W-0017

A PARTIAL LITERATURE REVIEW OF THE EFFECTS OF VARIOUS HUMAN ACTIVITIES ON WILDLIFE

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ELK RESPONSES TO DISTURBANCES BY CROSS COUNTRY SKIERS IN YELLOWSTONE NATIONAL PARK

Elk were disturbed in this study by having a person or group of persons approach the elk wherever they were. Established trails were not used.

	number of disturbances	flight distance	distance moved	% of elk leaving drainage	time elapsed before return	number of elk not returning
habituated elk*	62	15 meters	40 mmeers	0	0	0
non-habituated elk	40	400 meters	1,700 meters	31 (78%)	2 days	5 (.125%)

* The authors define habituated elk as those elk whose home range enclosed a year round human development. Where elk encountered humans on foot in unexpected places around the developed area, the elk responses increased 3-fold.

Cassirer, E. Francis; David J. Freddy; Ables, Ernest D. "Elk Responses to Cross Country Skiers in Yellowstone National Park," *Journal of Wildlife Management* 1988

RESPONSE OF TRUMPETER SWANS TO HUMAN DISTURBANCE (6 nests, 2 adult birds each)
Henson, Paul & Todd A.. Grant 1991 *Wildlife Society Bulletin* v19

disturbance response	aircraft 21 incidents	heavy truck 72 incidents	moving motor vehicle *	stopped or noisey vehicle (horn, loud motor, and/or person emerging) *	pedestrian 36 incidents**
no response	male 3 female 5	male 19 female 42	all	0 0	0 0
head up	male 17 female 16	male 53 female 29	0	reacted to all stopped vehicles	0 0
hiding position on nest (female)	0 0	1	0	0 0	0 0
swimming away until concealed or in open water	0	0	0	0	27
normal flight	0 0	0 0	0 0	0 0	0 0
disturbed flight	0 0	0 0	0 0	male 0 female 4	18
duration of disturbance in seconds	30	10 to 20	not recorded	not recorded	not recorded
duration of response before birds returned to normal activities	male 53 seconds female 53 seconds	male 33 seconds female 20 seconds	not recorded	not recorded	incubating females 51 minutes. all others, until sight & sound of humans was gone

** Data on pedestrian disturbance was divided up according to "pedestrian" disturbance, where a person unknowingly approached; and "observer" disturbance, where a researcher unintentionally disturbed. All pedestrian disturbances were also broken up according to incubating/brooding/unspecified bird activities. I combined the pedestrian disturbances because all of them were more profound than any other disturbance .

* Motor vehicle activity was heavy because this was next to the Copper River Highway.

Responses of National Park Elk to Human Disturbances

The elk in this study were habituated to human activity, and were not hunted, and that had a significant effect on the elk responses. Habituated or unhunted elk Are less sensitive to humans than elk that are rarely exposed to human activity. The elk are more sensitive to persons afoot than vehicles, although in this study the difference is not statistically significant. Both these tendencies have been observed in other studies of large mammals' response to human recreation disturbances. The chart from the study that compares elk response to the different disturbances is reprinted here.

observer activity	Number of elk	mean flight distance*	range**	trotted away	walked away
approach by MV***	46	76.8 m	19-308 m	46%	54%
approach by person	52	85.8 m	29-208 m	79%	21%
approach by MV with spotlight	195	49.2 m	16-130 m	26%	74%
approach by person with flashlight	103	50.9 m	17-144 m	76%	24%

* Distance of the observer from the elk when they began to move away
** distance the elk moved away before resuming normal activities
*** MV stands for motor vehicle

Schultz, R. D. and James A. Bailey "Responses of National Park Elk to Human Activity" *Journal of Wildlife Management* v42 (1975)

Two Studies

The following is a chart (page 6) that attempts to compare the results of two seperate studies. The objective is to identify similarities or differences in responses of the same species (bighorn sheep) to two different human recreation activities: hiking and recreational vehicle use. Some research works do this comparison for us, selecting various human activities and recording in a methodical way the animals' reaction to each, with the same controls in place for each activity. This provides a workable basis for management decisions. Most research, however, examines only one human recreational activity, and compares it with the animals behavior when human recreational activities are absent. As the literature review shows, this method does not help us with management decisions in areas of multiple human uses, because almost every human activity appears to have some effect on the animals.

