SUSITNA HYDROELECTRIC PROJECT

1983 ANNUAL REPORT

BIG GAME STUDIES

VOLUME V WOLF

Warren B. Ballard

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ALASKA DEPARTMENT OF FISH AND GAME
Submitted to the Alaska Power Authority
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NOTICE

ANY QUESTIONS OR COMMENTS CONCERNING THIS REPORT SHOULD BE DIRECTED TO THE ALASKA POWER AUTHORITY SUSITNA PROJECT OFFICE

PREFACE

In early 1980, the Alaska Department of Fish and Game contracted with the Alaska Power Authority to collect information useful in assessing the impacts of the proposed Susitna Hydroelectric Project on moose, caribou, wolf, wolverine, black bear, brown bear and Dall sheep.

The studies were broken into phases which conformed to the anticipated licensing schedule. Phase I studies, January 1, 1980 to June 30, 1982, were intended to provide information needed to support a FERC license application. This included general studies of wildlife populations to determine how each species used the area and identify potential impact mechanisms. Phase II studies began in order to provide additional information during the anticipated 2 to 3 year period between application and final FERC approval of the license. Belukha whales were added to the species being studied. In these annual or final reports, we are narrowing the focus of our studies to evaluate specific impact mechanisms, quantify impacts and evaluate mitigation measures.

This is the second annual report of ongoing Phase II studies. In some cases, objectives of Phase I were continued to provide a more complete data base. Therefore, this report is not intended as a complete assessment of the impacts of the Susitna Hydroelectric Project on the selected wildlife species.

The information and conclusions contained in these reports are incomplete and preliminary in nature and subject to change with further study. Therefore, information contained in these reports is not to be quoted or used in any publication without the written permission of the authors.

The reports are organized into the following 9 volumes:

Volume I.	Big Game Summary Report
Volume II.	Moose - Downstream
Volume III.	Moose - Upstream
Volume IV.	Caribou
Volume V.	Wolf
Volume VI.	Black Bear and Brown Bear
Volume VII.	Wolverine
Volume VIII.	Dall Sheep
Volume IX.	Belukha Whale

SUMMARY

During 1982 and 1983 wolf studies were continued in the Susitna River Basin to investigate potential impacts of the proposed Susitna Hydroelectric Project. Between 1 November 1981 and 31 December 1983, 42 wolves were captured and outfitted with transmitter-equipped collars to enable researchers to document movements, denning and rendezvous locations, habitat use, and food habits. Throughout the period, a total of 13 different packs and 1 lone wolf were known to be using areas in or adjacent to the Devil Canyon or Watana impoundment zones. During any particular year 5-6 individual wolf packs used areas to be inundated by the proposed project. Six hundred forty-nine radio locations yielded 945 wolf sightings upon which this report is based. Individual pack histories are presented.

Territory sizes of 7 intensively monitored packs ranged from 127 mi^2 to 602 mi^2 (329 km^2 to 1559 km^2), and averaged 452 mi^2 (1171 km^2) in 1982 and 1983. Territory sizes varied considerably among packs, probably due to pack size, prey densities, frequency of monitoring, and adjacent pack boundaries.

Distribution of wolf packs is suspected to be virtually complete in the basin, with elevational use generally restricted to less than 4,000 ft. Elevational distribution varies seasonally and is probably dependent on relative densities of major prey. Both moose and wolves used lowest annual elevations in February, with a general increase in elevational use until October with subsequent declines thereafter.

Analyses of food habits of wolves were based largely on aerial observations of wolves at kills. Moose of all age classes represented 61% of the diet, with caribou comprising 30%. Analysis of 1982 scat collections supported conclusions drawn from aerial observations.

Probably the most important impact on wolves resulting from the proposed project will be lowering of wintering densities of primary prey species (moose and caribou) in the impoundment zone, with resultant declines in wolf numbers. Secondly, loss of habitat through inundation and facilities development will undoubtedly force wolves to readjust territory boundaries resulting in intra-specific strife. This will affect not only wolf packs presently in the basin (especially the Watana pack), but also packs far removed from the area.

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The proposed Susitna Hydroelectric Project, consisting of 2 dams and power generating facilities, is expected to impact a vast area in the upper Susitna River Basin of southcentral Alaska. A number of wildlife species occurring within the inundation zones and along adjacent areas will probably be affected detrimentally. Of particular importance are the effects on moose (*Alces alces*) and caribou (*Rangifer tarandus*) populations. Subsequently, large carnivore and scavenging species will also be affected. The impacts on these carnivorous species which depend on large ungulates for food could be substantial. Wolves (*Canis lupus*), black bears (*Ursus americanus*), brown bears (*Ursus arctos*), and wolverine (*Gulo gulo*) have been identified as the large carnivorous species most likely to be severely impacted (Ballard *et al.* 1982).

Wolves in the upper Susitna River Basin and adjacent areas have been the focus of study for over 30 years (Ballard *et al.* 1981). History of Game Management Unit (GMU) 13 wolves has been described in detail by Ballard *et al.* (In Review). Wolf studies of particular importance to the proposed Susitna Project were reported by Ballard *et al.* (1982, 1983) and were designed to gather preliminary data on pack sizes, territory boundaries, den and rendezvous site use, turnover rates, and feeding habits. This report updates the Phase I report (Ballard *et al.* 1982) and encompasses the period from October 1981 through December 1983.

Because the information contained in this report treats only portions of continuing studies, it should not be used in scientific technical publications without the written approval of the investigators.

METHODS

Methods used in this study were discussed by Ballard *et al.* (1982; In Review) and will only be briefly reviewed here.

Wolves were captured according to methods described by Ballard *et al.* (1982). When practical, blood and hair samples were collected from captured wolves, and the following body measurements were recorded: weight, body length, tail length, heart girth, neck circumference, chest height, shoulder height, and length of canines.

Approximate ages of captured wolves were determined on the basis of tooth eruption and wear. Trappers and hunters were encouraged to provide wolf carcasses by offering them $10.00 per carcass, and an additional $25.00 for turning in radio-collars. Ages of most harvested wolves were determined by a combination of tooth eruption and wear, tooth sectioning and counts of cementum annuli (Goodwin and Ballard 1985) and by examination of epiphyseal cartilage of the longbone (Rausch 1967).

Captured wolves were fitted with radio-equipped collars manufactured by Telonics, Inc. (Mesa, Az.), and were located periodically from fixed-wing aircraft. Radio-collared wolves were visually observed, when possible, using methods described by Mech (1974). On each tracking flight the following data were recorded: exact location (plotted on 1:63,360 USGS maps), elevation, aspect, slope, associated wolves (color, ages), activity (bedded, feeding, etc.), kill data (species, sex, age, percent consumed, approximate length of time the animal had been dead), associated species, date and time of observation, and general habitat classification according to Viereck and Dyrness (1980) and Viereck *et al.* (1982).

The size of pack territories was outlined by plotting all radio locations on maps, and connecting outermost observations (Mohr

1947). Radio locations of pack members in the process of dispersing were not included. A compensating polar planimeter was used to determine territory size.

Information on wolf food habits was collected from observations of radio-collared wolves at kill sites. This method grossly underestimates the precentage of the diet made up of small prey such as rodents and birds, as the smaller items are consumed quickly, and are often impossible to identify from aerial observations. When practical, ungulate kills were examined on the ground according to methods described by Stephenson and Johnson (1973) and Ballard *et al*. (1979). In most cases, the mandibles and a femur or metatarsal were collected to aid in establishing the animal's age (Sergeant and Pimlott 1959, Skoog 1968) and physical condition (Neiland 1970).

Wolf dens and rendezvous sites located through radio-tracking efforts were inspected in August or September after the wolves had vacated the sites. All scats were collected, and records of other food remains were made. Scats were collected and individually placed in paper bags, autoclaved, and stored for later analysis.

