Pils, C. M.; and M. A. Martin. DOG ATTACK ON A COMMUNAL FOX DEN IN WISCONSIN. J. Wildl. Manage.; 38(2):359-360. 1974.

422. Platt, J. B. THE BREEDING BEHAVIOR OF WILD AND CAPTIVE GYRFALCONS IN RELATION TO THEIR ENVIRONMENT AND HUMAN DISTURBANCE. Ph.D. Diss. Cornell University, Ithaca, NY. 173 pp. 1977.

Nesting gyrfalcons in the Yukon Territory, Canada, were experimentally disturbed by helicopter overflights. There was an inverse relationship between the percentage of birds disturbed and the altitude of the helicopter above the nest. Gyrfalcons did not appear distressed by the sound of an unseen helicopter but watched aircraft passing up to 2 km away. No pair was

known to have abandoned nesting efforts because of helicopter overflights (Boyle and Samson 1983).

423. Plumpton, D. L.; and R. S. Lutz. INFLUENCE OF VEHICULAR TRAFFIC ON TIME BUDGETS OF NESTING BURROWING OWLS. J. Wildl. Manage.; 57(3):612-616. 1993.

The authors investigated time-budgets of adult burrowing owls to determine potential impacts of environmental cleanup at Rocky mountain Arsenal, Colorado. Vehicular traffic observed in the study (0-16 vehicles/15 min) was only weakly correlated to two of 8 behaviors evaluated (locomotion and alert). Vehicular traffic, the index of cleanup disturbance, was determined to have had little impact on nesting burrowing owl behavior, and it had no impact on productivity even though nesting locations placed them in close proximity.

424. Pomerantz, G. A.; D. J. Decker; G. R. Goff; and K. G. Purdy. ASSESSING IMPACT OF RECREATION ON WILDLIFE: A CLASSIFICATION SCHEME. Wildl. Soc. Bull.; 16:58-62. 1988.

425. Poole, A. THE EFFECTS OF HUMAN DISTURBANCE ON OSPREY REPRODUCTIVE SUCCESS. Colon. Waterbirds; 4:20-27. 1981.

Effects of visits to osprey nests by researchers, trapping of breeding adults, and other human activities near nests were studied on the Atlantic coast from New York City to Boston, Massachusetts, and in Everglade National Park, Florida. No evidence was found of adverse effects of osprey reproduction from nest visits, although climbing nest trees may increase raccoon predation on young or eggs. Nests exposed to nearly continuous human activity produced young at rates equivalent to wilderness nests (Boyle and Samson 1983).

426. Portnoy, J. W. SOME ECOLOGICAL AND BEHAVIORAL ASPECTS OF A NESTING POPULATION OF RED-SHOULDERED HAWKS. M.S. thesis; University of Massachusetts, Amherst. 61 pp. 1974.

Hawks reacted to human disturbance during incubation by abandoning clutches at four nests. A hypothesis is presented linking decline of red-shouldered hawks to factors including sensitivity to human disturbance during nesting (Boyle and Samson 1983).

427. Potter, D. R.; K. M. Sharpe; and J. C. Hendee. HUMAN BEHAVIOR ASPECTS OF FISH AND WILDLIFE CONSERVATION: AN ANNOTATED BIBLIOGRAPHY. USDA, U.S. For. Ser. Gen. Tech. Rep. PNW-4. 288 pp. 1973.

Annotated Bibliography.

428. Powell, R. A. *THE FISHER-LIFE HISTORY, ECOLOGY AND BEHAVIOR. Univ. Minnesota Press, Minneapolis. 217 pp. 1982.
429. Progulske, D. R.; and T. S. Baskett. MOBILITY OF MISSOURI DEER AND THEIR HARASSMENT BY DOGS. J. Wildl. Manage.; 22(2):184-192. 1958.
430. Purves, H. D.; C. A. White; and P. C. Paquet. WOLF AND GRIZZLY BEAR HABITAT USE AND DISPLACEMENT BY HUMAN USE IN BANFF, YOHO, AND KOOTENAY NATIONAL PARKS: A PRELIMINARY ANALYSIS. Heritage Resources Conservation, Canadian Parks Service, Banff, AB. 1992.

The SPANS Geographic Information System was used to analyze observations of radio collared wolves and grizzly bears. The value of existing habitat suitability models was tested for these two species, as well as the human displacement effect of varying intensities of human activity. Human activity levels were classified using an exponential scale of monthly traffic on human use vectors (roads and trails), or monthly person/days of use for human use points and polygons (campsites, towns, and ski areas).

Within Banff National Park (BNP) over 91% of the wolf telemetry observations occurred within ecosites rated as high and very high habitat capability. Most wolf observations were in the Bow Valley between Vermillion Lakes and Bow Lake and in the Spray Valley to Kananaskis Country. Wolves used the valley bottoms for travel corridors but showed aversion to regions where winter human use exceeded 10,000 visitors per month. The town of Banff has created a partial blockage to wolf movement denying wolves access to prime habitat east of the town.

Only 51% of the grizzly bear observations were in ecosites rated as high and very high capability within BNP, Yoho National Park (YNP), and Kootenay National Park (KNP). Of ten radio collared bears, four were habituated to humans, and therefore removed from future data analysis. Grizzly bear tolerance to human use was found to be within the range of 1,001-10,000 visitors per month. In the three parks, 335 square kilometers of available habitat were found to have use levels which exceeded the tolerance of non-habituated bears.

Given the displacement of wolves and grizzly bears by current human use levels in BNP, YNP, and KNP, and forecasted increases in visitation to these parks, management of human use is essential if humans, wolves, and grizzly bears are to continue to coexist. An objective of "no-net-loss" for carnivore habitat must be accepted by the Canadian Parks Service (CPS). A possible management strategy is to accommodate increased human activity in areas where wolves and grizzly bears have been totally displaced, and discourage increased human use of areas still used by these carnivores. In all cases, carnivore migration corridors must be preserved or widespread habitat alienation can occur.

As part of cumulative effects management, knowledge of displacement must be integrated with other factors that affect the survival of wolves and grizzly bears in the Canadian Rockies. It is recommended that a standing Environmental Assessment and Review Process (EARP) Panel should be established immediately to ensure that cumulative effects are recognized in preserving carnivores in YNP, KNP, and BNP.

431. Quinn, N. W. S.; and G. Parker. *LYNX. Pages 682-695 in: M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario. 1987.

432. Rabb, G. B. *REPRODUCTIVE AND VOCAL BEHAVIOR IN CAPTIVE PUMAS. J. Mammal.; 40:616-617. 1959.

433. Ream, C. H. HUMAN-WILDLIFE CONFLICTS IN BACKCOUNTRY: POSSIBLE SOLUTIONS. Page 153-163 in: R. Ittner, D. R. Potter, J. K. Agee, and S. Anschell, eds. Recreational impacts on wildlands. Conf. Proc., 27-29 October 1978, Seattle, WA. U.S. For. Serv. R-6-001-1979. 1979.

Increasing backcountry recreational use and diminishing wildlands contribute to growing pressures on wildlife in backcountry areas. The extent of human impacts and possible solutions are reviewed. Deliberate harassment sometimes occurs, but the major impact of humans on wildlife results from unintentional disturbance. Management of people, wildlife, and habitat may be necessary to reduce human-wildlife conflicts (Boyle and Samson 1983).

434. Ream, C. H. IMPACT OF BACKCOUNTRY RECREATIONISTS ON WILDLIFE: AN ANNOTATED BIBLIOGRAPHY. USDA, U.S. For. Serv. Gen. Tech. Rep. INT-84. 1980.

*Annotated Bibliography.

435. Ream, C. H. RESEARCH ON LOON PRODUCTIVITY AND PESTICIDE RESIDUES. USDI, U.S. Fish Wildl. Serv.; Bureau of Sport Fisheries and Wildlife, Final Report. 25 pp. 1968. Reasons for a decline in the reproductive rate of common loons were investigated in Minnesota. A major cause for the decrease was the use of island campsites by canoeists. Pesticide residues were determined to be a potential danger to loons in some lakes (Boyle and Sampson 1983).