In the chart on page six, the two studies are not comparable in some areas because different methodologies are used in each. Paul Jorgenson, the author of one of the studies, conducts his research alone and provides no statistical or site controls to eliminate natural (or researcher) bias in his results. His is the only work found so far to lack this level of professionalism. However, by studying the data closely, and identifying the common questions in each work, a reasonable comparison can be drawn.

Where the data seems important but not comparable, an explanation is provided. Before you read to the end of the chart, try to determine which study was of hiking disturbances and which was of motor vehicle disturbances.

Author(s) & study Comparators	Jorgenson- ungulate use of perennial water source in desert environment	Hamilton & Holl-ungulate use of mineral lick in forested environment	Remarks
Statistical controls?	None: Author reports what was observed with no set models for accuracy or bias (eg other factors in the environment, or model failure) and provides speculative conclusions	Yes: the authors use a control site, Chi-square, linear correlation, and probability formulas to produce numeric results, eliminate bias, and establish confidence level	
Abandonment of resource?	No	No	animals always return when humans leave
Shift in use of resource during human presence?	Yes - animals are never observed at resource while humans are present	Yes - animals are never observed at resource while humans are present	
Time elapsed before animals return to site?	appears to be 1 hour *	minimum of 1 hour*	
Change in the number of animals using the resource ?	*	*	Methodologies are not comparable *
Distance animals kept from human activities?	no quantitative data supplied, appears to be up to 2,500 feet in desert environment	600 to 1,000 feet in forested environment	other research indicates this is related to visibility
Suckling young & mothers more sensitive to disturbance?	Yes	Yes	
Further animal uses of study site (resource)	**	**	Data not comparable (the sites are too different) **
Changes in animal travel patterns to and from the resource due to human activities?	None	None	Animals select routes based on the nature of their escape skills

* Indicates the two methodologies are too different to compare. The raw data for the two studies is very similar. In both projects, it was established that the animals visit the resource during daylight hours, at the same time as the humans. In the Jorgenson work, during 10 daylight hours of

animal utilization of the resource, human activity occurred during six hours. Jorganson gives no data on how long it took the animals to return after the humans left, although it is clear from the published results that they did always return. Using simple extrapolation (consistent with Jorgenson's methodology), animal use should drop 60%. However, the direct comparison used by Jorgenson only shows 46% drop. It *may* be claimed that if six of the 10 daylight hours were not available to the animals due to human presence, the animals would have to return in an hour (or less) for the 64% (if undisturbed = 100%) utilization to occur. Conversely, in the Holl & Hamilton work, the data indicates that the animals will not return to the resource for a minimum of one hour after the humans have left. Thus if six parties of humans pass by at one-hour intervals, in the 10 hours of daylight, without any statistical controls (as in Jorgenson's work) there would be a 60% reduction in the time available for the animals at the resource.

** The absence of statistical controls in the Jorganson work makes assumptions about the uses of nearby habitat difficult to support, because the variables, bias, or shortcomings in the model are not controlled. The simplest example could be, *if* the area directly adjacent is suitable, and *if* the animals do not use it, the researcher's ability to identify or at least eliminate reasons they do not use it requires a larger sample and/or a control sample. The use of a control site can resolve many anomolies. In addition, in the desert environment, the distance between areas of "suitable habitat" differs from the distances between areas of suitable habitat in forested environments. Comparison between the two is not supportable.