RESULTS AND DISCUSSION

CAPTURE AND TELEMETRY DATA

Between 1 October 1981 and 31 December 1983, 42 wolves were captured and instrumented in the upper Susitna River Basin (Table 1). A total of 13 wolf packs and 1 lone wolf were known to be using areas bordering the Devil Canyon or Watana impoundment zones during this reporting period, although not concurrently. Use of the impoundment zones by these packs is dynamic, as some packs no longer exist (due to harvest and dispersal), and other packs immigrated into the area and were not located until

Table 1. Wolves captured in the Susitna River Basin, Alaska from November 1981 through December 1983.

PACK NAME	ACCESSION NUMBER	DATE OF CAPTURE	AGE	COLOR	SEX	BLOOD PARAMETERS P.C.V. 1/	%Hb 2/
Broad Pass	122414	12/06/82	4	gray	M	47.0	13.5
	122415	12/06/82	pup	gray	M	40.0	15.0
	122416	12/06/82	pup	gray	F	47.5	13.0
	122417	12/06/82	2-3	gray	F	54.0	20+
B-S	122367	12/07/81	2-3	gray	F	NR 3/	NR
	122368	12/07/81	Ad.	gray	M	NR	NR
	122405	4/11/82	3	gray	M	52.0	20+
	122479	4/08/83	pup	gray	M	51.0	17.5
	122480	4/08/83	pup	gray	M	48.0	18.0
Canyon Creek	122406	10/14/82	1	gray	F	58.0	20+
Clearwater	122323	10/15/82	2	gray	F	59.0	20+
	122424	12/12/82	Ad.	gray	M	55.5	20+
Goose Creek	122324	12/02/82	3	gray	F	NR	20+
	122423	12/12/82	2	gray	M	57.5	20+
Jay Creek	122199	12/06/81	7	gray	F	55.0	20+
	122355	11/30/81	pup	gray	M	NR	NR
	122356	11/30/81	pup	gray	F	50.5	20+
	122357	11/30/81	pup	gray	F	NR	17.0
	122358	11/30/81	pup	gray	M	48.0	17.4
	122365	12/06/81	2-3	gray	F	53.0	19.0
Maclaren	122369	12/08/81	3-4	black	F	NR	NR
Portage Creek	122361	12/02/81	Ad.	gray	M	44.0	18.4
	122362	12/02/81	2-3	gray	F	47.0	17.8
	122363	12/02/81	pup	gray	F	38.0	14.0
	122364	12/02/81	pup	gray	F	44.0	16.4
	122403	4/10/82	5	gray	F	43.0	16.0
	122404	4/10/82	pup	gray	F	NR	NR
Snodgrass Lake	122330	10/15/82	Ad.	gray	M	60.0	20+
	122366	12/06/81	2	gray	F	59.0	20+
	122407	10/15/82	pup	gray	M	39.0	14.4
Susitna-Stephan	122349	11/13/81	2	gray	M	44.0	18.5
Susitna II	122491	6/28/83	2-3	gray	F	70.5	13.0
Talkeetna R. I	122359	12/02/81	3	gray	M	54.0	18.5
	122360	12/02/81	2	black	F	NR	NR
Talkeetna R. II	122413	12/03/82	2-3	gray	M	53.5	20+
	122477	4/06/83	2	black	F	----	---
	122478	4/06/83	2	black	M	41.0	14.5

Table 1. (cont'd)

PACK NAME	ACCESSION NUMBER	DATE OF CAPTURE	AGE	COLOR	SEX	BLOOD PARAMETERS P.C.V. 1/	%Hb 2/
Watana	122308	4/10/81	4	gray	F	47.0	17.5
	122346	4/11/82	3	gray	F	30.0	12.3
	122400	4/09/82	5+	gray	M	46.0	17.0
	122401	4/09/82	2	gray	M	NR	NR
	122402	4/09/82	pup	gray	F	49.0	17.5

1/ Packed cell volume
2/ % Hemoglobin
3/ Not recorded

either late in 1982 or 1983. During any particular year 5-6 individual wolf packs had territories which overlapped the areas proposed for inundation.

A total of 649 radio locations were obtained on 42 radio-collared wolves over a 25 month period (Table 2). These relocations resulted in 945 wolf sightings. Descriptions of the dynamics of each pack are described in the following sections. Histories of particular packs prior to 1982 were described by Ballard *et al.* (1981 and 1982).

INDIVIDUAL PACK DESCRIPTIONS

Broad Pass Pack

An attempt was made in December 1982 to capture and instrument additional members of the Portage Creek Pack since contact with most of the pack had been lost in late fall. The Portage Creek pack often moved to the East Fork of the Chulitna River and Broad Pass areas, so an attempt was made to locate them there. On 2 December 1982, a wolf pack containing at least 12 members was located within the area traditionally used by the Portage Creek Pack. Four of the pack members were captured and instrumented (Table 1). Subsequent locations revealed that it was not the Portage Creek pack but a pack which occupied the area to the northwest extending into Denali National Park. Because this pack does not utilize areas to be severely impacted by the proposed project they were only located on 14 occasions during the 2 year period (Table 2.) Based upon the limited number of locations the pack occupied an area of 754 km^2.

B-S Pack

Throughout 1982, the B-S Pack was comprised of 3 adult members (numbers 367, 368 and 405). They were successful in raising a litter of 4 pups. Because of their differential degree of

Table 2. Telemetry data and status of wolves captured in the upper Susitna River Basin, Alaska from December 1981 through December 1983.

PACK NAME	ACCESSION NUMBER	NO. RADIO LOCATIONS	NO. WOLF SIGHTINGS	NO. PACK DAYS	STATUS (12/31/83)
Broad Pass	414	2	143	16	Trapped 12/82
	415	14			Still have contact
	416	13			Still have contact
	417	7			Missing 3/5/83
B-S	367	52	188	55	Ground shot 1/84
	368	40			Killed by Watana wolves 3/83
	405	42			Ground shot 1/84
	479	9			Ground shot 12/83
	480	10			Ground shot 1/84
Canyon Creek	406	8	8	8	Ground shot 2/83
Clearwater	323	4	8	4	Illegal harvest 1/83
	424	4			Illegal harvest 1/83
Goose Creek	324	5	15	10	Trapped 1/83
	423	8			Ground shot 2/83
Jay Creek	199	5	68	8	Illegal harvest
	355	7			Illegal harvest
	356	7			Illegal harvest
	357	7			Illegal harvest
	358	7			Illegal harvest
	365	5			Illegal harvest
Maclaren	369	27	26	27	Killed by other wolves
Portage Creek	361	12	100	33	Snared upper Gakona River 3/83
	362	5			Suspected illegal harvest
	363	16			Lost contact 8/18/82
	364	2			Lost contact 4/10/82
	403	18			Ground shot 11/83
	404	22			Ground shot 9/83
Snodgrass Lake	330	30	104	32	Suspected illegal harvest 2/83
	336	22			Missing
	407	8			Ground shot 2/83
Susitna-Stephan	331	9	9	9	Shot by ADF&G-Unit 20 control
	349	4			Suspected illegal harvest
Susitna II	491	3	20	3	Still have contact
Talkeetna R. I	359	4	7	5	Suspected illegal harvest
	360	4			unknown

Table 2. (Continued)

PACK NAME	ACCESSION NUMBER	NO. RADIO LOCATIONS	NO. WOLF SIGHTINGS	NO. PACK DAYS	STATUS (12/31/83)
Talkeetna R. II	413	13	17	13	Still have contact
	477	1			Dead-capture mortality
	478	3			Still have contact
Watana	308	42	232	49	Still have contact
	309	1			Capture mortality
	323	18			Dispersed to Clearwater Pack-Dead 1/83
	324	10			Dispersed to Goose Cr. Pack-Trapped 1/83
	325	0			Dispersed to Nelchina Pack-Trapped 3/83
	345	2			Missing
	346	24			Dispersed to Big Bend-Missing 3/83
	400	32			Still have contact
	401	32			Still have contact
	402	29			Dispersed to L. Louise-Shot 2/84
TOTALS		649	945	272	

attentiveness to the den site, it was suspected that wolf 367 was the producing female, 368 was the alpha male, and 405 was a subordinate member of the pack. Wolves 367 and 368 were instrumented in December 1981, and wolf 405 was instrumented in April 1982. At the end of 1982, the pack still contained 7 members.