436. Redman, R. L. *EGG SIZE AND LAYING DATE OF LONG-BILLED CURLEWS: IMPLICATIONS FOR FEMALE REPRODUCTIVE TACTICS. *Oikos*; 46:330-338. 1986.
437. Redmond, R. L.; and D. A. Jenni. *NATAL PHILOPATRY AND BREEDING AREA FIDELITY OF LONG-BILLED CURLEWS: PATTERNS AND EVOLUTIONARY CONSEQUENCES. *Behavioral Ecology and Sociobiology*; 10:277-279. 1982.
438. Redmond, R. L.; and D. A. Jenni. *POPULATION ECOLOGY OF LONG-BILLED CURLEWS IN WESTERN IDAHO. *Auk*; 103:755-767. 1986.
439. Reid, M.; R. Mule; and B. Renfrow. ASSESSMENT OF GRIZZLY BEAR UTILIZATION AND HABITAT QUALITY IN THE CLARK'S FORK SNOWMOBILE TRAIL CORRIDOR. Prep. for Douglass Hart B-4 Ranch. Prep. by KRA Nat. Resour. Consultants, Bozeman, MT. 54 pp. 1983.
440. Reid, N. J. PUBLIC VIEW OF WILDLIFE. Pages 77-80 in: Towards a new relationship of man and nature in temperate lands. Part 1: Ecological impact of recreation and tourism upon temperate environments. IUCN Tenth Technical Meeting, 26-30 June 1966, Lucerne, Switzerland, IUCN Publ. New Serv. 7, Morges, Switzerland. 1967.

Techniques for providing public viewing of wildlife in U. S. National Parks are discussed. Sound ecological management of parks resources can greatly improve wildlife viewing, and special viewing facilities and devices are suggested for increasing viewing opportunities. Park roads are often major viewing points in National Parks. Visitors should be encouraged to adjust their schedules to take advantage of seeing wildlife at their most active times (Boyle and Samson 1983).

441. Reinecke, K.; and D. Delnicki. DUCKDATA; A BIBLIOGRAPHIC DATA BASE FOR NORTH AMERICAN WATERFOWL (ANATIDAE) AND THEIR WETLAND HABITATS. USDI, U.S. Fish Wildl. Ser. Res. Pub. 188. 1992.

*Annotated Bibliography (available from authors on formatted user-supplied diskettes in ProCite format, contains some 9,000 citations).

442. Restani, M. RESOURCE PARTITIONING AMONG THREE SPECIES OF HAWKS IN THE CENTENNIAL VALLEY, MONTANA. M.S. thesis; Montana State University, Bozeman. 86 pp. 1989.
443. Retfalvi, L. I. BREEDING BEHAVIOR AND FEEDING HABITS OF THE BALD EAGLE ON SAN JUAN ISLAND, WASHINGTON. M. For. Thesis; University of British Columbia, Vancouver. 1965.

Studies of bald eagle breeding behavior in Washington determined reasons for the general decline in eagle numbers. Eagles subjected to prolonged human presence appeared to become accustomed to humans, and were less easily frightened from nests by human presence. Disturbance by interested tourists and the author may have been responsible for some nest abandonment, but the destruction of habitat poses the greatest threat to bald eagles (Boyle and Samson 1983).

444. Reynolds, H. V. ,. III. POPULATION STUDIES OF THE GOLDEN EAGLE IN SOUTHCENTRAL MONTANA. M.S. thesis; University of Montana, Missoula. 69 pp. 1969.

During population studies of golden eagles in Montana, effects of human disturbance on nesting eagles were assessed. Comparisons of data from different years when intensity of human disturbance varied suggest that banding activities and repeated visits to nests did not influence eagle nest occupancy or productivity (Boyle and Samson 1983).

445. Richens, V. B.; and G. R. Lavigne. RESPONSE OF WHITE-TAILED DEER TO SNOWMOBILES AND SNOWMOBILE TRAILS IN MAINE. Can. Field-Nat.; 92:334-344. 1978.

Studies of deer responses to snowmobiles in Maine revealed that deer were not driven from the area by snowmobiles and frequently followed snowmobile trails where the snow was firmer. It is suggested that snowmobiles could be used to manage deer in winter by providing trails where walking in snow is easier and inducing winter movements to suitable habitat (Boyle and Samson 1983).

446. Robert, H. C.; and C. J. Ralph. EFFECTS OF HUMAN DISTURBANCE ON THE BREEDING SUCCESS OF GULLS. Condor; 77:495-499. 1975.

The effects of human disturbance on a colony of western gulls on southeast Farallon Island, California, were studied. Overall mortality of young was higher on a disturbed plot than on an undisturbed plot, and hatching failure was directly proportional to the amount of disturbance (Boyle and Samson 1983).

447. Robertson, R. J.; and N. J. Flood. EFFECTS OF RECREATIONAL USE OF SHORLINES ON BREEDING BIRD POPULATIONS. Can. Field-Nat.; 94:131-138. 1980.

Studies at six lakes in southern Ontario investigated effects on breeding birds caused by recreational use of shorelines. Levels of disturbance were rated according to density of cottages, proximity of roads, and boat traffic adjacent to the shorelines. Disturbed areas had more birds but lower species diversity than more natural areas (Boyle and Sampson 1983).

448. Rocky Mountain/Southwestern Recovery Team. *AMERICAN PREGRINE FALCON RECOVERY PLAN (ROCKY MOUNTAIN, SOUTHWEST POPULATIONS). U.S. Fish Wildl., Denver, CO. 183 pp. 1977.

449. Rogers, L. L.; G. A. Wilker; and S. S. Scott. REACTIONS OF BLACK BEARS TO HUMAN MENSTRUAL ODORS. J. Wildl. Manage.; 55(4):632-634. 1991.

Due to widespread concern that menstruating women might be attacked by black bears (*Ursus americanus*), the authors recorded responses of 26 free-ranging black bears to tampons from 26 women and recorded responses of 20 free-ranging bears to 4 menstruating women in northeastern Minnesota. Menstrual odors were essentially ignored by black bears of all ages and either sex, regardless of season or the bear's reproductive status. In an extensive review of black bear attacks across North America, the authors found no instance of black bears attacking or being attracted to menstruating women.

450. Rolley, R. E. *BOBCAT. Pages 670-681 in: M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario. 1987.
451. Rost, G. R. RESPONSE OF DEER AND ELK TO ROADS. M.S. thesis; Colorado State University, Fort Collins. 51 pp.. 1975.

Responses of deer and elk to roads on winter ranges in Colorado were studied by counting fecal pellet groups along transects perpendicular to roads. Deer and elk apparently avoided areas near roads, particularly areas within 200 meters of roads. Deer avoided even dirt roads, some of which were used only by four-wheel drive vehicles, trailbikes, and hikers (Boyle and Samson 1983).

452. Rost, G. R.; and J. A. Bailey. RESPONSES OF DEER AND ELK TO ROADS ON THE ROOSEVELT NATIONAL FOREST. Dept. Fish and Wildl. Biol., Colo. St. Univ., Ft. Collins. 19 pp. (mimeo). 1974.

...In the mountain shrub and ponderosa pine vegetation zones on the Roosevelt National Forest, Colorado, deer and elk pellet-groups densities increased with distance from roads. Deer avoidance of roads was greater in the

ponderosa pine zone. Paved, gravel and unimproved dirt roads were avoided. Limited data for elk indicated that elk avoid gravel roads but not dirt roads, which are usually snowbound when elk are present, in the ponderosa pine zone. It is not known if deer or elk will avoid roads to an extent that is detrimental to their welfare (Neil et al. 1975).

453. Ryan, J. M. *DIETARY OVERLAP IN SYMPATRIC POPULATIONS OF PIGMY SHREWS AND MASKED SHREWS IN MICHIGAN. Can. Field-Nat.; 100:225-228. 1986.

454. Saltz, D.; and G. C. White. URINARY CORTISOL AND UREA NITROGEN RESPONSES TO WINTER STRESS IN MULE DEER. J. Wildl. Manage.; 55(1):1-16. 1991.

The authors investigated the urinary cortisol and urea nitrogen responses of mule deer in winter population densities. Urine cortisol, assumed to reflect energy deficit, allows researchers to distinguish high levels of urea nitrogen caused by the availability of crude protein from those caused by muscle catabolism. The authors concluded that by reflecting both environmental and animal condition, urine cortisol provides a tool for assessing population condition and ecological density.

455. Schaller, G. B. .. *THE BREEDING BEHAVIOR OF THE WHITE PELICAN AT YELLOWSTONE LAKE, WYOMING. Condor; 66(1):3-23. 1964.

456. Schmid, W. D. SNOWMOBILE ACTIVITY, SUBNIVIAN MICROCLIMATE AND WINTER MORTALITY OF SMALL MAMMALS. Bull. Ecol. Soc. Am.; 53(2):37 (Abstract only).

Compaction of snowfields by snowmobiles alters the mild snow microclimate, potentially affecting organisms that live within or beneath the snow by increasing temperature stress or restricting movement. Experimental manipulation of a snowfield showed that winter mortality of small mammals was significantly increased by snowmobile compaction (Boyle and Samson 1983).