Jorgenson's discussion assigns special impacts from the vehicles, but provides no evidence that the sheep would respond any differently if the same number of visitors were walking. In the raw data, however, Jorgenson did note the presence of at least one non-motorized visitor, and conspicuous by its absence is a notation of any difference in sheep response. A control site, with equal number of non-motorized visitors to a similar resource, would answer his question "is the presence of the motor vehicles the cause of the reduced sheep use at the site?" He has answered his question with a self fulfilling prophesy: of course it causes less sheep use. As our other research has clearly shown, *every* human approach displaces the sheep.

Hamilton, Kathleen, Holl, Steven A., Charles Douglas; "An Evauation of the Effects of Recreational Activity on Bighorn Sheep in the San Gabriel Mountains, California" Desert Bighorn Council 1982 Transactions

Jorganson, Paul, "Vehicle Use at A Desert Bighorn Watering Area" Desert Bighorn Council 1974 Transactions

Telemetered Heart Rate of Three Elk As Affected by Human Activity

The base assumption for this work is that the human activity will cause an immediate response in the elk's heart rate. Heart rates for undisturbed activities were observed and recorded as the baseline. A "passive response" means the animal is alerted (increased heart rate) and an "active" response" means the animal fled immediately.

This research was conducted in the mid 1970's using radio transmitters attached surgically to the animals. The generation of trailbikes in use during that era were rarely muffled, and those that did have mufflers were extremely loud by today's standards.

Disturbance	Distance to Elk (meters)	Times Occurred	Passive Response	Active response
Gunshots	30 to 450 500	8 9	7 1	4 0
Human walking	20 to 100 100 to 300 300	10 11 10	10 9 4	9 5 2
Human and dog	150	2	2	2
Trailbike	15 to 50 50 to 150 150 to 200 400	4 5 4 8	4 3 1 3	1 0 0 0

It is not necessary for the number of responses to add up to the total number of disturbances, because not every animalreacted the same way. For example, of eight gunshot trials, seven elk responded "passively," and only one's response progressed to active. Hence, of the four actives, one overlaps with passive.

Ward, Lorin A., Jerry J. Cupal, "Telemetered Heart Rate of Three Elk as Affected by Activity and Human Disturbance" (1976) *Planning for Trailbike Recreation* pub. U.S. Department of the Interior Heritage Conservation and Recreation Service.

Influences of Cross Country Skiing on Distribution of Moose and Elk

This study indicated that cross country skiing influenced the general overwinter distribution of moose but not of elk. However, both species moved away from areas near heavily used trails during the ski season when skiers were present on the trails, and returned after the human activity stopped.

	Relative density of Moose		Relative density of Elk	
	No use on trail	some use	no use on trail	some use
Distance from trails (meters)				
0-100	3.3	1.65	6.5	3.25
101-200	2.97	1.98	5.2	1.3
201-300	2.64	2.64	1.95	.65
301-400	2.64	1.98	2.6	2.6
401-500	2.64	2.31	3.25	1.95

It appeared to these researchers that the trails themselves did not influence the movement of animals, and neither species used the trails for travelways. However, the presence of skiers caused both species to move away from trails.

Ferguson, Michael A. D.; Keith B. Lloyd, "Influence of Nordic Skiing on Distribution of Moose and Elk in Elk Island National Park, Alberta, *The Canadian Field Naturalist*

Comparing responses between pedestrian and motor vehicles

"Responses of Mule Deer to Persons Afoot and Snowmobiles" Freddy, David J.; Whitcomb M. Bronaugh Fowler, Martin C.; *Wildlife Society Bulleting 1986*

	distance from deer at first response (developing from left to right)			total duration of resonse	total duration of response	total duration of response	percent of total in which deer fled, and distance	
type of response	alert	activity change	flight	alert	activity change	flight		
persons afoot	340 meters	250 meters	175 meters	225 sec	475 sec	375 sec (6.25 min)	80 %	907 m
snowmobiles	450 meters	280 meters	125 meters	240 sec	125 sec	75 sec (1.25 min)	24 %	158m

Location of deer dictated the approaches in each trial. Established trails were not used.

