PROJECT PLAN

Title: Ecological studies on wolves in the western National Parks

Project No. 82-5-2-136

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(1) Objectives

1. To determine present sizes of wolf populations in the western National Parks.
2. To predict whether, in view of circumstances facing or likely to face wolves on lands adjacent to National Parks, wolf populations can be maintained within the present National Parks system.
3. To determine effects of predation by wolves and other large carnivores such as cougar on ungulate populations, and to evaluate the potential of these predators as agents of biological control of ungulate populations in the National Parks.
4. To investigate predator-prey relationships as they are related to factors such as abundance and species diversity of prey, behavioral and spatial distribution of prey, environmental and physiographic conditions.

(2) Justification

In the past it has been necessary to conduct slaughters of ungulates in some of the western National Parks. These slaughters were designed to reduce the browsing and grazing pressures on wintering ranges. Slaughters are costly, detract from the aesthetics of the parks scene, and compromise the National Parks ideal. At the same time a policy of "no control" could lead to drastic changes of the biotic community.

Man's efforts to control the ungulate populations are contrived and artificial. Furthermore, because carcasses of ungulates shot must be salvaged, it has not been possible to adequately control populations on less accessible ranges. It therefore seems logical to turn our attention to possible "natural" methods of population control.

Under pristine conditions predation by large carnivores may have played a larger role in the regulation of numbers of hoofed animals than it does today. It is questionable whether predation can always limit the ungulate numbers below carrying capacity of the range. However, biological control, even if not totally effective, would be more appropriate in the parks than present methods of artifically balancing the ecosystem.

In the western National Parks wolves are the most widespread large predator. Wolves often range partially outside the parks where they become victims of predator control programs.

The status of wolves in the western National Parks is as follows. Wolf populations of Riding Mountain and Prince Albert National Parks have been reduced by provincial predator control programs in surrounding areas. Wolf densities of Jasper and Banff are low and have fluctuated widely. Wardens' reports indicate that wolves in Banff are increasing. This may be the direct result of an altered provincial predator control program in Alberta. However, how long will this policy last? Wolves are occasional visitors in Waterton Lakes, Kootenay and Yoho parks. Because of the small area, and the adverse snow conditions of Yoho and Kootenay, wolves probably will not be able to maintain themselves in those parks.

Because of their different physiographical and biological features (e.g. mountainous terrain vs. boreal forest and aspen parkland), most western parks are well suited for comparative biological studies on wolves. Species composition, movements and abundance of ungulates vary. Studies in the past have left many basic questions of wolf biology unanswered. For example, it has been shown that wolves prey heavily on old and diseased animals, and young of the year (Pimlott, 1967). This fact does not provide adequate answers to such questions as: To what extent is feeding on young of the year scavenging activity? What percentage of young ungulates would survive in the absence of wolves. How does a reduction in young affect survival of the remaining animals in their first winter? Do differences in female-juvenile behavior patterns of various ungulate species make the young more or less susceptible to wolf predation?

Furthermore: What controls wolf numbers? Why are certain areas in the mountain parks devoid of wolves, even though these areas have an overpopulation of ungulates? Can wolf packs be reestablished by natural dispersal or release of breeding stock in park areas devoid of wolves (e.g. Cascade Valley in Banff) where ungulate densities are high? Is availability of food in spring and summer critical in pup survival? How does social organization in wolves change from summer to winter, and how does this affect predation success?

I do not propose that the results of this study would answer all these questions. Wolves are extremely difficult to study, and for this reason I believe it is necessary to take a broad initial approach to the topic. Once the study has been initiated, I hope that it will

be easier to concentrate on certain phases of wolf biology and at the same time gather as much other information as is possible.

A major objective of this study is related to the preservation of the species. Ideally, National Parks should preserve all forms of wildlife for the enjoyment and benefit of future generations. In the past wolves have been widely persecuted.

With the continued spread of the influence of "man - the agriculturist" and "man - the technologist," our National Parks might soon provide the only refuge for certain wildlife species in Canada. It is therefore important to gather data on how park development and the location of boundaries affect these species. This is true for both existing and proposed new National Parks. Many past difficulties can be avoided by adhering to a policy of basing parks planning on detailed scientific evidence.

An ecological study on wolves in the western National Parks is, therefore, fully justified at this time. It is proposed that in this study detailed basic research be carried out with a view to a practical application of the results. Since wolves are "summit predators" such a study is not strictly a species-oriented one. Rather, we are concerned with the place of wolves in the ecosystem. An important further justification is that, although studies have been carried out on wolves in the past, many basic questions remain unanswered. Even fewer studies are applicable to the area under consideration. Information gained from other studies provides a suitable background for this study.