457. Schmutz, J. K. *FERRUGINOUS AND SWAINSON'S HAWK ABUNDANCE AND DISTRIBUTION IN RELATION TO LAND USE IN SOUTHEASTERN ALBERTA. J. Wildl. Manage.; 48:1180-1187. 1984.

458. Schreiber, R. W. BAD DAYS FOR THE BROWN PELICAN. Natl. Geogr. Mag.; 147:111-123. 1975.

Once abundant along much of the warmer United States shoreline, brown pelicans have been greatly reduced in numbers and face an uncertain future even in Florida, the pelicans, last U.S. stronghold. While birds are beginning to recover from the apparent effects of chemical contaminants, disturbance to colonies and entanglement of birds in fishing gear pose substantially increasing threats to this endangered species (Boyle and Samson 1983).

459. Schroeder, G. J. TWO-YEAR INVESTIGATION OF THE OSPREYS OF NORTHERN IDAHO. M.S. thesis; University of Idaho, Moscow. 63 pp. 1972.

Investigations of ospreys in northern Idaho determined that human disturbance was not detrimental to ospreys overall, although occasional shootings and nesting failures due to disturbances occurred. Recreational boating occurring frequently near two osprey nests did not prevent successful fledging of young (Boyle and Sampson 1983).

460. Schullery, P. *THE BEARS OF YELLOWSTONE. Yellowstone Library and Museum Assoc., Yellowstone National Park, WY. 176 pp. 1980.

461. Schultz, R. D.; and J. A. Bailey. RESPONSES OF NATIONAL PARK ELK TO HUMAN ACTIVITY. J. Wildl. Manage.; 42(1):91-100. 1978.

Responses of elk to human activities near a road were quantified for fall, winter, and spring in Rocky Mountain National Park. These elk, which experienced

little or no hunting, were not significantly affected by normal on-road visitor activities (Ream 1980).

462. Scott, P.; and the Waterfowl Trust. *THE SWANS. Houghton Mifflin, Boston. 242 pp. 1972.
463. Seidensticker, J. C. ,. IV; M. G. Hornocker; W. C. Wiles; and J. P. Messick. *MOUNTAIN LION SOCIAL ORGANIZATION IN THE IDAHO PRIMITIVE AREA. Wildl. Monogr. No. 35:1-60. 1973.
464. Serveen, C. W. ECOLOGY OF THE WINTERING BALD EAGLES ON THE SKAGIT RIVER, WASHINGTON. M.S. thesis; University of Washington, Seattle. 96 pp. 1975.

Bald eagle distributions in winter on the Skagit River, Washington, were related to habitat factors including human activity. Eagles initially utilized areas isolated from a road and receiving little human use, and only when food became less available in these areas were areas with more human activity utilized (Boyle and Samson 1983).

465. Several. SNOWMOBILES VERSUS WOLVES. International Wolf. 1992 Mar.

In response to the concern that snowmobile use may be harmful to wolf survival, the staff of "International Wolf" polled 40 wolf biologists with the question, "do you believe that snowmobiles are harmful to wolves in any way other than to provide accessibility to kill or harass them?" Excerpts from the seventeen biologists who responded are as follows:

Anonymous: "Snowmobile traffic may benefit wolves by packing the snow and allowing more efficient travel, particularly in deep snow. This probably allows more packs to travel their territories more rapidly, hunt more effectively, and advertise their territory (via scent marking and howling) more effectively. However, there must be some level of snowmobile traffic at which disturbance becomes detrimental. This may be 5 to 100 times the current level within wolf territories, but

undoubtedly there exists some threshold at which the network of snowmobile trails and frequency of passage of snowmobiles would preclude wolf occupancy."

Berg, B., Wildlife Biologist, Department of Natural Resources, Minnesota: "Unless a snowmobiler is hell-bent on killing a wolf, snowmobiles traveling on established trails likely have little or no adverse impacts on wolves. Rather, snowmobiles trails may help both wolves and deer by providing ease of access to other habitats and food sources. Most snowmobile trails and secondary roads in Minnesota have wolf tracks on them, and many wolf pack territories in northern Minnesota contain or border on snowmobile trails. With Minnesota's wolf population stable to slightly increasing, there is no reason to believe that average snowmobile traffic on established trails has any adverse effect."

Burch, J. Denali National Park, Alaska: "Wolves are smart, tough, adaptive animals both as individuals and as a species. There are several observations from both Alaska and Minnesota of wolves becoming accustomed to mechanized equipment. Wolves have proved their ability to deal with these disturbances and go on about their business as though they did not exist."

Darby, W. R. Ministry of Natural Resources, Ontario, Canada: "Snowmobile trails probably benefit wolves by making travel and access to prey easier."

Fuller, T. Asst. Prof., University of Massachusetts: "It seems clear that when no harassment is involved, and when the presence of vehicles does not otherwise disrupt normal behaviors, such vehicles likely are not harmful. However loud and unaesthetic snowmobiles may be to some people, wolves likely can adapt to them as long as there is no direct influence on behavior or survival."

Haber, G., Wildlife Scientist, Denali Park, Alaska: "If there are wolves in the area, there could be unintentional harassment. If there is a snow machine buzzing around them, wolves are likely to exit that immediate area, at least temporarily, whether the driver is intentionally after them or not."

Herbert, D., Integrated Environmental Resource Manager, Alberta-Pacific Forest Industries, Inc., Canada:

"Depending on the density of snowmobile activity and the size of the habitat area, I believe that most animals can accomodate this activity with short movements. Obviously, there is an activity level, even without harassment, that would limit accommodating movements".

"Although some evidence shows a change in [wolves] physiological response (heart rate), it has not been translated to increased mortality, body weight loss, etc.

It is highly unlikely that this activity will affect wolf survival. It certainly won't in Canada. There is a possibility it might in Minnesota. However, if snowmobile activity reaches that level, it probably isn't safe for humans either."

Kunkel. K. E., Graduate Research Assistant, University of Montana: "As long as the miles of trails in a given area don't reach a density where security cover for wolves is greatly diminished, the impact should be minimal. What this trail density is, is probably unknown, but I can think of no trail system in the northeastern portion of Minnesota where it is excessive and can't imagine such a system developing and being consistently used."

Mech, L. D., Wolf Biologist, National Biological Survey, Minnesota: "In my experience, wolves readily adapt to traffic and noise of snowmobiles just as they do to those of vehicles. I know of many wolf pack territories through which snowmobiles pass regularly every winter and have never seen any evidence of harm to wolves from them."

Nelson. M., Wildlife Research Biologist, U.S. Fish and Wildlife Service, Minnesota: "Except for providing human accessibilty to wolves, snowmobiles seem to present no direct threat to wolves. My observations of wolves in forested habitat indicate that wolves appear indifferent to snowmobile traffic that is not close to them (i.e., farther away that 100-220 yards). This is the same apparent indifference wolves display toward vehicular traffic, heavy machinery and walking humans at similar distances."

Meier, T., Denali National Park, Alaska: I'm disturbed by the tendency to use wolves to promote other agendas.

The result is usually a backlash against wolves and, more insidiously, a damage to the perception of wolves and natural systems in the minds of their strongest supporters. Wolves are not fragile losers who need our every effort to help them survive. They and their societies are robust and adaptable. If we refrain from killing them and allow them some prey to eat, they will thrive."

Peterson, R., Professor, School of Forestry and Wood Products, Michigan Technological University: "Wolves might avoid corridors used heavily by snowmobiles. One might expect this to be especially important where wolves are hunted/trapped. I am aware of no evidence that this is true, but such evidence is not easily obtained. Such avoidance, if it occurs, might not be important to a local wolf population, depending on distribution and abundance of prey. On the other hand, it is just as likely that wolves would utilize snowmobile trails for travel routes. Whether that might be beneficial or harmful to their long-term persistence is another open question."

Thiel, D., Coordinator, Sandhill Outdoor Skills Center, Department of Natural Resources, Wisconsin: "As our Cessna plane circled 300 feet above the snowy forest, I witnessed three members of the radioed Boot-jack pack nonchalantly devouring a deer, while within 300 feet, 15 snowmobilers passed by on an established trail. The "kill" was actually an unretrieved kill made two months earlier by a deer hunter, which the wolves had dug up and salvaged. Far from being intrusive, snowmobiles are simply a part of the wolves' winter environment and wolves deal with them as the circumstances dictate."

