

# Wolf management and harvest patterns on the Kenai National Wildlife Refuge, Alaska\*

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## 1. Abstract

Legislation enacted in 1980 by the US Congress broadly defined management objectives for the newly established Kenai National Wildlife Refuge (KNWR), formerly the Kenai National Moose Range, and ordered that a comprehensive planning effort be undertaken for the Refuge. Because wolves are prominent carnivores that have been hunted in the KNWR only since 1974, wolf harvest characteristics are germane to planning efforts by the US Fish and Wildlife Service (USF&WS) and the Alaska Department of Fish and Game (ADF&G). Wolf harvest on the KNWR increased steadily between the first trophy hunting season in 1974/75 and the 1979/80 hunting and trapping season. Although "land-and-shoot" harvest of wolves has sporadically been high on the KNWR, the principal method used appears to be snaring. The proportion of radio-collared wolves harvested on a study area on the northern half of the KNWR increased between 1976 and 1981; 39% of those available were killed in 1980/81. Preliminary analysis of data from the study area suggests that harvests by humans exceeding 25% of the early winter wolf population would produce a decline in numbers the following year; harvests of this magnitude occurred on the study area in 1979/80 and 1980/81. Wolf management objectives and actions by USF&WS and ADF&G are reviewed and a suggestion made that wolf management be incorporated into inter-agency planning efforts and integrated with management of habitat and other species in this ecosystem.

## 2. Introduction

The Kenai Peninsula, a 26 000 km<sup>2</sup> land mass connected by a narrow isthmus to the mainland in south-central Alaska, has been famous for decades as a major area for trophy hunting of big game. Moose (*Alces alces*) are prominent in the natural history of the region. The area has seen intensive human use since the Kenai gold rush in 1895 and 1896 (Peterson and Woolington 1982), and continues to receive

heavy recreational use, including hunting and trapping, because of its close proximity to half of Alaska's human population.

The Kenai National Wildlife Refuge (KNWR), formerly Kenai National Moose Range, covers 6910 km<sup>2</sup> on the western half of the peninsula. In 1976 the US Fish and Wildlife Service (USF&WS), which is responsible for managing the refuge, and the Alaska Department of Fish and Game (ADF&G) initiated a co-operative predator-prey study of wolves (*Canis lupus*), bears (primarily *Ursus americanus*), and moose. Studies of wolf ecology and wolf-moose relationships were conducted from 1976 to the present. Our study area on the northern half of the KNWR covered approximately 3700 km<sup>2</sup>. In the late 1970s this region supported about 1 moose/km<sup>2</sup> and 1 wolf/60 km<sup>2</sup> (Bailey 1978, Peterson and Woolington 1982).

Human use early in this century had a great effect on many wildlife species on the Kenai Peninsula. Commercial hunting and a general disregard for the minimal game laws that existed led to reductions in moose and Dall sheep (*Ovis dalli*) populations (Studley 1912) and disappearance of caribou (*Rangifer tarandus grantii*) (Davis and Franzmann 1979). There are many references to the widespread use of poison to reduce carnivores; this was considered instrumental in the elimination of wolves from this large land mass by about 1915 (Peterson and Woolington 1982). Moose, on the other hand, eventually benefited from extensive fires that occurred during the gold mining era and populations reached high densities in parts of the western Kenai Peninsula by the 1920s.

The significance of the low-lying western half of the peninsula as moose habitat was widely recognized by the 1920s and 1930s. This factor, together with concern for Dall sheep in the adjacent mountains, led to the creation of the Kenai National Moose Range by Executive Order of the President in 1941... "for the purpose of protecting the natural breeding and feeding range of the giant Kenai moose..." (Bailey 1978). A 1250 km<sup>2</sup> fire in 1947 created optimum moose habitat and led to peak moose populations in this area in the 1950s and early 1960s (LeResche *et al.* 1974). However, in the

early 1970s a series of severe winters, together with declining habitat, reduced moose on the KNWR to approximately their pre-1947 burn density (Oldemeyer *et al.* 1977, Bailey and Bangs 1980).