The study area chosen for this research is ideal because of the physical and biological diversity of the parks. Furthermore, the distribution

of wardens in districts within the parks provides unique opportunities for mutual cooperation between the Canadian Wildlife Service and the Parks Branch.

(3) Review of literature and related works

Two classical studies, both carried out in United States' National Parks, are by Murie (1944) and Mech (1966). Young and Goldman (1944) published an historical and taxonomical account of wolves in North America. Other general studies are by Stenlund (1955) in Minnesota, and Pulliainen (1965) in Finland. The following authors have dealt with wolves in Canada's western National Parks: Banff and Jasper (Cowan, 1947); Wood Buffalo National Park (Fuller and Novakowski, 1955); Prince Albert National Park (Banfield, 1951); Riding Mountain National Park (Flook, 1960). Progress reports, general wildlife investigation reports by the above and other authors, as well as considerable correspondence with Park Superintendents are additional sources of scattered information on wolves in western National Parks. Recently more specific studies, under the direction of Pimlott, are being carried out in Ontario and on Baffin Island, N.W.T. Rausch in Alaska has initiated a research program aimed at gathering information on the wolves that might be specifically applicable in game management. An up-to-date account on wolf biology has been published in the American Zoologist (Volume 7, No. 2, May, 1967). This issue contains the papers given at a Symposium, entitled "Ecology and Behavior of the Wolf."

Food habit studies have shown that wolves depend to a large degree on ungulates for food (Murie, 1944; Cowan, 1947; Thompson, 1952; Stenlund, 1955; Fuller and Novakowski, 1955; Pulliainen, 1965; Mech, 1966; Shelton, 1966; Pimlott, 1967).

Predation in summer is heavily oriented towards young of the year (Thompson, 1952; Murie, 1944, Mech, 1966, Shelton, 1966; Pimlott, 1967). It has been suggested that the wolf predation on young could effectively limit ungulate populations. Feces analyses have shown that the proportion of rodents and other small animals increases in the summer diet of wolves (Murie, 1944; Cowan, 1947). Pimlott believes that because of the physical size of wolves (therefore high energy requirements), and because of their intricate social organization, wolves cannot depend on smaller animals as a primary source of food. The question arises here whether this fact also holds true in years of cyclic eruptions of rodents, and to what extent these influence pup survival. Evidence on the degree to which wolves can stablize ungulate populations is contradictory. Wolf-prey relationships are complex, and few generalizations are possible. Data obtained from one area under certain biological and physiographical circumstances are not always applicable to situations in other areas. For example, Cowan (1947) points out that wolves in Jasper and Banff were ineffective in controlling ungulate populations during the period of 1943-1946. Murie (1944), on the other hand, concluded that wolves controlled Dall sheep populations in Mt. McKinley National Park. Similarly, Mech (1966) and Shelton (1966) found that wolves were controlling moose

populations in Isle Royale National Park.

Data on reproduction in wolves under free roaming condition is hard to obtain. Detailed observations at a den were described by Murie (1944). Considerable information on reproduction has been collected from predator control programs (Fuller and Novakowski, 1955; Rausch, 1967). Important information as to age and sex, composition of packs, dates of implantation, spermatogenesis, pregnancy rates, breeding age, and litter size was obtained from this source.

Because wolves are long-lived, reach early sexual maturity, and have large litters, they have a high potential rate of productivity. The question arises: What controls wolf populations? If there were no natural controls, the wolf population in the absence of man's interference would rapidly build up in peak numbers and outstrip its food supply. Several theories as to what controls wolf numbers have been postulated.

Indications are that wolf population controls are intrinsic or "self-imposed." The fact that wolves are highly social animals is well known. Several studies have implied that social behavior may be the greatest single population controlling factor. This has been demonstrated in a captive group of wolves (Rabb et al., 1967) where due to intraspecific strife subordinate females were not fertilized. However, Rausch (1967) reported that in a field study in Alaska 90 per cent of adult and 2-year-old females collected from March 13 to April 30 were pregnant. His data further indicated that the production of ova by multiparous females is greater than

that of first breeders. Stress resulting from intraspecific strife could cause mortality in utero through loss of ova before implantation and resorption of blastocysts. Rausch has found evidence of in-utero mortality.

Cowan (1947) believed that an unbalanced sex ratio greatly reduced the reproductive potential of wolves in Jasper and Banff National Parks. This would be the case if wolves were strictly monogamous. However, recent evidence (Rausch, 1967) has shown that wolves continue to function as a pack during the breeding season.