Wydeven, A., Wildlife Technician, Department of Natural Resources, Wisconsin: "In Wisconsin, we don't feel that normal traffic along designated trails probably has much effect on wolves. Travel off trails and near den sites in late winter may be more of a problem. Snowmobile traffic should probably be evaluated in relationship to road access concerns; where road densities (including snowmobile trails) become too high (one mile of road per square mile of land), the ability of wolves to exist will decline."

466. Severinghaus, C. W.; and B. F. Tullar. WINTERING DEER VERSUS SNOWMOBILES. *Conservationist*; 29(6):31. 1975.

Potential and observed effects of snowmobiles on wintering deer are discussed. Studies are cited in which deer were observed fleeing from approaching snowmobiles from as far as three quarters of a mile. Energy expenditure calculations demonstrate the danger of snowmobile harassment to deer already hard-pressed by winter conditions. Snowmobiles should not be permitted in deer wintering areas, and established trails should be kept at least one half mile from such areas (Boyle and Samson 1983).

467. Shaw, W. W.; and W. R. Mangun. NONCONSUMPTIVE USE OF WILDLIFE IN THE UNITED STATES. U.S. Fish Wildl. Serv. Res. Pub. 154, Washington, DC. 1984.

468. Shea, D. S. A MANAGEMENT-ORIENTED STUDY OF BALD EAGLE CONCENTRATIONS IN GLACIER NATIONAL PARK. M.S. thesis; University of Montana, Missoula. 78 pp. 1973.

Observations of bald eagles congregating in Glacier National Park, Montana, revealed that the greatest threat to eagles in the park was disturbance caused by park visitors. Management recommendations include the protection of certain areas from visitor disturbance such as snowmobiling and boating, and the establishment of designated areas where viewing and photography can be managed (Boyle and Samson 1983).

469. Short, L. L. *HABITATS AND INTERACTIONS OF NORTH AMERICAN BLACK-BACKED WOODPECKERS. *American Museum Novitates* No. 2547:1-42. 1979.

470. Short, L. L. *HABITS AND INTERACTIONS OF NORTH AMERICAN THREE-TOED WOODPECKERS. *American Museum Novitates* No. 2547:1-42. 1979.

471. Short, L. L. *WOODPECKERS OF THE WORLD. Delaware Museum of Natural History, Greenville, DE. 676 pp. 1982.

472. Shult, M. J. AMERICAN BISON BEHAVIOR PATTERNS AT WIND CAVE NATIONAL PARK. Ph.D. Diss. Iowa State University, Ames. 191 pp. 1972.

Encounters with humans resulted in various responses by bison depending on the degree of harassment. Examples of possible effects of bison behavior on the American Indians of the Great Plains are presented (Boyle and Samson 1983).

473. Shultz, R. D.; and J. A. Bailey. RESPONSES OF NATIONAL PARK ELK TO HUMAN ACTIVITY. J. Wildl. Manage.; 42(1):91-100. 1978.

Responses of elk to human activities near a road were quantified for fall, winter and spring in Rocky Mountain National Park. These elk, which experienced little or no hunting, were not significantly disturbed by normal on-road visitor activities (Ream 1980),.

474. Sidhu, S. S.; and A. B. Case. A BIBLIOGRAPHY ON THE ENVIRONMENTAL IMPACT OF FOREST RESOURCE ROADS: A LIST. Newfoundland forest Research Centre, St. Johns, Info. Rep. N-X-149. 28 pp. 1977.

Bibliography.

475. Sidle, J. G.; W. H. Koonz; and K. Roney. *STATUS OF THE AMERICAN WHITE PELICAN: AN UPDATE. American Birds; 39(5):859-864. 1985.
476. Singer, F. BEHAVIOR OF MOUNTAIN GOATS, ELK, AND OTHER WILDLIFE IN RELATION TO U.S. HIGHWAY 2, GLACIER NATIONAL PARK. Glacier National Park, West Glacier, MT. 96 pp. 1975.

Behavior, habitat use, and disturbance of elk, mountain goats, and other wildlife were studied in relation to a highway in Glacier National Park, Montana. Habituation to the highway made elk more vulnerable to poaching. Mountain goat-human interactions occurred frequently

near a salt lick; goat reactions were avoidance of and/or flight from humans. Highway design and construction are discussed (Boyle and Samson 1983).

477. Singer, F. J. BEHAVIOR OF MOUNTAIN GOATS IN RELATION TO HIGHWAY 2, GLACIER NATIONAL PARK, MONTANA. J. Wildl. Manage.; 42(3):591-597. 1978.

A study was conducted in 1975 on mountain goats crossing a highway to visit a mineral lick in Glacier National Park, Montana. Collision hazards and high disturbance during crossings suggested that a goat crossing should be constructed and visitors should be restricted from the crossing area (Boyle and Samson 1983).

478. Singer, F. J. SOME PREDICTIONS CONCERNING A WOLF RECOVERY INTO YELLOWSTONE NATIONAL PARK: HOW WOLF RECOVERY MAY AFFECT PARK VISITORS, UNGULATES AND OTHER PREDATORS. Trans. N. Am. Wildl. Nat. Resour. Conf.; 57:567-583. 1991.

479. Skaar, P. D. *MONTANA BIRD DISTRIBUTION. Monograph 3, Montana Acad. of Sciences, 44:ii-69. 1985.

480. Skagen, S. K.; R. L. Knight; and G. H. Orians. HUMAN DISTURBANCE OF AN AVIAN SCAVENGING GUILD. Ecol. Appl.; 1:215-225. 1991.

481. Skarr, D. MONTANA COMMON LOON MANAGEMENT PLAN. Report to USDA For. Serv., Region 1, Missoula. 57 pp. 1989.

482. Skiba, G. T. ECOLOGICAL EVALUATION OF THE DINOSAUR NATIONAL MONUMENT BIGHORN SHEEP HERD. M.S. thesis; Colorado State University, Fort Collins. 107 pp. 1981.

Human disturbance is one of several factors discussed relating to bighorn sheep ecology in Dinosaur National Monument, Colorado/Utah. An apparent sheep population decline has coincided with an increase in whitewater rafting through important sheep habitat, but

observations suggest that sheep are not seriously disturbed by people on foot or in rafts. Management recommendations include considerations for location of campsites to minimize sheep disturbance (Boyle and Samson 1983).

483. Smith, E. L. EFFECTS OF CANOEING ON COMMON LOON PRODUCTION AND SURVIVAL ON THE KENAI NATIONAL WILDLIFE REFUGE, ALASKA. M.S. thesis; Colorado State University, Fort Collins. 53 pp. 1972.

Impacts of recreational canoeing on common loons in Alaska were studied by comparing loon production, survival, and behavior between lakes receiving high and low use areas. Loon production was similar between high and low use areas, although changes in loon behavior due to canoeing were evident. Impacts of canoeing apparently have not reached critical levels (Boyle and Sampson 1983).

484. Snow, C. HABITAT MANAGEMENT SERIES FOR ENDANGERED SPECIES, REPORT NO. 1: AMERICAN PEREGRINE FALCON AND ARCTIC PEREGRINE FALCON. USDI, Bureau of Land Management; U.S. Bur. Land Manage. Tech. Note 167. 35 pp. 1972.

The distribution, biology, and decline of the peregrine falcon in the United States is described. Human disturbance is an important factor at some eyries, especially in the western U.S. Rock climbing near eyries during the nesting season usually causes falcons to abandon nesting activities. Some falcons are so sensitive to disturbance that they may not breed if humans have been anywhere near their eyries (Boyle and Samson 1983).

485. Snow, C. HABITAT MANAGEMENT SERIES FOR UNIQUE OR ENDANGERED SPECIES, REPORT NO. 7: GOLDEN EAGLE. USDI, Bureau of Land Management; U.S. Bur. Land Manage. Tech. Note 239. 52pp. 1973.

The distribution, life history, and habitat requirements of the golden eagle are reviewed. The tolerance of nesting golden eagles to human

interference appears to vary greatly. Although populations in the western U.S. are currently stable, human pressures from increasing development and recreational use of eagle habitat could become a serious factor. Management recommendations include the restriction of human activity in areas of eagle concentrations during breeding periods (Boyle and Samson 1983).

486. Snow, C. HABITAT MANAGEMENT SERIES FOR UNIQUE OR ENDANGERED SPECIES, REPORT NO. 13: FERRUGINOUS HAWK. USDI, Bureau of Land Management; U.S. Bur. Land Manage. Tech. Note 255. 23 pp. 1974.

The status, biology, and limiting factors of ferruginous hawks on public lands are reviewed. Nest desertions following human disturbance may be a significant factor limiting reproduction. Egg collectors and researchers have noted that even one visit within sight of a nest may cause desertion and abandonment of eggs. Human activities from resource development and recreation may become an important factor if it occurs before young have hatched (Boyle and Samson 1983).