76 percent of the snowmobile encounters never progressed beyond "activity change;" 20 percent of person disturbances never progressed past "activity change". No figures were given for how many responses never progressed past "alert." Tendencies for flight distances to increase after multiple flight responses to persons afoot indicated that deer do not habituate to persons afoot.

Effects of Human Intrusion on Selected Species of Songbirds

This was a three year study that examined the amount and the quality of songbird singing after the birds were subjected to controlled human intrusions. The authors could not provide consistent year to year statistics due to natural variations in bird populations; however, the authors were very thorough in "flattening" these and other natural biases.The results were given in different formats, hence the fairly complex table.

Singing consistency was calculated as the maximum number of consecutive censuses during which an individual species sang, out of the number of censuses it was detected on the site. Each site could be simplistically described as a 150 meter circle.

The authors state that the levels of disturbance administered were analogous to those caused by hikers, backpackers, nature viewers, and wildlife photographers. This reviewer would not include backpackers and hikers because the disturbances consisted of a human remaining conspicuously in the 150 meter area for one to two hours. Corresponding human activities are birdwatching, nature viewing, and photography.

Species	song occurrance	singing consistency*	
	control vs. intruded	control	intruded
Ruby crowned kinglet	8% reduction	4.38	3.76
Mountain Chickadee	no difference detected	2.36	1.82
Yellow-rumped Warbler 1989	30% reduction	3.33	2.54
American Robin	75% reduction	no difference detected	
Brown Creeper	no difference detected	no difference detected	
Yellow-rumped Warbler 1990	no difference detected	3.63	2.96
Hermit Thrush 1991 (3rd year of intrusions)	30% reduction	2.97	2.22

* Indicates contrast statistics for square-root transformed data. A lower figure reveals a negative impact.

Waterbird Behavioral Responses to Human Disturbances
Mary L. Klein *Wildlife Society Bulletin* v21

A chart of waterbird responses to human activities. Apologies to authors: the charts in the original works were shown in 20 point increments, so what is shown here is not precise. Rather, the majority response for each activity is shown. The numerical value shown is the percentage average for each response.
The trials were conducted at the J.N. Darling National Wildlife Refuge. Recreationists drove automobiles, rode two wheeled motor vehicles and pedal bikes, or walked on one main route through the refuge.The noises administered were tape recordings of human voices. The authors note that wildlife photographers and wildlife viewers (birdwatchers) had the most profound effects on the birds.

	DRIVE BY	STOP	GET OUT	NOISE	APPROACH
Brown Pelican	70 no response 20 look up 10 fled	30 no response 70 look up	25 no response 65 look up 10 fled	20noresponse 60 look up 20 fled	38 look up 12 move away 60 fled
Cormorant	40 no response 50 look up 10 move away	100 look up	100 look up	90 look up 10 move away	50 looked up 30 moved away 20 fled
Anhinga	35 no response 65 look up	15 no respone 85 look up	10 no response 80 look up 5 alarm call 5 fled	100 look up	55 look up 5 alarm call 20 move away 20 fled
Blue Heron	48 no response 37 look up 14 fled	15 no response 50 look up 15 move away 10 fled	7 no response 28 look up 5 move aw ay 60 fled	20 no response 20 look up 35 move away 25 fled	15 look up 35 move away 50 fled
Tricolor Heron	30 no response 50 look up 3 alarm call 17 fled	35 no response 62 look up 3 move away 10 fled	5 no response 45 look up 15 move away 35 fled	50 look up 10 move away 40 fled	40 look up 20 move away 40 flee
Grebe	4 no response 88 look up 8 move away	75 look up 25 move away	30 look up 40 move away 30 fled	30 look up 65 move away 5 fled	10 look up 50 move away 40 fled
White Ibis	50 no response 40 look up 10 move away	35 no response 35 move away 10 fled	25 no response 30 look up 35 move away 10 fled	15 no response 25 look up 30 move away 30 fled	10 noresponse 10 look up 20 move away 60 fled