From 1915 to about 1960 there was no evidence of a reproducing wolf population anywhere on the Kenai Peninsula, and for some of this period wolf populations on the adjacent mainland were locally reduced by federal wolf control programs (Peterson and Woolington 1982). Reports of single wolves in the late 1950s and the sighting of one wolf by an ADF&G biologist in 1961 led to the closure of the Kenai Peninsula to all taking of wolves, a restriction that remained in effect until 1974.

In this paper we shall review Kenai wolf management and harvest patterns since 1974, especially on the KNWR. Management objectives of such agencies as ADF&G and USF&WS will be discussed. We hope this will provide background and a common basis for future discussion of Kenai wolf management, an undoubtedly controversial issue. Where applicable, we shall provide pertinent data and conclusions resulting from our recent wolf research on the KNWR (Peterson and Woolington 1982).

## 3. Wildlife administration relating to wolves

Since 1960, management of resident wildlife has been the responsibility of the State of Alaska, with regulations set by the Alaska Board of Game, appointed by the Governor. The Board acts annually on recommendations received from the ADF&G, USF&WS, special interest groups, and the general public. Hunting seasons and bag limits for hunters and trappers usually follow closely the recommendations of the ADF&G. Because the USF&WS regulates access and uses of Refuge lands, it can issue more restrictive special regulations affecting hunting and trapping on Refuges.<sup>1</sup>

<sup>1</sup>The court decisions regarding Federal/State jurisdiction over wolves and other resident wildlife (see Harbo and Dean, this publication) were not intended to apply to National Parks and National Wildlife Refuges, many of which have specific Congressionally mandated objectives for resident wildlife species, as stated in the 1980 Alaska National Interest Lands and Conservation Act.

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In preliminary wildlife management plans issued by ADF&G in 1976, the recreational potential of wolf harvests on the Kenai was stressed. The Kenai Peninsula was the only large area in Alaska where the primary objective was to "provide the greatest opportunity to participate in hunting and trapping of wolves", an objective that emphasizes the recreational value of this wolf population rather than the sustaining of a maximum yield of wolves. The main objective for most of Alaska is "optimum harvest", which "emphasizes the yield of animals for human use", including both predator and prey. In some areas of Alaska wolf control measures have been considered necessary in order to maintain or increase harvestable prey populations (Harbo and Dean, this publication). Presumably, recreational harvest of wolves would control short-term wolf increases and reduce potential management problems caused by peak wolf populations. ADF&G and the Board of Game both consider wolf control to be a valid management action in specific instances to promote increases in game populations, but intentional wolf control is limited to cases where "substantial data" justify the action and "only after it has been shown that public hunting and trapping harvests will not achieve the stated management goals" (Preliminary Wildlife Management Plan 1976, ADF&G).

The Management Plan states that as the hunting of wolves increases on the Kenai, reduced seasons and bag limits might be necessary to reduce wolf harvests. The only management change implemented by the Board since 1976, however, was an increase from two to four wolves in the bag limit for hunters, in accordance with recommendations (Spraker 1980, Fed. Aid Wildl. Res. Rep.) to reduce wolf populations and thus, presumably, loss of moose by predation.

The only USF&WS management objectives specifically stated for wolves were contained in Environmental Impact Assessments written in 1974 and 1976 (KNWR files), preceding the opening of the KNWR to hunting and trapping of wolves; the stated intent of the USF&WS was that human harvest of wolves should not exceed the level that could be annually replaced. Objectives for the Kenai Ref-

uge were recently re-defined by the Alaska National Interest Lands Conservation Act<sup>1</sup> of 1980. One of the diverse aims of the KNWR is "to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, moose, bears, mountain goats, Dall sheep, wolves and other furbearers..." The Congress charged the USF&WS with the responsibility for developing and implementing a Comprehensive Conservation Plan for new refuges, and the Kenai Refuge will be the first to undertake the planning effort.