487. Snyder, H. A.; and N. F. R. Snyder. INCREASED MORTALITY OF COOPER'S HAWKS ACCUSTOMED TO MAN. Condor: 76:215-216. 1974.

Recovery patterns from 235 banded Cooper's hawk nestlings suggest that familiarity with man renders a hawk more likely to die from predation by man, especially shooting. Birds with frequent exposures to man from banding activities or observation from blinds were recovered more frequently after being killed by humans than birds with little exposure to man; such birds apparently have less fear of humans and are more vulnerable to human predation (Boyle and Samson 1983).

488. Sodja, R. Jr. EFFECTS OF SNOWMOBILE ACTIVITY ON WINTERING PHEASANTS AND WETLAND VEGETATION IN NORTHERN IOWA MARSHES. M.S. thesis, Iowa State University, Ames. 72 pp. 1978.

Effects of dispersed snowmobile use on ring-necked pheasants and marsh vegetation were studied in Iowa. No effects of snowmobiling on pheasant movements were found. Observed vegetation changes did not appear to seriously alter wildlife habitat (Boyle and Samson 1983).

489. Spencer, A. W.; and D. Pettus. *HABITAT PREFERENCES OF FIVE SYMPATRIC SPECIES OF LONG-TAILED SHREWS. Ecology; 47: 677-683. 1966.

490. Spring, L. W. *CLIMBING AND PECKING ADAPTATIONS IN SOME NORTH AMERICAN WOODPECKERS. Condor; 67:457-488. 1965.

491. Stalmaster, M. V. *THE BALD EAGLE. Universe Books, New York. 227 pp. 1987.

492. Stalmaster, M. V.; and J. R. Newman. BEHAVIORAL RESPONSES OF WINTERING BALD EAGLES TO HUMAN ACTIVITY. J. Wildl. Manage.; 42(3):506-513. 1978.

Tolerance of wintering bald eagles in Washington to disturbance was determined by relating eagle distributions to human activity and measuring flight distances of eagles from simulated human disturbances. Human activity had adverse effects on eagle distribution and behavior. Management recommendations aimed at reducing human-caused disturbance are suggested (Boyle and Samson 1983).

493. Stalmaster, M. V.; and R. G. Plettner. DIETS AND FORAGING EFFECTIVENESS OF BALD EAGLES DURING EXTREME WINTER WEATHER IN NEBRASKA. J. Wildl. Manage.; 56(2):355-367. 1992.

The authors studied the diets and foraging efficiency of bald eagles on a system of reservoirs and canals adjacent to, and including a portion of, the Platte River System during extreme weather and extensive ice cover in southwestern Nebraska in 1989. Hunting, piracy, and scavenging comprised 87, 9, and 4% of 1,395 foraging attempts, respectively. Foraging opportunities and efficacy were enhanced by the maintenance of ice-free waters by hydroelectric and stream-plant operations, and by the disabling of prey by hydroelectric facilities. Adults were more effective foragers than subadults. The authors conclude that, with proper maintenance, power-generating facilities can benefit wintering eagles by providing foraging opportunities during periods of potential energy stress.

494. Stalmaster, M. V.; J. L. Kaiser and S. K. Skagen. EFFECTS OF RECREATIONAL ACTIVITY ON FEEDING BEHAVIOR OF WINTERING BALD EAGLES. J. Raptor Res.; 27(1):93. 1993.

495. Stankey, G. H.; and D. W. Lime. RECREATIONAL CARRYING CAPACITY: AN ANNOTATED BIBLIOGRAPHY. USDA, U.S. For. Serv. Gen. Tech. Rep. INT-3. 45 pp. 1973.

*Annotated Bibliography.

496. Stenzel, L. E.; H. R. Huber; and G. W. Page. *FEEDING BEHAVIOR AND DIET OF THE LONG-BILLED CURLEW AND WILLET. Wilson Bull.; 88:314-332. 1976.

497. Stephenson, R. O. CHARACTERISTICS OF WOLF DEN SITES. Alaska Dept. Fish Game Project W-017-R-06/WP14/J06/FIN. 29 pp. 1974.

Studies of wolf den site characteristics in the Brooks Range of Alaska and potential effects of human disturbance at den sites are discussed. Incidents of wolf-human interactions and factors important in determining wolf responses to humans are noted. It is suggested that in areas where wolves are shy of humans, prolonged human presence within 3.2 km of dens may affect wolf behavior and cause den abandonment (Boyle and Samson 1983).

498. Stevens, D. R. BIGHORN SHEEP MANAGEMENT IN ROCKY MOUNTAIN NATIONAL PARK. Proc. Bienn. Conf. North Am. Wild Sheep Goat Counc., 3. 1982.

One objective of bighorn sheep management in Rocky Mountain National Park, Colorado, has been to reduce the effects of park visitors on sheep. Visitor use of critical sheep habitats has been reduced by trail closures, and initial analysis indicates that disturbance of sheep has been reduced (Boyle and Samson 1983).

499. Stewart, R. E. *BREEDING BIRDS OF NORTH DAKOTA. Tri-College Center for Environmental Studies, Fargo. 1975.

500. Storer, B. E. *ASPECTS OF THE BREEDING ECOLOGY OF THE PIGMY NUTHATCH AND THE FORAGING ECOLOGY OF WINTERING MIXED-SPECIES FLOCKS IN WESTERN MONTANA. M.S. thesis; Univ, Montana, Missoula.. 1977.

501. Strickland, M. A.; C. A. Douglas; M. Novak; and N. P. Hunziger. *FISHER. Pages 586-598 in: J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. John Hopkins Univ., Baltimore. 1982.

502. Strickland, M. A.; C. W. Douglas; M. Novak; and N. P. Hunziger. *MARTEN (MARTES AMERICANA). Pages 599-612 in: Wild mammals of North America: biology, management, and economics. The John Hopkins Univ. Press, Baltimore. 1982.

503. Stringham, S. F. MOTHER-INFANT RELATIONS IN SEMI-CAPTIVE ALASKAN MOOSE. M.S. thesis; Univ. Alaska, Fairbanks. 140 pp. 1974.
Reactions of moose to the researcher are described in the methods section. Moose habituated to researcher but were disturbed by persistence of researcher once they were aware of his presence.

504. Sweeny, J. R.; R. L. Marchinton; and J. M. Sweeny. RESPONSES OF RADIO-MONITORED WHITE-TAILED DEER CHASED BY DOGS. J. Wildl. Manage.; 35(4):707-716. 1971.

505. Swenson, J. E. ECOLOGY OF THE BALD EAGLE AND OSPREY IN YELLOWSTONE NATIONAL PARK. M.S. thesis; Montana State University, Bozeman. 146 pp.. 1975.

Relationships of bald eagles and ospreys to human disturbances were examined during studies in Yellowstone National Park. Ospreys nesting on Yellowstone Lake had significantly lower nest success and productivity per occupied nest than ospreys nesting along streams, and the difference appeared to be related to human disturbance. Bald eagle reproduction did not appear to be affected by human disturbance. Management recommendations are presented (Boyle and Samson 1983).

506. Swenson, J. E. FACTORS AFFECTING STATUS AND REPRODUCTION OF OSPREYS IN YELLOWSTONE NATIONAL PARK. J. Wildl. Manage.; 43:595-601. 1979.

Reproduction of ospreys in Yellowstone National Park was higher along streams with little human disturbance than on Yellowstone Lake, where humans were more concentrated. Reproduction at active nests more than 1 km from a backcountry campsite on Yellowstone Lake was comparable to that for nests near streams. Since

undisturbed ospreys reproduced at a rate allowing population stability, the elimination of disturbance by visitor management should allow the declining lake population to stabilize (Boyle and Samson 1983).

507. Swenson, J. E.; K. L. Alt; and R. L. Eng. *THE ECOLOGY OF THE BALD EAGLE IN THE GREATER YELLOWSTONE ECOSYSTEM. Wildl. Monogr. 95. 46 pp. 1986.

508. Tarshis, I. B. AN UNUSUAL FATALITY OF A YEARLING CANADA GOOSE. Jack Pine Warbler; 49:128. 1971.

An incident of a Canada goose fatality from fishing line is reported from Michigan. A goose at the Seney National Wildlife Refuge was observed with a lump in its throat and breathing with difficulty; when the bird died it was found to have swallowed a mass of vegetation containing monofilament fishing line, which had caught on the bird's tongue. Fishermen frequently lose lines and tackle in the aquatic vegetation of the refuge (Boyle and Samson 1983).