Evidence that wolf packs are territorial has been presented by Murie (1944), Cowan (1947), Stenlund (1955), and Joslin (1967). Because wolves are wide-ranging, home ranges overlap considerably Mech (1966). Conflict between packs and an individual wolf or small groups (2 or 3 individuals) have been observed by Murie (1944), Cowan (1944) and Mech (1966). In some cases such conflict resulted in the wounding and killing of alien wolves (Cowan, 1947). Jordan et al. (1967) reported interactions of a pack and a small group of wolves within the same area. The relationships of smaller groups of wolves and single wolves to the main pack are often not clearly understood. In the available literature there is an obvious lack of information on such aspects of wolf biology as: interrelationships of packs; exchange of animals between packs; emigration and establishment of new packs; social status of single wolves. Jordan et al. (1967) classified lone animals as: 1) trailing subordinates of the large pack; 2) separate and socially unacceptable wolves scavenging within

the range of the main pack, or 3) animals totally independent of the main packs. Accidents incurred by wolves while killing ungulates has been suggested by Rausch (1967) as a possible factor in controlling wolf populations.

Fuller and Novakowski (1955), Rausch (1967), Jordan et al. (1967) have concluded that juvenile mortality in free-living wolf populations is high. Jordan believes that juvenile mortality could be a result of the lack of available food in spring and early summer. Ginsburg (1965) reported that mortality was high in wolf pups born in captivity. Here shortage of food was not a factor. Similarly, Anderson et al. (1959) have shown that in domestic dogs the greatest mortality is at and shortly after birth. In Arctic foxes few whelps survived in years of lemming scarcity (Macpherson, pers. comm.). Thus the evidence as to factors governing pup survival in canids is not clear. If dens could be located, this could be a fruitful avenue of investigation.

(4) Location and description of study areas

On the basis of prey species diversity and physiographic features the western National Parks provide three general situations:

(a) The mountain parks have low wolf densities and locally high ungulate populations. Movement and concentration of seven different ungulate species is governed by valleys and altitudinal gradients.

(b) Riding Mountain National Park has a fairly high wolf population. This park is completely surrounded by

agricultural land. Ungulate populations are quite similar to those of Prince Albert National Park. Moose and elk are the most common ungulates in both parks. However, in Riding Mountain Park elk are more numerous than moose, which provides an interesting contrast with Prince Albert Park where the reverse is true. Unlike Riding Mountain Park, Prince Albert Park forests are continuous with forests on provincial land.

(c) Wood Buffalo National Park has fewer ungulate species and wolves are numerous. Because of its remote and inaccessible nature, detailed studies in this park would not be feasible at this time.

(5) Duration of project

The project will be divided into three phases.

Phase a. (September 1968 to September 1969); Headquarters - Edmonton. With Park Warden participation, conduct a winter survey of wolves in Jasper, Banff, Prince Albert, and Riding Mountain National Parks. At the end of this period the project will be re-evaluated and it could then be decided whether it is worthwhile to conduct phases b and c. An interim (or final) report will be written at the termination of this phase.

Phase b. (September 1969 to September 1971); Headquarters - Field Station (trailer). Conduct an intensive study in an

area where wolves are abundant and the terrain is accessible. At this stage, telemetric devices could be used to monitor movements.

Phase c. (September 1971 to September 1973); Headquarters - Edmonton. Conduct further field investigations in areas with different environmental and physiographic features e.g. mountain valleys vs. boreal forest. If feasible, reintroduce wolves into wolf-free areas. A final, comprehensive report will be written at the termination of this phase.

(6) Methods

1. Study of wolf populations.

a. Obtaining wolf population counts.

Information of wolf populations will be gathered by interviews with wardens, checking over wildlife observation cards, conducting patrols by motor vehicle, snowmobile, on horseback and on foot. All information on wolf sightings, direction of travel, size of packs, and location of wolf kills will be plotted on maps (4 miles = 1 inch). Standard mimeographed sheets will be distributed to wardens who are available to gather data in their districts. Observation of cougars will also be included on these forms.

b. Intensive studies of wolf movements.

Past studies on summer movements of wolves have been too subjective (Pimlott, pers. comm.). During the

intensive phase of the study, telemetry and wolf howling should be combined with simple marking techniques (e.g. dog chain collars). Aerial and ground tracking of wolf packs in winter will be carried out. During the summer months, a program of wolf howling (using battery-operated tape recorder with amplifier) will be used to locate wolves in the field. Joslin (1967) states that human imitations of wolf howling were more successful than tape recordings in inducing responses. Both methods will be tried. Evidence obtained from howling responses, tracks, and scats will be used to determine summer range of packs wherever feasible.

Once the research is yielding interesting information, progress reports and perhaps also brief notes could be circulated among wardens and other cooperating personnel, e.g. provincial agencies.

c. Autopsy of carcasses.

A concentrated effort will be made to gather all wolf carcasses killed by predator control officers of the Alberta, Saskatchewan, and Manitoba government agencies in areas adjacent to the National Parks. In no way will these efforts be designed to encourage such programs

All wolves will be individually tagged, weighed, and autopsied at headquarters; standard measurements for subspecific classification will be made for each carcass

(Jolicoeur, 1959). Autopsy will include a thorough examination for parasites, collection of reproductive tracts, and examination of stomach contents. Autopsy information will be recorded on standard mimeographed autopsy sheets and then transferred to a punch card system. Reproductive tracts and parasites will be preserved in A.F.A.