Due to unknown reasons the adult members of the B-S pack became separated from the pups in early February. Two pups were captured and radiocollared in April 1983. The two groups remained separated until early May when they were observed close to the 1983 den site.

During 1983 the pack moved further west apparently in response to the vacancy created by the elimination of the Jay Creek pack. An eastward expansion of the Watana wolves also occurred at this time, resulting in a confrontation with the B-S pack which resulted in the death of B.S. wolf 368.

The pack was located on only 3 occasions between 27 May and 31 December 1983. By early December the pack numbered 8 and had obviously produced pups. Either some wolves had dispersed or the 1983 litter size was small because based on average GMU-13 litter sizes the pack should have numbered 12. From December 1981 through December 1983 the pack occupied on area of 1412 km^2. In late December and early January 1984 the entire pack was killed by aircraft-assisted hunters.

Canyon Creek Wolf #406

In October 1982, a lone yearling gray female (406) was captured and instrumented in the upper Susitna River Basin on Canyon Creek near the Denali Highway. This single wolf was located on 8 occasions between October 1982 and late February 1983 (Table 2) and ranged from Deadman Creek to the east fork of the Jack River to Canyon Creek. This suggests that during this time period the

area immediately north of the Watana Pack was probably vacant except for sporatic excursions by the Snodgrass Lake pack and this single wolf. Based upon the limited number of relocations the single wolf occupied an area of 671 km^2.

Clearwater Pack

Contact with the Clearwater Pack was established in December 1982 when Watana wolf 323 was relocated between Clearwater Creek and the Maclaren River. Wolf 323 was accompanied by another wolf which was captured and instrumented on 12 December 1982 (adult gray male 424). Only 4 locations were gathered on this pair before they were killed by aircraft-assisted hunters. This pair was apparently recolonizing the area left vacant after the death of wolf 369 (see Maclaren wolf history). Because of the small number of locations no territory size was computed.

Goose Creek Pack

Contact with the Goose Creek Pack was established on December 1982 when Watana wolf 324 (adult gray female) was recaptured and her radio-collar replaced. Her lone associate was captured 12 December 1982 (adult gray male #423). The wolves appeared to be in the process of colonizing the area but were killed in early 1983. Because of the small number of relocations the estimated territory size of 322 km^2 was probably low.

Jay Creek Pack

During winter 1979-80 there were reports of 10 to 11 wolves within the Jay Creek pack area. Six wolves were ground shot at that time. At least 4 wolves were observed on the Susitna River near Jay Creek during a moose survey in March 1980, indicating that the pack area was still occupied, probably by descendants of wolf 199. No further information on this pack was obtained until November 1981.

Radio contact with the Jay Creek Pack was first established on 30 November 1981. Prior to contact, track sightings and uncollared wolf sightings in the area suggested the pack's presence for quite some time. On 30 November, the pack contained 12 members and wolves 355, 356, 357 and 358 were captured and instrumented (all pups; male, female, female and male, respectively). On 6 December, 2 additional wolves were captured (adult gray females 199 and 365). Wolf 199, originally from the Tsusena Pack, was the alpha female. The Jay Creek Pack inhabited the area from Coal Creek to the Susitna River and Jay Creek without attrition until mid-January when they were suspected to have been illegally shot by aerial hunters. Four wolf carcasses were found on the Susitna River in early March, and it was suspected that the rest had also been killed. The unskinned carcass of wolf 365 was found in July and examination of the carcass revealed punctures in the pelvis which matched the size of 00-buck shotgun pellets.

Maclaren Wolf 369

In early December 1981 an adult black female (#369) was captured and radio-collared near Clearwater Creek. At capture, she was accompanied by 1 gray wolf which was apparently harvested in early January. Regular radio-contact with 369 was continued until 30 October 1982, when she was suspected to be sick or injured. Her carcass was retrieved in early 1983 and indications were that she had been attacked by other wolves, was weakened, and later starved to death. Her territory size during the period she was instrumented was 127 mi^2 (329 km^2).

It was interesting to note that during the time she was being monitored, wolf 369 showed fidelity to a den site, although no other wolves were seen at the den and no pups were known to have been produced.

Portage Creek Pack

The Portage Creek Pack was first located on 2 December 1981, and 4 members were captured and radio-collared (wolf 361 - adult gray male; 362 - adult gray female; 363 and 364 - pup gray females). At that time, there were only 5 individuals in the pack. Relocation of the pack was not successful on 9 succeeding attempts, and it was not until 14 January 1982 that they were found. By then, the pack contained at least 8 members.

By early March the pack had split up, with a maximum of 5 wolves observed together. Wolf 362 was suspected to have been illegally shot from the air, as the collar was retrieved and had obviously been cut off and the harvest was never officially documented on mandatory sealing certificates. Two additional wolves were captured and instrumented in April 1982 (403 - adult gray female; 404 - pup gray female) bringing the Portage Creek Pack to 5 members, all of which were instrumented.

Wolf 364 was suspected to have dispersed or was harvested from the pack in mid-April, because she was never again observed with the pack. The den site was located on 14 June at which time the pack was comprised of 2 adults and 2 yearlings (adults 361 and 403; yearlings 363 and 404). At collaring wolf 403 was pregnant, thus was assumed to be the alpha female. The den site was inspected on 17 September and several pup scats were collected even though no pups were ever observed.

By late fall 1982, radio contact with all but 2 members of the pack was lost. We suspected that several of the wolves had been shot or dispersed. Radio-collared wolves 403 and 404 and 2 uncollared wolves were the only pack members known to be still alive. On March 1983, wolf 361 was snared along with 1 associate on the upper Gakona River, a straightline movement of 180 km. The pack denned at an unknown location in 1983. They were not

located between early May and December 1983. Wolf 403 was killed in November while wolf 404 was shot in September 1983. In early fall 1983, the pack had numbered 8 according to public reports.

Snodgrass Lake Pack

Wolf 330 apparently colonized the Snodgrass Lake Pack in November 1981 after dispersing from the Susitna Pack in early May. This 2-year-old gray male was accompanied by another wolf which was captured and instrumented on 6 December 1981 (2-year-old gray-black female wolf 366). They remained together through the winter and were observed at a den site near Butte Creek where at least 6 pups were produced.

Pups began to travel with the adults by mid-September and used an area from upper Brushkana Creek to Clearwater Creek throughout the fall. Total area encompassed within their territory was 602 mi^2 (1559 km^2). On 15 October 1982, the 7-member pack was located and an additional wolf (pup gray-brown male wolf 407) was instrumented.

On 18 or 19 November, a trapper near Susitna Lodge watched an airplane harassing the pack, and subsequently observed the occupant(s) aerially shooting at the pack. He reported that they illegally harvested at least three of the pack members. On subsequent radio-tracking flights, the pack was found to contain only 4 members, including wolves 330 and 407. It was not certain whether wolf 366 had been harvested or her transmitter had failed. In early February 1983, the remainder of the pack was killed by illegal aerial hunters. The pack area was believed to be vacant throughout 1983.

Susitna - Stephan Pack

During the short time the pack existed it was comprised of 2 collared wolves. Wolf 331, originally from the Susitna Pack, had a history of wanderings over much of the upper Susitna Basin (Ballard *et al*. 1982). They had apparently not established a territory during the time they were monitored, as their movements were typical of dispersing wolves (*op. cit.*).

Wolf 331 was recaptured along with his lone associate (wolf 349, adult gray male) in November 1981 near Stephan Lake. It was suspected that wolf 349 was either another Susitna Pack member or was from the Watana Pack (Ballard *et al*. 1982, page 19).