509. Taylor, D. B.; and C. H. Trost. *FALL RAPTOR CONCENTRATION ON HENRYS LAKE FLATS. Raptor Res.; 19:143-144. 1985.

510. Taylor, R. J.; and E. D. Michael. PREDATION ON AN INLAND HERONRY IN EASTERN TEXAS. Wilson Bull.; 83:172-176. 1971.

A heronry of little blue herons, anhingas, green herons, and common egrets were studied in Texas. The investigators could give no explanation for the observed complete nesting failure, but suggested that human activity in the heronry may have been partly responsible (Boyle and Samson 1983).

511. Temple, S. A. *SYSTEMATICS AND EVOLUTION OF THE NORTH AMERICAN MERLINS. Auk; 89:325-338. 1972.

512. Tevis, L. Jr. MAN'S EFFECT ON BIGHORN IN THE SAN JACINTO-SANTA ROSA MOUNTAINS. Trans. Desert Bighorn Counc.; 3-69-76. 1959.

Human encroachment threatens the largest continuous population of bighorn sheep in California. Changes in land use toward real estate development threaten to destroy sheep habitat and eradicate vital waterholes. Despite the risk of increased disturbance to sheep, promotion of the herds's recreational value to tourists, photographers, and sightseers is seen as the way to generate public support for sheep conservation efforts (Boyle and Samson 1983).

513. Theil, R. P. RELATIONSHIP BETWEEN ROAD DENSITIES AND WOLF HABITAT SUITABILITY IN WISCONSIN. Am. Midl. Nat.; 113: 404-407. 1985.

Data on demise of wolf and increase in road densities compared between 1926 and 1960. Wolves failed to survive when road densities exceeded 0.93 miles/sq. mi.

514. Thelander, C. G. SPECIAL WILDLIFE INVESTIGATIONS: BALD EAGLE REPRODUCTION IN CALIFORNIA, 1972-1973. Calif. Dept. Fish Game Project W-054-R-06/WP02/J05/8A. 18 pp. 1973.

Human disturbances interfere with nest selection and occupancy of bald eagles in California, posing a major threat to the already endangered population. A territory in a recreation area used by boaters, campers, and off-road vehicles was abandoned by eagles in 1972, possibly due to human disturbance (Boyle and Samson 1983).

515. Thompson, R. W. POPULATION DYNAMICS, HABITAT UTILIZATION, RECREATIONAL IMPACTS AND TRAPPING OF INTRODUCED ROCKY MOUNTAIN GOATS IN THE EAGLE'S NEST WILDERNESS AREA, COLORADO. Proc. Bienn. Symp. North. Wild Sheep Counc.; 2:459-464. 1980.

Recreation impacts on mountain goats was assessed by simulating disturbances and observing goat-human

interactions in Colorado. Flight distance of goats was greatest for nanny and sub-adult groups, and averaged 82.6 m for all groups. The typical flight intensity was a slow walk away from the human. It is concluded that recreational impacts on the goat population are slight (Boyle and Sampson 1983).

516. Thorn, T.; G. Butler; T. Varcalli; K. Becker; and S. Hayden-Wing. THE STATUS, MORTALITY, AND RESPONSE TO MANAGEMENT OF THE BIGHORN SHEEP OF WHISKEY MOUNTAIN. Wyo. Game Fish Dept., Game Fish Res. Lab. Wildl. Tech. Rep. 7. 213 pp. 1979.

Ecological aspects of bighorn sheep studied in Wyoming included responses of sheep to encounters with humans. Sheep responses to humans varied with sex, age, and activity of sheep, environmental factors, and the nature of the disturbance. All mountain recreationists may stress sheep they encounter; stress induced by such passive harassment might be the most serious consequence of man-sheep encounters. Management recommendations include control of human-sheep interactions (Boyle and Samson 1983).

517. Thornburg, D. D. DIVING DUCK MOVEMENTS ON KEOKUK POOL, MISSISSIPPI RIVER. J. Wildl. Manage.; 37:382-389. 1973.

Human disturbance from hunting, boating, and other activities was found to be the primary cause of mass movements of ducks on the Keokuk Pool of the Mississippi River. The ducks adapted to human disturbance by deviating from typical patterns of diurnal activity. Intensive human activity at preferred feeding sites resulted in flights to less disturbed areas. Restrictions on boating activities in some areas of this pool may eventually be necessary (Boyle and Samson 1983).

518. Thurber, J. M.; R. O. Peterson; T. D. Drummer; and S. A. Thomasma. GRAY WOLF RESPONSE TO REFUGE BOUNDARIES AND ROADS IN ALASKA. Wildl. Soc. Bull.; 22:61-68. 1994.

The response of gray wolves to different road types and human presence at the boundaries of Kenai National Wildlife Refuge, Alaska, was examined in a study of radio-collared wolves in 1976-1979. Wolf activity within discrete distances up to 5 km from roads and boundaries were computed. Wolves avoided oilfield access roads open to public use, yet they were attracted to a gated pipeline access road and secondary gravel roads with limited human use. Wolf response to a major public highway was equivocal, perhaps because wolves used a den only 1 km away. There was no detectable difference in wolf use of land on either side of the eastern refuge boundary adjacent to national forest lands, but on the western, settled boundary wolves used refuge lands more than adjacent private land. The data presented in this study suggests that wolf absence from settled areas and some roads was caused by behavioral avoidance rather than direct attrition resulting from killing of animals.

519. Tibbs, A. L. SUMMER BEHAVIOR OF WHITE-TAILED DEER AND THE EFFECTS OF WEATHER. M.S. thesis; Pennsylvania State University, State College. 93 pp. 1967.

During research of summer behavior of white-tailed deer in Pennsylvania, responses of deer to the presence of the observer and various other disturbances were noted. The observer on a 20-foot high observation tower did not appear to significantly affect deer behavior. Deer response to disturbance was inversely related to its regularity (Boyle and Samson 1983).

520. Titus, J. R.; and L. W. van Druff. RESPONSES OF THE COMMON LOON TO RECREATIONAL PRESSURE IN BOUNDARY WATER CANOE AREA, NORTHEASTERN MINNESOTA. Wildl. Monogr.; 79:3-59. 1981.

Results are reported of a field study to evaluate the impact of outdoor recreationists on nesting and breeding success of the common loon in Minnesota. The

authors conclude that that human use of the Boundary Waters Canoe Area slightly reduces the nesting and breeding success of loons in high impact areas, but since some loons are undisturbed and others habituate to human use the adult breeding population has not declined in the past 25 years (Boyle and Samson 1983).

521. Toweill, D. E.; and J. E. Tabor. *THE NORTHERN RIVER OTTER (LUTRA CANADENSIS)(SCHREBER). Pages 688-703 in: J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. John Hopkins Univ. Press, Baltimore. 1982.

522. Tracy, D. M. REACTIONS OF WILDLIFE TO HUMAN ACTIVITY ALONG MOUNT MCKINLEY NATIONAL PARK ROAD. M.S. thesis; University of Alaska, Fairbanks. 260 pp. 1977.

Reactions of 5 species of wildlife to human and vehicle activity on the park road in McKinley National Park were studied. Avoidance was observed for some bears, foxes, and possibly caribou; many other animals were attracted to the road. Of the ungulates studied, females with young were the most easily disturbed. Many animals appear habituated to human activities. Management recommendations based on the study are presented (Boyle and Samson 1983).

523. Trapp, J. L. EFFECTS OF HUMAN DISTURBANCE ON A RED-FACED CORMORANT NESTING COLONY. Pac. Seabird Group Bull.; 5(2):88. (Abstract only). 1978.

Human disturbance of nesting red-faced cormorants was investigated in the Aleutian Islands, Alaska. Nesting success rates and the number of young per successful nest were both significantly lower in a disturbed colony than in a nearby undisturbed colony. Disturbance frightened adult cormorants from nests, causing increased predation of eggs and young by glaucous gulls (Boyle and Samson 1983).

524. Trapp, J. L. MUTE SWANS ENTANGLED IN FISHING LINE. Jack-Pine Warbler; 51:91-92. 1973.

Two cases of mute swans becoming entangled in fishing line are reported from Scotland. One swan had a hook and line embedded in its mouth; the other swan had a line protruding from its throat and apparently internally imbedded. Neither case was fatal. In waters that are fished heavily or contain many snags, lost lines and hooks become potential hazards for foraging waterfowl (Boyle and Samson 1983).

525. Tremblay, J.; and L. N. Ellison. EFFECTS OF HUMAN DISTURBANCE ON BREEDING BLACK-CROWNED NIGHT HERONS. Auk; 96:364-369. 1979.