New management directions for the KNWR will follow the general philosophy outlined in the Congressional legislation that established the Refuge. Key concepts implicit in enabling legislation, and recent directions in refuge management, include preservation of the ecosystem by maintaining a natural diversity of wildlife species, decreased emphasis on game production, public use consistent with long-term maintenance of the above values, and high quality hunting and trapping programs.

#### 4. Kenai wolf research highlights

Wolf research over the past 5 years has revealed many characteristics of the wolf population and its interaction with Kenai moose; detailed results are to be published elsewhere. The 1976 wolf density in the Kenai study area on the northern half of the KNWR was relatively high for Alaska, at 1 wolf/60 km<sup>2</sup>, but not high in relation to prey biomass (1 wolf/55 moose in midwinter). Peterson and Woolington (1982) proposed that the wolf population was at or near natural saturation density in 1976. On the study area, packs were initially large, with an average early winter size of 12 wolves, but by 1980 had declined to about 6 wolves as harvesting by man increased. The proportion of pups in the wolf packs studied increased because average pack size was smaller, but there was little evidence of increased pup recruitment per pack to compensate for increased mortality.

<sup>1</sup>Major federal legislation that formally established various large tracts of "national interest" lands to be managed by the US National Park Service and the US Fish and Wildl. Serv.

Predation rates for Kenai wolf packs in winter were intermediate in the range of kill rates observed elsewhere. Wolves killed calves and adult moose (almost exclusively old cow moose) in winter and probably relied heavily on calves in summer (Peterson *et al.*, in prep.). There were no abundant alternative prey species. An estimated 8% of the adult moose on the study area and an average of 13% of calves in their first year of life were killed by wolves annually (Peterson *et al.*, in prep.).

Over a third of the calves killed were in poor condition, with a bone marrow fat content of less than 10%. Concurrent studies by Franzmann *et al.* (1980) indicated significant predation on young calves by black bears, accounting for 40% loss of calves on a study area that was burned in 1947. Peterson and Woolington (1982) suggested that in view of the marginal habitat available to moose on most of the study area (with the exception of 350 km<sup>2</sup> burned in 1969) the moose population had relatively little growth potential even if wolf predation could be reduced.

Hunter harvest of moose on the study area declined from a peak of about 1100 moose in 1971, when cow-moose hunting was allowed, to about 250 in the late 1970s (Spraker 1980, Fed. Aid Wildl. Res. Rep.). Hunting pressure on moose (bulls only) continues to be high and is largely responsible for a highly skewed adult sex ratio of 15 bulls/100 cows on the northern portion of the KNWR.

#### 5. Characteristics of Kenai wolf harvest

During the period of total protection, the Kenai wolf population became rapidly re-established, and large packs were reported from all major areas of the Refuge by the early 1970s. Following 3 years of discussion between the ADF&G and the USF&WS, a trophy hunting season was approved by both parties in 1974, permitting a 4-month hunting season with a limit of 1 wolf/hunter. In 1975 the Board approved the addition of a 5-month trapping season with no limit — the same trapping regulations that applied elsewhere in Alaska — but because the accuracy of wolf population estimates was in question, the USF&WS closed half of the KNWR to wolf trapping. In 1976,

however, concurrent with the initiation of a predator-prey study sponsored jointly by ADF&G and USF&WS, both wolf hunting and trapping were allowed over the entire KNWR except for the surfaces of two large lakes, which were kept closed in order to prevent trappers with aircraft from taking wolves by using a land-and-shoot technique. Since 1978 there have been no additional federal special regulations affecting wolf harvest on the KNWR except for a short-lived closure in 1979 designed to limit land-and-shoot harvest of furbearers. The sporadic special regulations issued previously by the USF&WS reflect an attempt to control increasing wolf harvests on the KNWR. ADF&G recommendations (Spraker 1980, Fed. Aid Wildl. Res. Rep.), on the other hand, have called for increased wolf harvests in the belief that the moose population would benefit.