On 13 December 1981, wolf 349 was suspected to have been illegally shot from the air, as evidenced by airplane ski tracks and blood in the snow. This may have prompted wolf 331 to disperse out of the area.

On 16 April 1982, ADF&G personnel from the Fairbanks office reported the death of wolf 331. He had been harvested by Department personnel as part of control efforts in Game Management Unit 20 near Healy; a straightline movement of 129 km. When killed he was accompanied by 6 wolves, apparently having been accepted into an existing pack.

Susitna II

During late June 1983, three wolves were observed near the old Susitna pack rendezvous site. Since November 1981 this pack area had been largely vacant except for colonizing pairs. One wolf (adult female 491) was captured and radio-collared. The pack produced 6 pups, however no information was obtained on pack distribution due to inadequate funding.

Talkeetna River I Pack

Contact with this pack was established in early December 1981. The origin of the wolves was unknown but because only 2 wolves (359, adult gray male and 360, adult black female) were present, they probably had recently colonized the area. They were located only 3 times between collaring and 4 January 1982, and were always together. On 16 February, however, only wolf 360 was seen, and the signal from 359 was located in steep, rocky terrain not typical of wolves at this time of year. At this time, wolf 360 appeared to be shy of the airplane, leading us to assume that they had been shot at by hunters. Because the signal from 359 remainded at that same location on subsequent flights, it was assumed that aerial hunters had shot him, and the transmitter had been thrown out of the plane. Wolf 360 was never again located, and it was assumed that she had either been harvested or had dispersed. No estimate of territory size was calculated because of the minimal number of relocations.

Talkeetna River II

Wolf 413 (adult gray male) was captured on 3 December 1982 on the Talkeetna River upstream of Prairie Creek. Tracks in the area indicated other wolves were present. Wolf 413 was observed with 1 other black wolf in early March 1983 and by early April was associated with 2 blacks. An adult pregnant female was killed as a result of capture activities in early April. An additional black adult male (477) was captured and radio-collared at that time. The pair of males occupied an area of 2081 km^2 during 1983.

Watana Pack

At the beginning of 1982, the Watana Pack was comprised of at least 10 members, at least 6 of which were adults. The Watana Pack resided in a location which may have been beneficial to

their survival. The area has few lakes and much of the area is heavily timbered so hunter accessibility is limited. In addition, the constant human habitation of Susitna Hydroelectric Project's Watana Camp from 1980-82 and associated aircraft frequenting the area may have deterred illegal hunters from using the area. Whether these factors or others were responsible, the Watana Pack has historically realized little attrition and has been responsible for production of many wolves which have dispersed to other areas of southcentral Alaska.

Only 1 Watana wolf was suspected to have been harvested during 1982. This was a wolf found 22 March on the Susitna River, suspected to have been illegally shot from aircraft.

During 1982 at least 4 radio-collared wolves were known to disperse from the Watana Pack, either joining existing packs or starting new packs. We suspect the reason for the high incidence of dispersal was due to the low attrition within the pack, resulting in high pack numbers and subsequent dispersals. In previous years, at least 5 other wolves from the Watana Pack were known to have dispersed to new areas.

During recollaring operations in early April 1982, wolf 309 was accidentally killed. When a necropsy was performed, it was learned that this wolf was pregnant. Beginning in early May, however, the Watana wolves were repeatedly located at the den site of 1981, indicating that a litter had been produced. This was later verified. Had wolf 309 not been killed, it is suspected that the pack would have double-denned, producing 2 litters.

Pups were first observed in early July 1982. By the end of summer, the Watana Pack contained at least 18 members, when the pack was beginning to split up. By late October, there were at least three groups, two of which were thought to be dispersing. Wolves 308, 400, 401 and 402, along with the pups, remained in

the Watana territory. Wolf 346 and two associates moved approximately 30 mi (48 km) to the upper Coal Creek-Big Bend of the Susitna area and was shot in late February 1983. Wolf 323 and one associate had moved about 43 mi (69 km) to the Round Mountain area, between the Clearwater and Maclaren Rivers and were probably attempting to colonize the area after the death of Maclaren wolf 369. In December, the wolves remained separated and in their respective areas.

Additionally, wolf 324 was captured during the December collaring operation in the vicinity of Goose Creek-Oshetna River. This wolf dispersed from the Watana Pack in late April 1982. Its distance from the Watana den site to recapture location was approximately 26 miles (42 km). Also sometime between October 1982 and January 1983 wolf 402 dispersed from the Watana area and had joined a pack of 4 wolves which occupied an area south of the Alphabet Hills. This latter wolf pack is referred to as the Dog Lake Pack. By mid-March 1983 the Watana pack had been reduced to 7 wolves due to dispersal and hunting mortality. The pack had an encounter with the B-S pack on the Susitna River and 1 B-S wolf was killed. Although the pack denned in 1983 at the same site it had used since 1980, no estimate of the number of pups born was obtained until early December 1983. At that time the pack numbered 15. During 1982 and 1983 the pack occupied an area of 1913 km^2.

Other Packs

In addition to the above-mentioned packs, other packs not directly associated with the impoundment zones were sporadically monitored during 1982. These packs were usually located by following dispersing wolves out of an existing Susitna Basin pack, and subsequently either initiating new packs or joining existing packs.

As mentioned in the individual pack descriptions, many members of the Watana Pack left that territory and dispersed into vacant areas or dispersed from the Watana territory to join existing packs. In addition to the Clearwater and Goose Creek Packs that were colonized during 1982, 2 other packs have resulted from dispersals out of the Watana Pack.

The Eureka Pack, inhabiting an area from upper Tyone River to Eureka to the south of the Susitna Basin, was colonized by a Watana wolf (344) prior to 1982. This wolf was accompanied by 2 suspected female wolves in 1982, and they were successful in an apparent double-denning attempt and raised a total of 13 pups. It was suspected that the entire pack was killed by hunters and trappers during 1982-83.

Wolf 325, another Watana wolf, dispersed to the southeast in 1980, and became integrated into the Nelchina Pack. Accompanied by at least 3 additional adults, this pack was successful in raising 5 pups in 1982. Wolf 325 and several other pack members were trapped or shot during 1982-83. By late spring 1983, the pack was comprised of 6 wolves but they did not den and no pups were produced.

During summer 1983 archeologists reported observing a single wolf at a den site near Kosina Creek. Apparently, a pair of wolves colonized the area south of Jay Creek and successfully produced pups. Five wolves were observed during late fall 1983. We suspected that most of the wolves from this pack were killed during the winter of 1983-84.

DISTRIBUTION

Figures 1 and 2 depict the distribution of known and suspected wolf packs in the middle Susitna River Basin during 1982 and 1983, respectively. A minimum of 6 wolf packs utilize portions of the area to be inundated by the 2 impoundments. The figures

Depictions of wolf pack boundaries were deleted from this report due to previous instances of heavy harvests by individuals using the maps to concentrate their hunting efforts. The data is available to Susitna personnel upon request.

Figure 1. Known and suspected pack boundaries of wolf packs occupying the Susitna River Basin from December 1981 through December 1982.

Depictions of wolf pack boundaries were deleted from this report due to previous instances of heavy harvests by individuals using the maps to concentrate their hunting efforts. The data is available to Susitna personnel upon request.

Figure 2. Known and suspected pack boundaries of wolf packs occupying the Susitna River Basin during 1983.

also depict the colonization and establishment of new packs following elimination of some packs due to hunting and trapping.

NUMBERS OF WOLVES AND TERRITORIES

The number of wolves inhabiting areas which could be impacted by the proposed project has fluctuated from 25 in spring 1983 to 47 in fall 1983 (Table 3). Both hunting and trapping have regulated the number of wolves occupying the area. Mostly wolf mortality occurred during the months of January through April primarily from aircraft assisted ground shooting (Table 2, Fig. 3).

Territory sizes of 9 wolf packs in the Susitna River Basin ranged from 124 mi^2 to 803 mi^2 (322 km^2 to 2081 km^2), and averaged 452 mi^2 (1171 km^2) (Table 4). Some territory sizes may not be adequately described because some packs have only been located a few times.