Visits by researchers to black-crowned night heron colonies just before or during laying resulted in abandonment of nests and egg predation. Mortality of young was also caused by later disturbance. Settlement of late-nesting herons was evidently discouraged by frequent colony visits. Recommendation for minimizing effects of intrusion are suggested (Boyle and Samson 1983).

526. Trimble, S. A. *HABITAT MANAGMENT SERIES FOR UNIQUE OR ENDANGERED SPECIES-MERLIN. USDI, Bur. Land Manage. Tech. Note, Report No. 15, Denver. 41pp. 1975.

527. Tucker, P. ANNOTATED GRAY WOLF BIBLIOGRAPHY. USDI, U.S. Fish Wildl. Serv., Region 6, Denver, CO. 117 pp. 1988.

*Annotated Bibliography.

528. U.S., Fish and Wildlife Service. *GRIZZLY BEAR RECOVERY PLAN. USDI, U.S. Fish Wildl. Ser., Washington, DC. 199 pp. 1982.

529. U.S. Environmental Protection Agency. EFFECTS OF NOISE ON WILDLIFE AND OTHER ANIMALS. U.S. Environ. Prot. Agency, Off. Noise Abatement. Control NTID300.5. 74 pp.. 1971.

Demonstrated and suspected effects of noise on wildlife and domestic animals are reviewed in this comprehensive report. Sources of noise potentially disturbing to wildlife include industries, automobiles, aircraft, and recreational vehicles (Boyle and Samson 1983).

530. U.S. Fish and Wildlife Service. *BALD EAGLE MANAGEMENT GUIDELINES OREGON-WASHINGTON. USDI; Fish and Wildlife Service, Portland Area Office, Oregon. 10pp. 1981.
531. U.S. Fish and Wildlife Service. *NORTHERN ROCKY MOUNTAIN WOLF RECOVERY PLAN. USDI, U.S. Fish Wildl. Ser., Denver. 119 pp. 1987.
532. U.S. Fish and Wildlife Service. *WHOOPIING CRANE RECOVERY PLAN. U.S. Fish Wildl. Serv., Albuquerque. 283 pp. 1986.
533. USDI, U. S. Fish and Wildlife Service. GUIDELINES FOR THE MANAGEMENT OF THE AMERICAN WHITE PELICAN, WESTERN POPULATION. U.S. Fish Wildl. Ser. Unpub. ms. 44 pp.. 1984.
534. USDI, U. S. Fish and Wildlife Service. THE REINTRODUCTION OF GRAY WOLVES TO YELLOWSTONE NATIONAL PARK. U.S. Fish Wildl. Ser., Draft Environmental Impact Statement, Helena, MT. 1993.
535. USDI, U. S. National Park Service. STATEMENT FOR MANAGEMENT-GRAND TETON NATIONAL PARK. U.S. National Park Service. 1985.
536. USDI, U. S. Fish and Wildlife Service. *WHITE-FACED IBIS: MANAGEMENT GUIDELINES, GREAT BASIN POPULATION. U.S. Fish Wildl. Ser., Portland, OR. 31 pp. 1985.

537. Van de Zande, A. N.; J. C. Berkhuizen, H. C. van Latesteijn; W. J. ter Keurs; and A. J. Poppelaars. IMPACT OF OUTDOOR RECREATION ON THE DENSITY AND NUMBER OF BREEDING BIRD SPECIES IN WOODS ADJACENT TO URBAN RESIDENTIAL AREAS. Biol. Conserv.; 30:1-39. 1984.

538. Vermeer, K. SOME ASPECTS OF THE NESTING REQUIREMENTS OF COMMON LOONS IN ALBERTA. Wilson Bull.; 85:429-435. 1973.

A significant correlation was found between number of breeding loons and the amount of human disturbance occurring at lakes. It is suggested that because loons appear to be intolerant of human disturbance they may serve as indicators of the wilderness qualities of lakes (Boyle and Samson 1983).

539. Wagar, J. V. K. RECREATION AND WILDLIFE PROBLEMS OF THE CENTRAL ROCKY MOUNTAINS. J. For.; 52:186-190. 1954.

Recreation based on wildlife resources in the central Rocky Mountains is discussed in terms of noneconomic value to participants. Problems such as value mensuration, financing of research, land ownership, and need for development are discussed (Boyle and Samson 1983).

540. Wakelyn, L. A. CHANGING HABITAT CONDITIONS ON BIGHORN SHEEP RANGES IN COLORADO. J. Wildl. Manage.; 51(4):904-912. 1986.

Changes in habitat associated with the decline and extinction of 36 populations of Rocky mountain bighorn sheep in Colorado were investigated using a mapping approach. The author concludes that in the absence of fire or habitat management, vegetation succession has been a major cause of habitat loss for bighorn sheep in Colorado.

541. Wall, G.; and C. Wright. THE ENVIRONMENTAL IMPACT OF OUTDOOR RECREATION. Univ. Waterloo, Ontario, Dept. Geogr. Publ. Ser. 11. 69 pp.. 1977.

A comprehensive review of environmental impacts of outdoor recreation is presented, including a chapter on wildlife impacts. Sections describe disturbance of wildlife, loss and gain of habitats, and changes in populations and species composition. The nature and scope of research on wildlife impacts are critically evaluated (Boyle and Samson 1983).

542. Wall, J. H. IMPACTS OF OUTDOOR RECREATION ON THE ENVIRONMENT. Council of Planning Librarians, Monticello, Ill., Exch. Bibliog. 1363. 19 pp. 1977.

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543. Wallen, R. L. *ANNUAL BROOD SURVEY FOR HARLEQUIN DUCKS IN GRAND TETON NATIONAL PARK. Grand Teton National Park Resource Management files, Moose, WY. 15 pp. 1987.
544. Wallen, R. L. *HABITAT UTILIZATION OF HARLEQUIN DUCKS IN GRAND TETON NATIONAL PARK. M.S. thesis; Montana State University, Bozeman. 67 pp. 1987.
545. Wallen, R. L.; and C. R. Groves. *STATUS AND DISTRIBUTION OF HARLEQUIN DUCKS IN NORTHERN IDAHO. Unpublished Report, Idaho Dept. of Fish and Game, Boise. 34 pp. 1988.
546. Wallis, C. A.; and C. R. Wershler. *STATUS AND BREEDING OF MOUNTAINS PLOVERS IN CANADA. Can. Field-Nat.; 95:133-136. 1981.

547. Walter, H. IMPACT OF HUMAN ACTIVITY ON WILDLIFE. Pages 241-262 in: K. A. Hammond, C. Macinko, and W. B. Fairchild, eds. Sourcebook on the environment: A guide to the literature. Universtiy of Chicago Press, Chicago, Ill.. 1978.

Literature concerning human impacts on wildlife is reviewed. Effects of human population expansion and utilization of energy and resources are emphasized, but nonconsumptive uses are also mentioned. Sections discuss general surveys, attitudes toward wildlife, changes in wilflife population levels, species diversity, and wildlife conservation, among others (Boyle and Samson 1983).

548. Ward, A. L.; J. J. Cupal; A. L. Lea; C. A. Oakley; and R. W. Weeks. ELK BEHAVIOR IN RELATION TO CATTLE GRAZING, FOREST RECREATION, AND TRAFFIC. Proc. N. Am. Wildl. Conf.; 38:327-337. 1973.

Telemetered elk in Wyoming study area preferred to be one-half mile distance from people who were camping, picnicking, and fishing. Suggests that in planning recreation facilities in elk habitat, people concentration areas should be one-half mile from elk feeding sites and provide adequate cover buffer zones (Ream 1980).

549. Ward, L. WHAT'S IT GOING TO BE, DEER OR DOGS IN SOUTHERN WEST VIRGINIA? West Virginia Conserv.; 18(6):3-5. 1954.

550. Watson, A. E.; M. J. Niccolucci and D. R. Williams. HIKER AND RECREATIONAL STOCK USERS: PREDICTING AND MANAGING RECREATION CONFLICTS IN THREE WILDERNESSES. USDA; Forest Service; Intermountain Res. Stn. Res. Paper; INT-468. 1993.

A long-term problem that continues to grow in many wildland areas is the displeasure hikers express about meeting recreation livestock (primarily horse and mules) and seeing impacts from stock use. Three studies were conducted to provide a broad look at this interaction at the John Muir Wilderness in the Sierra

and Inyo National Forests, at the Sequoia-Kings Canyon National Parks in California, and at the Charles C. Deam Wilderness in the Wayne-Hoosier National Forest in Indiana. The results of these studies indicate that the management option of separating uses by providing some trails for hikers is generally supported by hikers, but not by horse users, at these three wildernesses. The authors conclude that while persuasive and educational messages may reduce conflict between hikers and horse users, if managers fail to reduce the number of encounters that create conflict or impacts of horse use that hikers label as inappropriate, they may find some restrictions on horse use to be necessary.