Mortality data for radio-collared wolves (Table 1) reveal that few wolves die of causes unrelated to harvest by man, with 88% of all mortality recorded after the age of 6 months attributable to human causes. Radio-collared wolves lived an average of 16 months after being collared. Wolves most vulnerable to human harvest were dispersing young adults, which had a mortality rate of at least 42%. The average period between dispersal and death was 5 months.

The sample of radio-collared wolves provided a different picture of the methods used to harvest wolves than did the mandatory ADF&G reporting forms (Table 2). We tried to contact personally every individual who killed a radio-collared wolf, and discussed the circumstances of each kill. Table 2 shows that most

**Table 1**  
Cause of death of radio-collared wolves on the KNWR study area, 1976-80

Cause of mortality	Method	N
Human	Snared	15
	Shot	16
	Trapped	1
	Unknown	1
Natural		3
Total		36

**Table 2**  
Percentages of wolves taken using different methods of harvest on the Kenai Peninsula, Alaska

Source of data	N	Method (%)				
		Ground shooting	Trapping	Snaring	Other	Unknown
ADF&G sealed (%)	207	41	32	24	2	1
Radio-collared wolves (%)	35	46	3	49	-	3

harvested radio-collared wolves were either shot or snared, and only one (3%) was known to have been trapped. We suggest that the distinction between snaring and trapping may not be reported accurately by individuals registering wolf hides. Snaring seems to be the principal method of harvesting Kenai wolves, because wolves recorded as being shot included those taken both by land-and-shoot trappers and by ground-based hunters acting opportunistically.

There is some misunderstanding about how aircraft may be used in taking wolves in Alaska. The federal Airborne Hunting Act of 1972 forbids shooting of wildlife from aircraft, or herding or harassment of animals with aircraft, except under special permits issued by states for management purposes. ADF&G currently issues aerial hunting permits in several areas where they wish to reduce wolf populations. This is a practice distinct from harvesting by the commonly used technique of land-and-shoot, which is legal under trapping regulations that allow the hunter to spot free-ranging furbearers from an aircraft, but to shoot only after landing. A number of individuals in Alaska are quite proficient at land-and-shoot trapping, and this technique has been used with considerable success by a few individuals on the KNWR. Hunting regulations forbid the shooting of big game on the "same day airborne", but this regulation does not apply to furbearers. Wolves and wolverines (*Gulo luscus*) are classified as both big game and furbearers, and while a licensed hunter must not spot wolves from aircraft and proceed to land and shoot, a licensed trapper can do so legally, with no limit on the number of wolves he may take in this manner.

**Table 3**  
Proportion of aircraft users among "trappers" on the KNWR

Regulatory year <sup>1</sup>	Total no. of permits issued	Aircraft users	
		N	%
1976-77	86	12	14
1977-78	86	21	24
1978-79	96	30	31
1979-80*	97 <sup>2</sup>	32	33

\*As of February 1980.

Use of aircraft in the Kenai area increased dramatically in the mid-1970s (Federal Aviation Administration, pers. comm.) and the proportion of trappers that use aircraft on the KNWR is about one out of three (Table 3). There are at least 1200 small privately owned aircraft within 80 km of the KNWR (FAA records, 1979), mostly in the Anchorage area.

## 6. Kenai wolf harvest trends

Peninsula-wide wolf harvest reached a peak in 1978/79 after increasing steadily since the first hunting season in 1974/75. The increase in the number of wolves taken on the KNWR was matched by a similar increase in the mortality rates of radio-collared wolves from human harvest (Table 4). In 1980/81, 39% of the radio-collared wolves available during a hunting and trapping season were killed.