Variation in observed teritory size for individual packs was due to adjacent pack boundaries, changes in distribution of prey, number & frequency of monitoring, and increases or decreases in pack size as a result of hunting mortality, dispersal, and natality. When a territory is vacant of wolves due to harvest or natural mortality, it is likely that that area will be recolonized by dispersing wolves within a short period of time (in most cases, less than a year) or will be usurped by an existing pack.

ELEVATIONAL USE

Generally, wolves restrict their movements to elevations less than 4,000 ft/1300 m. For example, the Watana Pack had only 2 of 56 (3.6%) observations at elevations greater than 4,000 ft/1300 m elevation in 1982.

Table 3. Seasonal numbers of wolves per pack occupying the Susitna River Basin of southcentral Alaska from fall 1982 through fall 1983.

Pack Name	No. of wolves		
	Fall 1982	Spring 1983	Fall 1983
B-S	7	6	8
Canyon Creek	1	0	0
Clearwater	2	0	0
East Fork	3	3	3
Goose Creek II	2	0	0
Jay Creek - Clarence Lake	0	>2	5
Maclaren	1	0	0
Portage Creek	4	3	8
Snodgrass	7	0	0
Susitna II	?	3	9
Talkeetna II	3	2	2
Watana	16	6	12
Total	46	>25	47

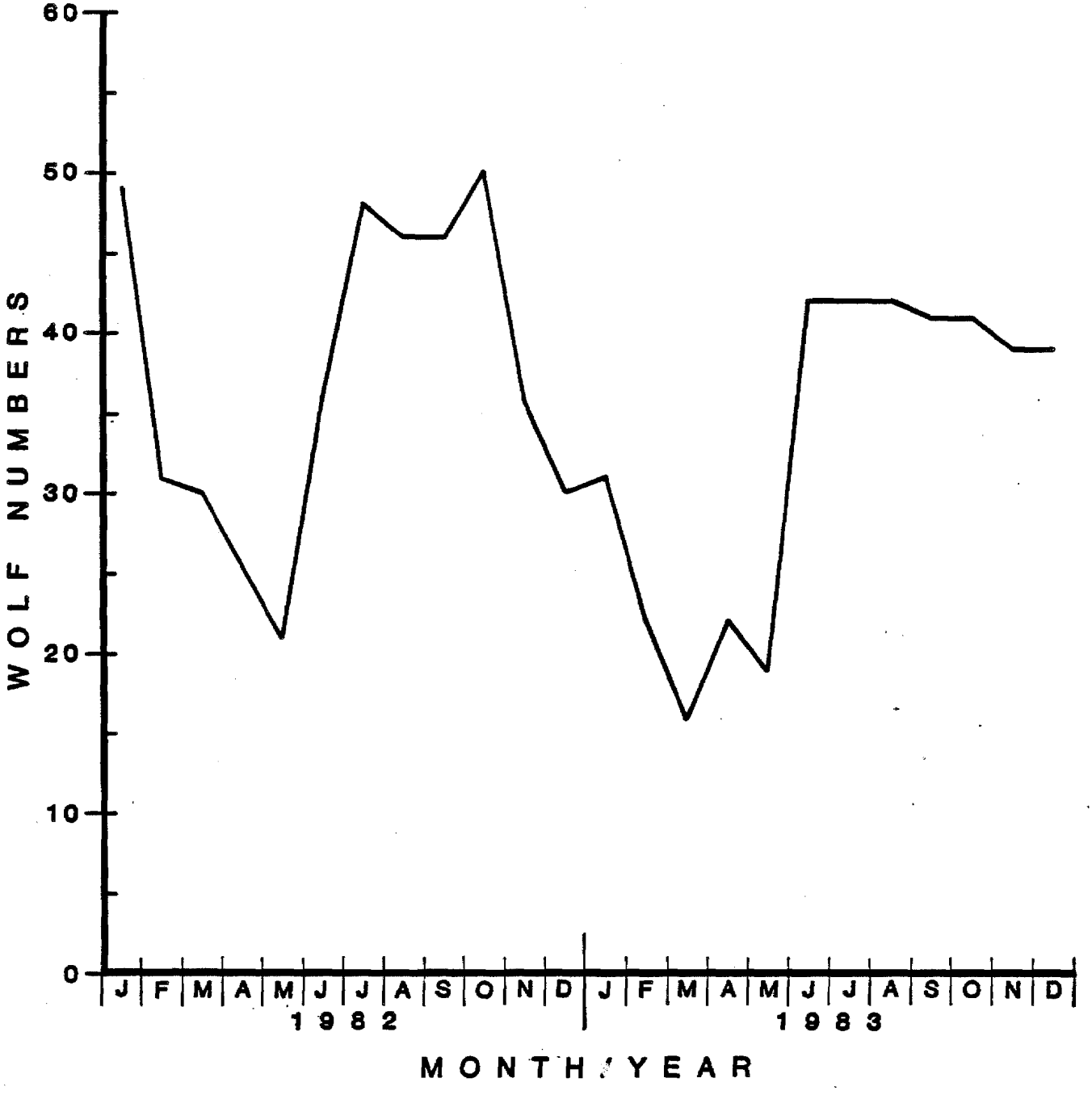

Figure 3. Combined monthly numbers of wolves in 8-9 packs in the Susitna River Basin, 1982-83.

Table 4. Numbers of radio locations and territory sizes of selected wolf packs in the Susitna River Basin during 1982 and 1983.

Pack Name	No. Radioed Wolves	No. of Radio Locations	Territory (mi^2)	Territory (km^2)	No. Pack Days
Broad Pass	4	36	291	754	16
B-S	5	153	545	1412	55
Canyon Creek	1	8	259	671	8
Clearwater	2	8	---	---	4
Goose Creek	2	13	124	322	10
Jay Creek	6	38	---	---	8
Maclaren	1	27	127	329	27
Portage Creek	6	75	580	1501	33
Snodgrass Lake	3	60	602	1559	32
Susitna-Stephan	2	13	---	---	9
Talkeetna I	2	8	---	---	5
Talkeetna II	3	17	803	2081	13
Watana	10	190	738	1913	49
Susitna II	1	3	---	---	3
	48	649	$\bar{x}$ = 452	1171	272

Elevational distribution of wolves varies seasonally. We suspected that the changes in distribution were largely dependent on changes in prey distribution. For example, the Watana wolves rely heavily on moose (Ballard *et al*. 1982) as a source of prey and it was suspected that their differential elevational use was a reflection of availability of those moose. Mean monthly elevations of nine radio-collared moose that had annual home ranges that overlapped portions of the Watana pack territory were compared with elevations of the Watana Pack (Fig. 4). Lowest mean elevation for both wolves and moose was in February, with both species exhibiting a general increase in elevations occupied until October, with subsequent declines thereafter. This suggests that wolves were following the movements of their principal prey.

FOOD HABITS

Seven radio-collared wolf packs were observed on 76 kills during 1982 and 1983 (Table 5). Moose of all age classes accounted for 61% of the observed prey. Of the moose kills which could be assigned to 1 of 3 age classes (calf, yearling or adult) both adult and calf moose comprised 44 and 41% of the kills, respectively. Calf moose do not appear to be preferred prey in early summer but from November through April they represent a disproportionate portion of the diet (Ballard *et al*. 1981, 1982, In Review).

Caribou comprised the second most important wolf prey species, accounting for 30% of the observed kills. There appeared to be no selection for calf caribou.

Aerial observations of wolf food habits during summer were supplemented with data obtained from scat analyses. Scats were collected from 5 home sites (includes den and rendezvous sites) in 1982 (Appendix I). No scats were collected in 1983.