551. Watson, J. W. RESPONSES OF NESTING BALD EAGLES TO HELICOPTER SURVEYS. Wildl. Soc. Bull.; 21:171-178. 1993.

This study determined that bald eagles from several populations in northwestern Washington had lower response rates to fixed-wing aircraft than to survey helicopters at similar distances. The authors conclude that helicopter survey protocol that minimizes disturbance, and maximizes cost efficiency, data reliability, and observer safety should include hovering for <10 seconds at >60 m from nests, surveying on calm, dry days, and as late in the season as possible to minimize adult presence.

552. Weaver, J. L.; R. E. F. Escano; and D. S. Winn. A FRAMEWORK FOR ASSESSING CUMULATIVE EFFECTS ON GRIZZLY BEARS. Trans. N. Am. Wildl. and Nat. Resour. Conf.; 52:364-376. 1987.

553. Webb, R. H.; and H. G. Wilshire. AN ANNOTATED BIBLIOGRAPHY OF THE EFFECTS OF OFF-ROAD VEHICLES ON THE ENVIRONMENT. U.S. Geol. Surv. Open File Rep. 78-149. 15 pp. 1978.

Annotated Bibliography.

554. Weedon, R. NONCONSUMPTIVE USERS: A MYTH. Alaska Conserv. Rev.; 17(3):3,15. 1976.

Several examples of adverse impacts on wildlife from recreationists and scientists are cited to support the contention that nonconsumptive users of wildlife do not exist (Boyle and Samson 1983).

555. Werschkul, D. F.; E. McMahon; and M. Leitschuh. SOME EFFECTS OF HUMAN ACTIVITIES ON THE GREAT BLUE HERON IN OREGON. Wilson Bull.; 88:660-662. 1976.

556. Whinam, J.; E. J. Cannel; J. B. Kilpatrick; and M. Confort. STUDIES ON THE POTENTIAL IMPACT OF RECREATIONAL HORSE RIDING ON SOME ALPINE ENVIRONMENTS OF THE CENTRAL PLATEAU, TASMANIA. J. Environ. Manage.; 40(2):103-117. 1994.

557. White, R. P. *DISTRIBUTION AND HABITAT PREFERENCE OF THE UPLAND SANDPIPER IN WISCONSIN. Amer. Birds; 37:16-22. 1983.

558. Wilinon, T. GREATER YELLOWSTONE NATIONAL FORESTS. Falcon Press, Helena. 104 pp. 1991.

559. Wilkes, B. THE MYTH OF THE NONCONSUMPTIVE USER. Can. Field-Nat.; 91:343-349. 1977.

The concept that some outdoor recreational activities are nonconsumptive of the resource base is examined and rejected. Impacts of such on vegetation, wildlife, and the quality of the environment are noted. User restrictions, a proposed theory for non-use planning, and justification for landscape preservation are discussed (Boyle and Samson 1983).

560. Wilkinson, P. F. ENVIRONMENTAL IMPACT OF OUTDOOR RECREATION AND TOURISM: A BIBLIOGRAPHY. Vance Bibliographies, Monticello, Ill., Publ. Admin. Ser. Bibliogr. P-57. 90 pp. 1978.

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561. Wilmore, S. B. *SWANS OF THE WORLD. Taplinger Publ., New York. 229 pp. 1974.
562. Wilson, D. E. *WOLVERINE. Pages 644-652 in: J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. John Hopkins Univ. Press, Baltimore. 1982.
563. Wilson, L. O. THE FORGOTTEN DESERT BIGHORN HABITAT REQUIREMENT. Trans. Desert Bighorn Counc.; 13:108-113. 1969.

An important but often-neglected habitat requirement of bighorn sheep is space. A review of the literature shows that bighorn are generally intolerant of human disturbance. Management of developments, livestock grazing, other ungulates, and recreational activities should take into account adverse effects of these activities on bighorn sheep (Boyle and Samson 1983).

564. Woffinden, N. D.; and J. R. Murphy. DECLINE OF A FERRUGINOUS HAWK POPULATION: A 20-YEAR SUMMARY. J. Wildl. Manage.; 53(4):1127-1132. 1989.

A central Utah population of ferruginous hawks became extinct from 1967 to 1986. The decline was initially correlated with a black-tailed jack rabbit population crash. The hawk population did not respond numerically to an increase in prey numbers. The failure of the population to increase as prey increased and habitat vacancy occurred may be explained by low production and nomadism. The authors concluded that seral vegetative changes may be depressing jack rabbit population recovery and hence be responsible to some degree for low numbers of ferruginous hawks.

565. Woodsworth, G. C. *SPATIAL PARTITIONING BY TWO SPECIES OF SYMPATRIC BATS, MYOTIS CALIFORNICUS AND MYOTIS LEIBII. M.S. thesis; Carleton University, Ottawa. 94 pp. 1981.
566. Woodworth, C. G.; G. P. Bell; and M. B. Fenton. *OBSERVATIONS ON THE ECHOLOCATION, FEEDING BEHAVIOR AND HABITAT USE OF EUDERMA MACULATUM IN SOUTH CENTRAL BRITISH COLUMBIA. Can. J. Zool.; 59:1099-1102. 1981.
567. Wyoming Game and Fish Department. A STRATEGIC PLAN FOR THE COMPREHENSIVE MANAGEMENT OF WILDLIFE IN WYOMING. Wyoming Game and Fish Department, Cheyenne. 1990.
568. Yalden, D. W.; and P. E. Yalden. THE SENSITIVITY OF BREEDING GOLDEN PLOVERS, PLUVIALIS APRICARIA, TO HUMAN INTRUDERS. Bird Study; 36:49-55. 1989.
569. Yarmoloy, C.; M. Bayer; and V. Geist. BEHAVIOR RESPONSES AND REPRODUCTION OF MULE DEER DOES FOLLOWING EXPERIMENTAL HARASSMENT WITH AN ALL-TERRAIN VEHICLE. Canadian Field-Nat.; 102(3):425-429. 1988.

Five mule deer does were caught by helicopter and net gun and were equipped with radio collars. They were habituated to an all-terrain Vehicle (ATV) travelling the same truck trail for 12 weeks. Three of the females were then followed by ATV for 9 minutes per day for 15 days between 1 to 24 October, 1981, for a total of 135 minutes. The harrassed females, but not the other females, shifted feeding into darkness, used cover more frequently, left their home ranges more often, and increased flight distance from the ATV. In the following year the three harrassed females collectively raised 1 fawn, having had normal reproduction the year before and the year after. Neither the unmarked females in the study area nor the two radio-collared control feamles suffered decreases in reproduction during the study. these results confirm expectations and are statistically significant.

570. Young, D.; and J. Beecham. *BLACK BEAR HABITAT USE AT PRIEST LAKE, IDAHO. Pages 73-80 in: Bears: their biology and management. Int. Conf. on Bear Res. and Manage., vol 6. 1983.
571. Young, E.; and P. J. L. Bronkhorst. OVERSTRAIN DISEASE IN GAME. African Wildlife; 25:51-52. 1971.
572. Young, S. P. *THE BOBCAT OF NORTH AMERICA. The Stackpole Co., Harrisburg, PA. 193. 1958.
573. Yunist, R. P. *A REVIEW OF RECENT IRRUPTIONS OF BLACK-BACKED AND THREE-TOED WOODPECKERS IN EASTERN NORTH AMERICA. Jour. Field Ornith.; 56:138-152. 1985.
574. Zarn, M. HABITAT MANAGEMENT SERIES FOR UNIQUE OR ENDANGERED SPECIES:OSPREY. USDI, Bureau of Land Management, U.S. Bur. Land Manage. Tech. Note 254. 41 pp. 1974.

The status, biology, and limiting factors of ospreys on public land are described. While ospreys sometimes successfully nest in close proximity to humans, deliberate harassment and shooting are common in some areas. Recreationists who carry out their activities close to nesting ospreys may keep parent birds off the nest and cause losses of eggs and young to exposure. Management recommendations include actions to limit human disturbance of breeding ospreys (Boyle and Samson 1983).

575. Zarn, M. *HABITAT MANAGEMENT FOR UNIQUE OR ENDANGERED SPECIES-BURROWING OWL. USDI, Bur. Land Manage. Tech. Note T-N-250, Rep. No. 11, Denver. 25 pp. 1974.