Although there have been instances of high harvests of wolves on the Kenai by land-and-shoot trappers, the steady increase in total wolf harvest on the KNWR cannot be attributed to increased use of aircraft. The KNWR exists in virtually a semi-urban situation, with 200 000 people living less than an hour's flight or half-day's drive away. Increased wolf harvest has

**Table 4**  
Wolf harvest summary, Kenai Peninsula

Year	Total wolves taken on Kenai Peninsula	Method*					Total wolves taken on KNWR	Proportion of harvested wolves taken with aircraft, (%)‡	No. of radio-collared wolves taken per year	No. of radio-collared wolves avail. per year	Proportion of radio-collared wolves taken per year (%)	Over winter loss in radio-collared packs (%)
		Ground shooting†	Trapping	Snaring	Other	Unknown						
1974-75	6	3	1	0	0	2	1	0	-	-	-	-
1975-76	21	9	8	4	0	0	4	0	-	-	-	-
1976-77	12	7	5	0	0	0	6	0	0	11	0	26
1977-78	36	19	6	10	1	0	13	46	3	25	12	29
1978-79	55	20	22	9	3	1	32	41	9	37	24	43
1979-80	43	11	18	13	1	0	37	14	10	37	27	57
1980-81	34	15	6	13	0	0	17	0	10	26	39	n.a.
Total	207	84	66	49	5	3						

\*As recorded on ADF&G sealing forms.

†Including all "land-and-shoot" harvest.

‡Data available for KNWR only.

been associated with increased public awareness of the presence of wolves, to which the research effort itself has contributed to some extent.

#### 7. Impact of harvest on the wolf population

The degree to which a wolf population can compensate for human harvest has been poorly documented. Although there is evidence that some wolf populations can annually replace nearly 50% of total losses (Mech 1970, Peterson and Woolington 1982), the distinction between mortality from human harvest and total over-winter loss is often ignored, leading to the incorrect assertion that wolf populations can universally maintain pre-harvest densities at a harvest level of 50% (Preliminary Alaska Wildlife Management Plan 1976, Rearden 1980). From data on Kenai wolves, we estimated that a recorded (reported) harvest of 25% would actually produce an average over-winter loss of 43%, the difference being attributed to natural mortality, dispersal loss, and unreported harvest or human-caused mortality. From an analysis of population age structure, observed mortality, dispersal, and wolf density, we earlier suggested that a recorded human harvest in excess of 25% of the early winter wolf population would reduce density the following year, as annual losses could not be replaced by reproduc-

tion. Wolf harvests in 1979/80 and 1980/81 on the study area exceeded 25% of the early winter wolf population; preliminary data suggest that wolf density did subsequently decline. Key characteristics of the Kenai wolf population that might limit the applicability of these figures to other populations are:

- 1) generally one average-sized litter of pups in each pack each year, regardless of pack size;
- 2) large pack size, averaging 12 wolves in early winter; for a given litter size, recruitment rate will be higher for small packs than large packs;
- 3) wolf density originally believed to be close to natural saturation density;
- 4) unreported over-winter loss of 18% due to natural mortality and dispersal.

Additional empirical evidence that wolf populations often cannot be maintained with 50% overwinter loss is provided by Van Ballenberghe *et al.* (1975), Van Ballenberghe (1981), and Mech (1977a). Undoubtedly a review of all available data on the subject and future research will allow us to refine our thinking on the subject of critical levels of overwintering wolf mortality.

#### 8. Concluding remarks

Wolf management on the KNWR will continue to be controversial because of agencies' differing management objectives. Inter-

agency agreement will be facilitated if management objectives are clearly stated and, if possible, jointly proposed. Wolf population responses reflect to a large extent changes in resource levels and characteristics at lower trophic levels, as well as human harvest patterns. It is imperative that wolf management be integrated with management of habitat and prey species, especially moose, and that allowable human harvest be compatible with the long-term goal of preserving natural diversity in this ecosystem.