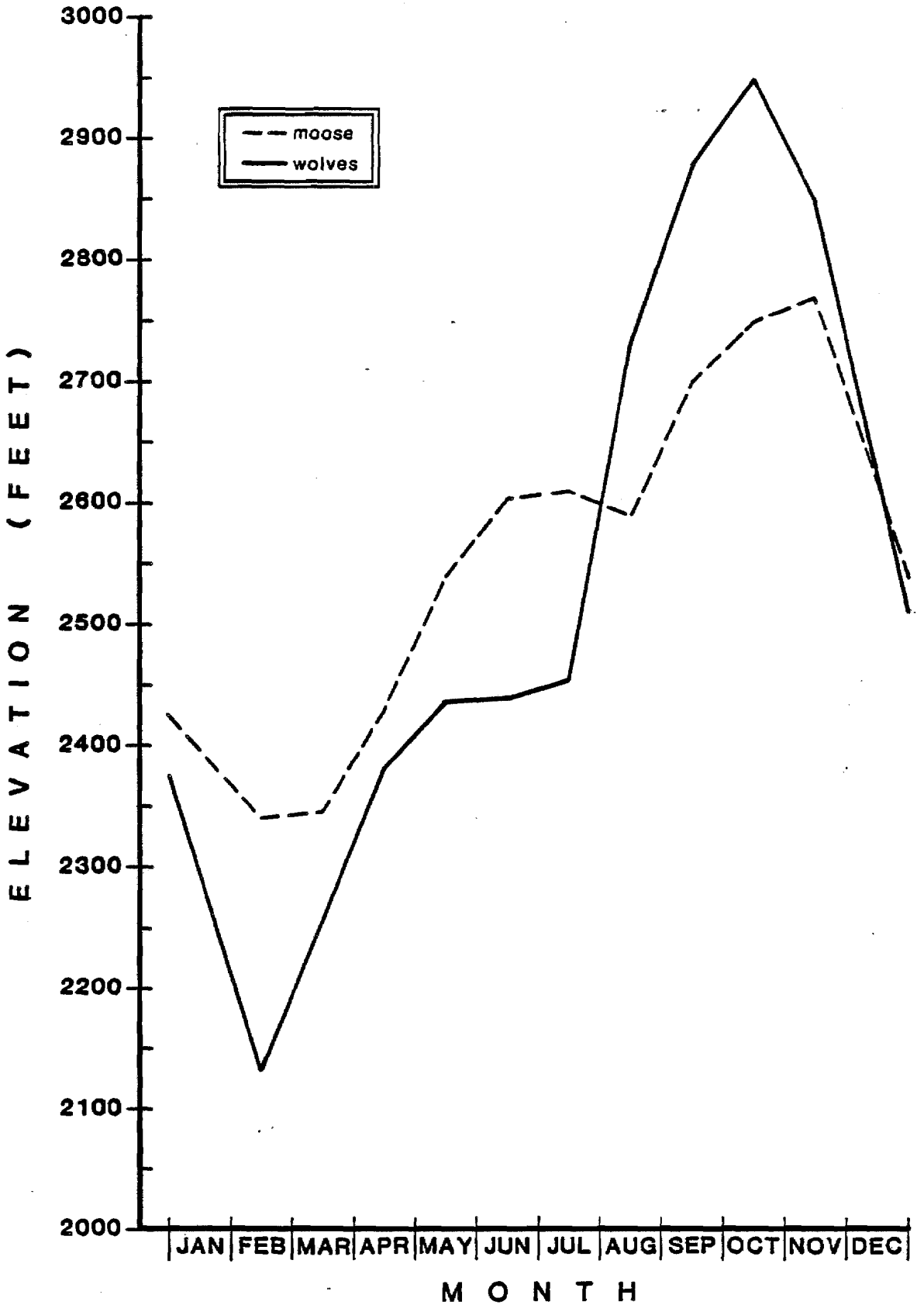

Figure 4. Watana Pack monthly elevations and monthly elevation averages of nine radio-collared moose within the Watana Pack territory during 1981 and 1982 in the Susitna River Basin, Alaska.

Table 5. Kills at which 7 wolf packs were observed during 1982 and 1983 in the Susitna River Basin of southcentral Alaska.

	Pack Name															
	B-S		Fish Lk.		Jay Cr.		Portage		Snodgrass		Stephan		Watana		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Moose, Adult	3	16	2	8	2	100	1	20	1	14	--	--	3	20	12	16
Moose, Yrlg.	1	5	2	8	--	--	--	--	1	14	--	--	--	--	4	5
Moose, Calf	4	21	2	8	--	--	1	20	--	--	1	50	3	20	11	14
Moose, Unknown	5	26	4	15	--	--	2	40	2	29	--	--	6	40	19	25
Total Moose	13	68	10	38	2	100	4	80	4	57	1	50	12	80	46	61
Caribou, Adult	2	11	11	42	--	--	--	--	2	29	1	50	3	20	19	25
Caribou, Calf	--	--	--	--	--	--	--	--	1	14	--	--	--	--	1	1
Caribou, Unknown	--	--	3	12	--	--	--	--	--	--	--	--	--	--	3	4
Total Caribou	2	11	14	54	--	--	--	--	3	43	1	50	3	20	23	30
Ungulate, sp. unk.	3	16	--	--	--	--	--	--	--	--	--	--	--	--	3	4
Sheep, Adult	--	--	--	--	--	--	1	20	--	--	--	--	--	--	1	1
Total Ungulate	18	95	24	92	2	100	5	100	7	100	2	100	15	100	73	96
Other: Beaver	--	--	1	4	--	--	--	--	--	--	--	--	--	--	1	1
Snowshoe	--	--	1	4	--	--	--	--	--	--	--	--	--	--	1	1
Unknown	1	5	--	--	--	--	--	--	--	--	--	--	--	--	1	1
Total Other	1	5	2	8	--	--	--	--	--	--	--	--	--	--	3	4
Grand Total	19	100	26	100	2	100	5	100	7	100	2	100	15	100	76	100

Incidence of moose and caribou in the wolf diet is probably a reflection of availability due to population numbers. The Nelchina caribou herd reached a low of approximately 10,000 animals in 1973 (Pitcher, pers. comm.). By 1981, the population had increased to approximately 22,000 (*op. cit.*). We suspect the increase in the caribou population has made them generally more available to wolves. If true, this would suggest that as the herd grows, caribou will probably become more important in the diet. This may be beneficial to moose populations in the Basin if caribou populations become high enough to provide the major source of food for wolves.

IMPACTS

Impacts of the proposed impoundments and their associated borrow pits, transmission corridors, work camps and facilities are difficult to quantify at this time. However, based on earlier research and that reported herein, some impacts can be estimated.

Probably the most significant impact the impoundments will have on wolves will result from a change in population density, distribution, sex and age composition and/or physical condition of moose and caribou. The majority of the wolf's diet in this area is moose, and any decrease in prey numbers will probably be reflected in both wolf density and distribution. Ballard *et al.* (1984) estimated that approximately 2,800 moose will be directly impacted by the impoundments. During the impoundment filling stage and for at least 1 year following inundation, there will probably be an increase in wolf numbers in response to higher concentrations of moose adjacent to the impoundments. There will be a high number of displaced moose which will be concentrated adjacent to the reservoirs due to the decreased availability of usable habitat. However, the duration of this relatively high moose concentration will probably be short, i.e. 2-3 years.

No quantitative data are presently available upon which to base current moose carrying capacity figures. However, our observations of browse utilization in areas presently used by moose for winter habitat indicates that preferred willow (*Salix* spp.) species are heavily used in many areas. Displacement of moose from the low elevation areas to available habitat above high pool level will undoubtedly lead to a further increase in the use of preferred areas, ultimately leading to a deterioration of that preferred habitat. Ultimately, remaining wolves and the area's ability to support larger numbers will be reduced, but for a short period they will remain relatively high and further depress the moose population and possibly prevent it from increasing.