Particular attention will be given to female reproductive tracts to examine old and new placental scars, stages of embryo development, and evidence of resorption of embryos. A technique using benzyl-benzoate to clear embryological material will be applied (Orsini, 1962).

Volume of testes will be determined. Sperm smears will be stained with eosin, and stages of spermatogenesis determined during the breeding season.

Age determination will be based on body weights, dental characteristics, and baculum size and weight. Two age classes can be readily assigned from tooth replacement and wear, pups (1-12 months) and adults over 12 months (Fuller and Novakowski, 1955). Two-year-old females have been separated from pups and adults on the basis of size and development of the uterus and the absence of corpora albicantia in the ovaries (Rausch, 1967). I understand that Mr. Kuyt has been successful in using cemental layers as a criterion of age.

2. Effects of wolf predation on prey populations.

a. Population studies of prey.

Data on abundance, movements and reproduction of prey populations will be obtained through:

(i) Intensive ground and aerial surveys;

(ii) Park Wardens' wildlife reports;

(iii) Ungulate research carried out by other biologists in the parks (e.g. Stelfox on bighorn sheep).

Particular emphasis will be placed on comparing ungulate populations in wolf-free areas with populations that are preyed upon by wolves.

b. Determination of condition of ungulate prey.

Once a wolf kill has been found the lower jaw and one femur will be collected for further analysis in the laboratory as to age and physical condition of the animal. Standard aging methods for ungulates will be employed. Remains of animals killed by wolves show little evidence of the physical condition of the victim when killed. Fat contents in the bone marrow of long bones is a valuable criterion (Riney, 1955; Mech, 1966).

To draw valid conclusions from samples of marrow from skeletons found in the field it is necessary to know the characteristics of marrow of animals of known sex, age, and condition. It is also necessary to know the rate at which

fat and other components of marrow are leached from bones lying on the forest floor. To establish these benchmarks an experiment is being conducted in collaboration with D. R. Flook using femurs of moose slaughtered in Elk Island Park.

The procedure has been to collect right and left femurs of calves, adult male and adult female moose. The length and weight of these bones was recorded. From a randomly chosen femur from each pair a 10 cm plug of fresh marrow was examined in the laboratory for consistency and colour, and is being analyzed chemically for moisture, fat, protein, and iron. To measure the effect of weathering on bone marrow components the remaining femurs were set outdoors in two wire cages - one on a shaded area, the other in a non-shaded area. The marrow of those are being sampled at intervals of 4, 8, and 16 months after death.

c. Examination of wolf feces collected.

Feces will be collected for food and parasite analysis. Particular efforts will be made to gather scat from den and rendezvous sites. Precautions will have to be taken by all cooperating personnel to guard against Echinoccus infections.

For each park a photomicrograph reference collection of hair impressions of all the potential mammal prey species will be made to facilitate identification of food items in the feces. Slides will be made by placing the

hair on strips of plexiglass and then brushed over with a light solution of acetone. A second slide pressed unto the the first leaves the desired scale impression of the hair.

Samples of fresh feces will be preserved in vials with a potassium dichromate solution for coccidia analysis. It is hoped that through sampling feces in one park at regular intervals information on seasonal variation of symbiotic protozoans could be obtained.

(7) Further scope of study

Often preconceived plans cannot be applied to field conditions, but a knowledge of the possibilities is necessary to take advantage of every opportunity that may arise. Success of this study will depend on the availability of wolves, and efficiency in applying field techniques. If phase a. leads to phases b. and c., then various other possibilities could be considered. Tagging (capturing of pups, tranquilizing with Cap-chur guns, tranquilizing traps, snaring in winter), tracking animals with radios, monitoring physiological data (especially in winter), and introducing wolves in wolf-free areas are all possible endeavours.

If suitable den sites are found wolf sequences can be filmed. These films could be used by Canadian Widlife Service and National Parks Branch staff for interpretative programs.

(8) Personnel and cooperation required

Field work will be conducted by L. N. Carbyn with assistance from a technician whenever available, and a student assistant during the summer.

Chemical analyses of bone marrow is being contracted out to University of Alberta Animal Science Laboratory. D. R. Flook will be conducting research closely connected with this phase of the study.

Cooperation of the Parks administration is important. The assistance of District Wardens in aiding in field work, obtaining biological specimens, and keeping careful notes will be essential in the success of this project. Liason will be sought with provincial Wildlife agencies where wolves range outside National Park boundaries.

(9) Estimated total cost

To be submitted and approved annually.

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