For the period of 1972-73 through 1982-83, mandatory wolf sealing documents have shown that 48 percent of all harvest in GMU-13 is from trapping and snaring. Land-and-shoot methods accounted for 42 percent of the harvest. An increase in access roads and the proposed permanent village for project personnel will result in a significant increase in human use of the area. Correspondingly, there will probably be a higher incidence of hunting, trapping and accidental mortality upon wolves. Indirect effects upon wolves resulting from higher human populations will probably also occur. Activity near den and rendezvous sites in early summer will certainly disrupt, and in some cases, will probably cause wolves to abandon den and feeding sites. Den site abandonment could lead to higher pup mortality.

Inundation of den and rendezvous sites, travel corridors and hunting/feeding areas will eliminate portions of wolf territories. Loss of this habitat will force wolves to readjust territory boundaries and will probably result in increased interpack strife. Since present wolf mortality from some of the packs adjacent to the Susitna River are low (Watana Pack in particular) with subsequent high dispersals to surrounding areas, this area acts as a reservoir in supplying wolves to adjacent areas. Should mortality within these packs increase, there will probably

be less dispersal away from the area. Consequently, the reduction of wolf numbers adjacent to the impoundments may well affect not only those packs immediately adjacent to the river, but also packs far removed from the area. Movements of over 50 miles (80 km) away from the Watana territory by wolves which either joined new packs or initiated new packs have been recorded.

Of the 6 packs which will be impacted by the proposed project, the Watana pack will be one of the packs to be impacted most severely. The effects of habitat inundation on the Watana wolves was selected for a further analysis because of the relatively high number of relocations. During 1982 the Watana Pack occupied a territory of 482 mi^2 (1246 km^2) within and adjacent to both the proposed Watana and Devil Canyon impoundments. Twenty-six of 58 (45%) relocations of Watana Pack members were at or below high pool level of the impoundments (Fig. 5). During the first half of the year (January through June) over half (57%) the recorded observations were at or below maximum pool level. Fifty-one mi^2 of the 482 mi^2 territory were greater than 4,000 ft. altitude and were rarely used by the pack (‘4% of all relocations). Of the 431 mi^2 of usable habitat within the Watana pack territory, 55 mi^2 would be inundated by the two impoundments. However, the 55 mi^2 (13% of territory) accounted for 45% of the annual locations of the pack, indicating that the lower elevations are preferred by wolves in the Susitna River Basin. This was probably the result of higher concentrations of moose in these lower altitudinal areas.

Preliminary borrow and encampment site locations have been delineated and their locations will further limit the extent of the Watana territory. The exact percent of habitat loss of the Watana territory is not known. In particular, quarry sites A and B, and borrow sites D, E, F, I, J, and L will at least have portions within the Watana territory and will impact the Watana wolves during and/or after construction of Watana Dam.

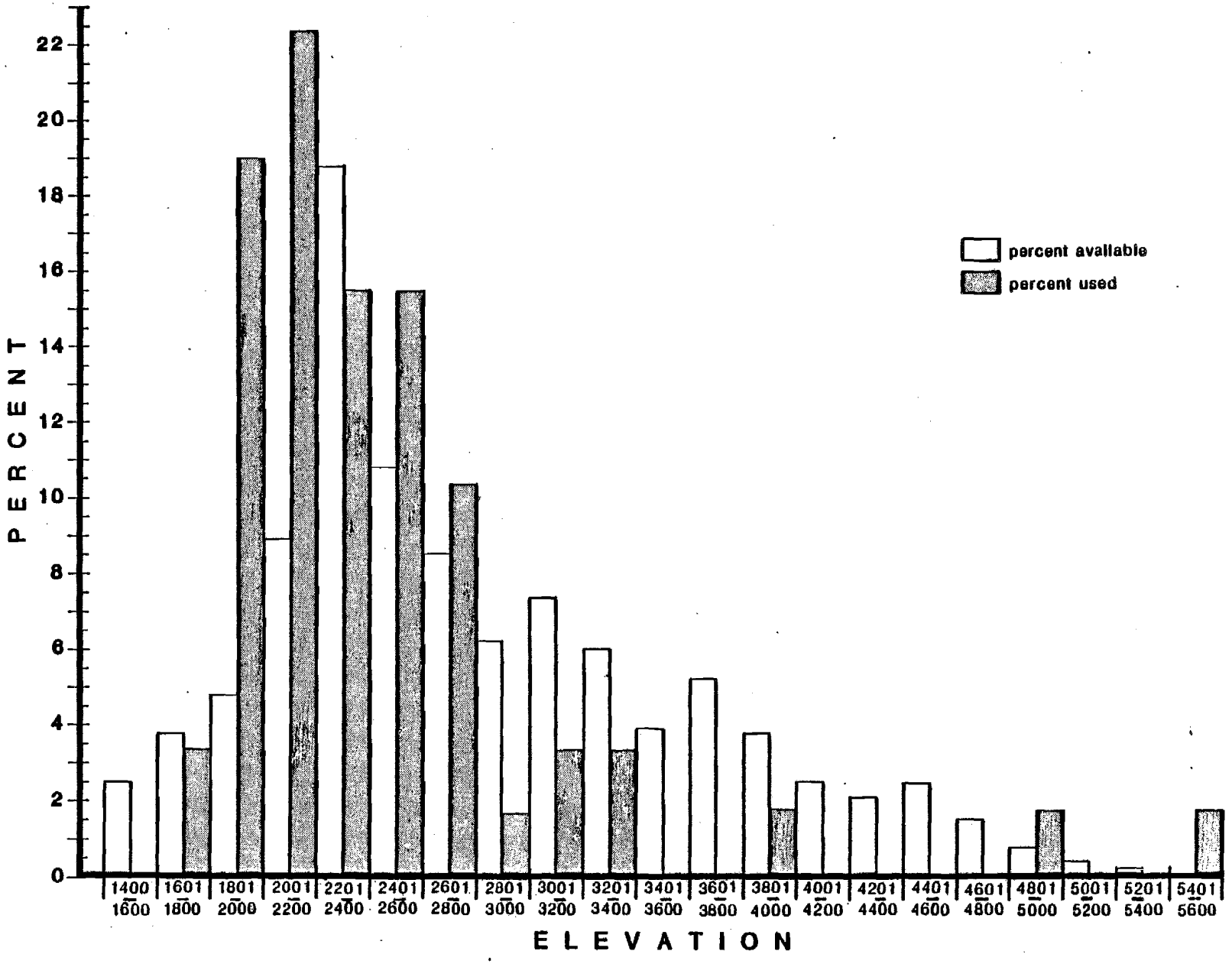

Figure 5. Use and availability of various elevational strata by the Watana Wolf Pack from November 1981 through December 1982.

The percent of various elevational strata available to the pack (calculated by random selection of 482 points within the Watana territory) compared to the percent of radio-locations at those various elevations shows that between 1801 and 2200 ft. were significantly preferred elevations (Chi-Square test, $P<0.005$) (Fig. 5). These elevational strata were available to Watana wolves in 13 percent of their territory, yet were used on 45 percent of the locations. The inundation of this zone will undoubtedly affect the shape and extent of wolf territories and subsequent recruitment and mortality of wolves in the Susitna Basin.

PROPOSED STUDIES

Continuation of monitoring efforts of wolves already instrumented is important. Population and individual pack boundaries are highly dynamic and documentation of denning, rendezvous, and hunting/traveling areas should be continued. Efforts should be made to instrument numbers of additional packs, especially in the area from Devil Canyon to Sherman. Of particular concern is a better representation of preferred habitat types when higher resolution vegetation mapping is finished.

In conjunction with ongoing moose and caribou studies, investigations of calf consumption by wolves should be conducted. More accurate documentation of food habits could be gathered in this way.

Mitigation of the losses of major prey species (moose and caribou) is of major importance to the continued viability of wolf populations. Evaluation of those mitigation options include their impacts on wolves.

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LITERATURE CITED

Ballard, W. B., A. W. Franzmann, K. P. Taylor, T. Spraker, C. C. Schwartz and R. O. Peterson. 1979. Comparison of techniques utilized to determine moose calf mortality in Alaska. Proc. N. Am. Moose Conf. Workshop, Kenai, Alaska. (5):362-387.

Ballard, W. B., R. O. Stephenson and T. H. Spraker. 1981. Nelchina Basin Wolf Studies. Alaska Dept. Fish and Game. P-R Proj. Final Report, W-17-9 and W-17-10.

Ballard, W. B., C. L. Gardner, J. H. Westlund and J. R. Dau. 1982. Susitna Hydroelectric Project Phase I Final Report. Volume V - Wolf. 220 pp.

Ballard, W. B., J. S. Whitman, L. D. Aumiller and P. Hessing. 1983. Susitna Hydroelectric Project Phase II Progress Report. Vol. III Moose-Upstream. 61pp.

Ballard, W. B., J. S. Whitman, L. D. Aumiller and P. Hessing. 1984. Susitna Hydroelectric Project Annual Progress Report. Upstream Moose.

Ballard, W. B., S. M. Miller, K. B. Schneider, and R. O. Stephenson. In Review. Ecology and relationships of wolves, brown bear and moose in southcentral Alaska. Wildl. Monograph.

Goodwin, E. and W. B. Ballard. 1985. Use of tooth cementum for age determination of gray wolves. J. Wildl. Manage: in press.

Mech, L. D. 1974. Current techniques in the study of elusive wilderness carnivores. Proc. XI Internat. Congress of Game Biol. P. 315-322.

Mohr, C. O. 1947. Table of equivalent populations of North American small mammals. Am. Midl. Nat. 37(1):223-249.

Neiland, K. A. 1970. Weight of dried marrow as indicator of fat in caribou femurs. J. Wildl. Manage. 34(4):904-907.

Rausch, R. A. 1967. Some aspects of the population ecology of wolves, Alaska. Am. Zool. 7:253-265.

Sergeant, D. E. and D. H. Pimlott. 1959. Age determination in moose from sectioned incisor teeth. J. Wildl. Manage. 23(3):315-321.

Skoog, R. O. 1968. Ecology of caribou (*Rangifer tarandus granti*) in Alaska. PhD. Thesis, Univ. of Cal., Berkeley, California. 699 pp.

Stephenson, R. O. and L. Johnson. Wolf Report. Alaska Department of Fish and Game. P-R Proj. Rept., W-17-4. 52pp.

Viereck, L. A. and C. T. Dyrness. 1980. A preliminary classification system for vegetation of Alaska. U.S.D.A. Forest Service. Pac. N.W. Forest and Range Expt. Sta. Report. PNW-106.

Viereck, L. A., C. T. Dyrness, and A. R. Batten. 1982. 1982 Revision of Preliminary Classification for Vegetation of Alaska. Proc. of Workshop on Classificaton of Alaskan vegetation. 72 pp.

APPENDIX I. WOLF SCAT ANALYSIS RESULTS.

Portage Creek 1982 Densite

	PUP (N = 51)		ADULT (N = 38)		TOTAL (N = 89)	
Prey Species	N	%	N	%	N	%
adult moose	6	5.9	6	5.9	12	11.9
calf moose	6	5.9	2	2.0	8	7.9
total moose	12	11.9	8	7.9	20	19.8
caribou	8	7.9	14	13.9	22	21.8
Dall sheep	5	5.0	2	2.0	7	6.9
unidentified ungulate	-	-	2	2.0	2	2.0
total ungulates	25	24.8	26	25.7	51	50.5
beaver	8	7.9	4	4.0	12	11.9
microtine rodent	5	5.0	6	5.9	11	10.9
ground squirrel	8	7.9	2	2.0	10	9.9
unknown mammal	-	-	2	2.0	2	2.0
total mammals	46	45.5	40	39.6	86	85.1
unidentified birds	6	5.9	2	2.0	8	7.9
vegetation	7	6.9	-	-	7	6.9
TOTAL	59		42		101	
items/scat	1.16		1.11		1.13	

Appendix I. (cont'd)

B. S. Lakes 1982 Densite

	PUP (N = 40)		ADULT (N = 12)		TOTAL (N = 52)	
Prey Species	N	%	N	%	N	%
adult moose	13	23.2	-	-	13	23.2
calf moose	17	30.4	4	7.1	21	37.5
total moose	30	53.6	4	7.1	34	60.7
caribou	4	7.1	4	7.1	8	14.3
total ungulates	34	60.7	8	14.3	42	75.0
beaver	2	3.6	2	3.6	4	7.1
microtine rodent	2	3.6	1	1.8	3	5.4
ground squirrel	1	1.8	1	1.8	2	3.6
porcupine	1	1.8	-	-	1	1.8
total mammals	40	71.4	12	21.4	52	92.9
unidentified birds	2	3.6	2	3.6	4	7.1
TOTAL	42		14		56	
items/scat	1.05		1.17		1.08	

Appendix I. (cont'd)

Snodgrass Lake 1982 Densite

	PUP (N = 140)		ADULT (N = 17)		TOTAL (N = 157)	
Prey Species	N	%	N	%	N	%
adult moose	27	15.6	5	2.9	32	18.5
calf moose	6	3.5	6	3.5	12	6.9
total moose	33	19.1	11	6.4	44	25.4
caribou	46	26.6	2	1.2	48	27.7
total ungulates	79	45.7	13	7.5	92	53.2
beaver	45	26.0	6	3.5	51	29.5
microtine rodent	3	1.7	6	3.5	9	5.2
snowshoe hare	8	4.6	-	-	8	4.6
ground squirrel	7	4.0	-	-	7	4.0
porcupine	5	2.9	-	-	5	2.9
total mammals	147	85.0	25	14.5	172	99.4
ptarmigan	1	0.6	-	-	1	0.6
TOTAL	148		25		173	
items/scat	1.06		1.47		1.10	

Appendix I. (cont'd)

Watana 1982 Densite

Prey Species	PUP (N = 94) N	%	ADULT (N = 57) N	%	TOTAL (N = 151) N	%
adult moose	34	20.9	20	12.3	54	33.2
calf moose	27	16.6	11	6.7	38	23.3
total moose	61	37.4	31	19.0	92	56.4
caribou	24	14.7	17	10.4	41	25.2
unknown ungulate	1	0.6	1	0.6	2	1.2
total ungulates	86	52.8	49	30.1	135	82.8
snowshoe hare	4	2.5	4	2.5	8	5.0
beaver	3	1.8	2	1.2	5	3.0
microtine rodent	4	2.5	-	-	4	2.5
ground squirrel	-	-	1	0.6	1	0.6
total mammals	97	59.5	56	34.4	153	93.9
unidentified birds	4	2.5	1	0.6	5	3.1
vegetation	2	1.2	2	1.2	4	2.4
wolf hair (grooming	-	-	1	0.6	1	0.6
TOTAL	103		60		163	
items/scat	1.10		1.05		1.08	

Appendix I. (cont'd)

Watana 1982 Rendezvous Site

	PUP (N = 40)		ADULT (N = 18)		TOTAL (N = 58)	
Prey Species	N	%	N	%	N	%
adult moose	13	20.6	6	9.5	19	30.2
calf moose	2	3.2	2	3.2	4	6.3
total moose	15	23.8	8	12.7	23	36.5
caribou	14	22.2	8	12.7	22	34.9
unidentified ungulate	2	3.2	1	1.6	3	4.8
total ungulates	31	49.2	17	27.0	48	76.2
snowshoe hare	2	3.2	1	1.6	3	4.8
marten	2	3.2	-	-	2	3.2
red squirrel	1	1.6	-	-	1	1.6
microtine rodent	1	1.6	-	-	1	1.6
ground squirrel	1	1.6	-	-	1	1.6
unknown mammal	1	1.6	-	-	1	1.6
total mammals	39	61.9	18	28.6	57	90.5
unidentified birds	3	4.8	-	-	3	4.8
vegetation	2	3.2	1	1.6	3	4.8
TOTAL	44		19		63	
items/scat	1.10		1.06		1.09	