USE OF AVERSIVE CONDITIONING TO REDUCE GRIZZLY BEAR/HUMAN CONFLICTS IN THE NORTH SLOPE OILFIELDS

1990 Progress Report

By

Richard T. Shideler and John L. Hechtel

May 1991

Alaska Department of Fish and Game
1300 College Road
Fairbanks, Alaska 99701

TABLE OF CONTENTS

ACKNOWLEDGMENTS

Financial assistance for this study was provided by BP Exploration Alaska, Inc. and ARCO Alaska, Inc. through a grant to the Alaska Department of Fish and Game (ADF&G), and by the Habitat and Wildlife Conservation Divisions of ADF&G. John Monarch (Chevron USA), Steve Taylor (BP Exploration Alaska, Inc.), and Tom Fink (ARCO Alaska, Inc.) were instrumental in obtaining the grant. Chris Herlugson (BP Exploration Alaska, Inc.) and Scott Ronzio (ARCO Alaska, Inc.) coordinated funding and assistance. Al Schuyler and Larry Boone (ARCO Alaska, Inc.-KRU) provided the culvert trap, greatly facilitating our capture operations. Al Ott, Regional Supervisor (ADF&G, Habitat Division) and Chris Smith, Regional Supervisor (ADF&G, Division of Wildlife Conservation) provided administrative supervision. Melissa Johnson (ADF&G) typed this report and was very helpful and cooperative.

Field assistance in capturing bears was provided by ADF&G biologists Ray Cameron, Chuck Gewin, Howard Golden, Carl Hemming, and Walt Smith; ARCO Security Captain Ken Snow and ARCO Environmental Technician Cathe Grosshandler; and North Slope Borough employees Bob Worl and Wally Smith. ADF&G biologists Harry Reynolds, John Schoen, and Dan Reed provided advice and support on the proposal and many other facets of the study. Ray Cameron (ADF&G) and Dennis Miller (Caribou Air) provided air support for capture and radio-tracking operations. Considerable field support and assistance was provided by Security Captains Dave Grinde and Craig Clemens (BP Exploration Alaska, Inc.) and Ken Snow (ARCO Alaska, Inc.) and their staffs.

And finally, the senior author acknowledges the support, encouragement, and sacrifices of Terra and Taylor Shideler.

FIGURES

TABLES

INTRODUCTION

The interaction of grizzly bears (*Ursus arctos*) with the existing North Slope oilfields has implications not only in the context of bear conservation, but also in terms of safe and efficient oilfield operation. Several investigators have evaluated the effects of oil and gas activities on grizzly bears (e.g., Harding and Nagy 1980; McLellan and Shackleton 1988, 1989a,b; McLellan 1989a,b,c, 1990; Follmann and Hechtel 1990). One effect common to these reports has been an increase in the number of bears destroyed in defense of life or property. Bears can become attracted to worksites and facilities because of the presence of human foods or garbage and learn to associate food with humans. These food-conditioned bears often become nuisances by destroying property, causing work stoppages, or threatening the safety of personnel. At least 12 reported nuisance grizzly bears have been destroyed in the vicinity of the North Slope portions of the Trans-Alaska Pipeline (TAPS) corridor since the mid-1970's (Follmann and Hechtel 1990, ADF&G files). In contrast, only one confirmed and one unconfirmed nuisance grizzly have been destroyed in the North Slope oilfields (including Deadhorse) since 1980 (ADF&G files). However, reports from oilfield security and environmental and agency personnel over the past several years indicate that the number of bears using the oilfield and the number of bear/human interactions have apparently increased. This apparent increase could be due to better reporting of observations of bear use of the area, or to a real increase in the number of bears.

Grizzly bears on the arctic coastal plain are at the northern extent of their range, exist generally at low densities compared with other regions, and exhibit low reproductive rates. Bear populations with these characteristics are vulnerable to the

creation of "populations sinks" (sensu Knight et al. 1988) where bears contact human developments over a period of time and are removed from the population as nuisance animals.

McCullough (1982) proposed one solution to reduce bear/human conflicts by "teaching" bears to avoid humans--essentially, by aversive conditioning of the bears (Hunt 1983)--without markedly displacing bears from their habitat. Such programs have been attempted on a small scale at Denali National Park, Alaska (Dalle-Molle and Van Horn 1989, Shults 1990) and in the Yellowstone Ecosystem in Wyoming (Hammond et al. 1989). Both programs attempted to condition a small number of nuisance grizzlies to avoid human food, garbage, or property by hitting the bears with plastic bullets or other nonlethal projectiles when they approached areas of human habitation.

In the Denali study between 1982 and 1989, 5 nuisance grizzlies were conditioned to avoid developed campgrounds and backpacker camps. One bear did not return to these sites for 3 years following conditioning, 3 bears did not enter sites for 1 year, and 1 bear was killed at a mining camp outside the park a few weeks after conditioning. In the Wyoming study between 1986 and 1988, 5 nuisance grizzlies were conditioned to avoid human or livestock food sources. Three required additional conditioning during subsequent field seasons, while one of the remainder was relocated and the other illegally killed. Although all 5 bears did not necessarily demonstrate complete avoidance of such food sources, conditioned bears in this study did reduce the amount of time spent around areas of human activity. Although small sample sizes and/or lack of suitable controls limit the direct applicability of these studies, the results suggested that aversive conditioning is a promising bear management technique.

Therefore, in 1990 the Alaska Department of Fish and Game (ADF&G) proposed a 2-phase study to evaluate the effectiveness of aversive condition in reducing bear/human conflicts in the

existing North Slope oilfields (and Deadhorse). Phase I is intended to gather baseline data on current bear use of the oilfields. Phase II is intended to implement the "treatment" of the bears with aversive conditioning techniques that can be continued as a management program after the study. The long-term goal of the project is to reduce bear/human conflicts without significantly altering natural habitat use of bears in and around the oilfields.

Phase I does not begin until spring 1991; however, the investigators spent part of summer and fall 1990 capturing and radio-collaring a few of the bears in the oilfields, studying bear use of the oilfields, and locating dens of the radio-collared bears. Preliminary results are reported here.

STUDY AREA

We classified the study area into 2 types. The primary area is the immediate vicinity of the oilfields, where data will be intensively collected and the aversive conditioning program conducted. The secondary area consists of an ca. 4,600-mi^2 (12,000 km^2) area where bear location will be determined from the air to identify denning locations, and to monitor general movements of bears toward or away from the oilfield.

The study area is located along the Beaufort Sea coast between the Colville and Shaviovik Rivers and extending inland ca. 50-60 mi (80-90 km) to ca. 69°50'N lat (Fig. 1). The area is in the arctic coastal plain physiographic province (Wahrhaftig 1965). All of the study area is arctic tundra and consists of flat thaw-lake plains near the coast, grading toward rolling hills less than 1,000 ft (300 m) MSL toward the south (Walker and Acevedo 1987). Large, braided rivers traverse the area and, in the primary study area, provide well-drained soils along broad floodplains. Minor river courses are often meandering, single channel streams, with adjacent dry tundra terraces. Within the

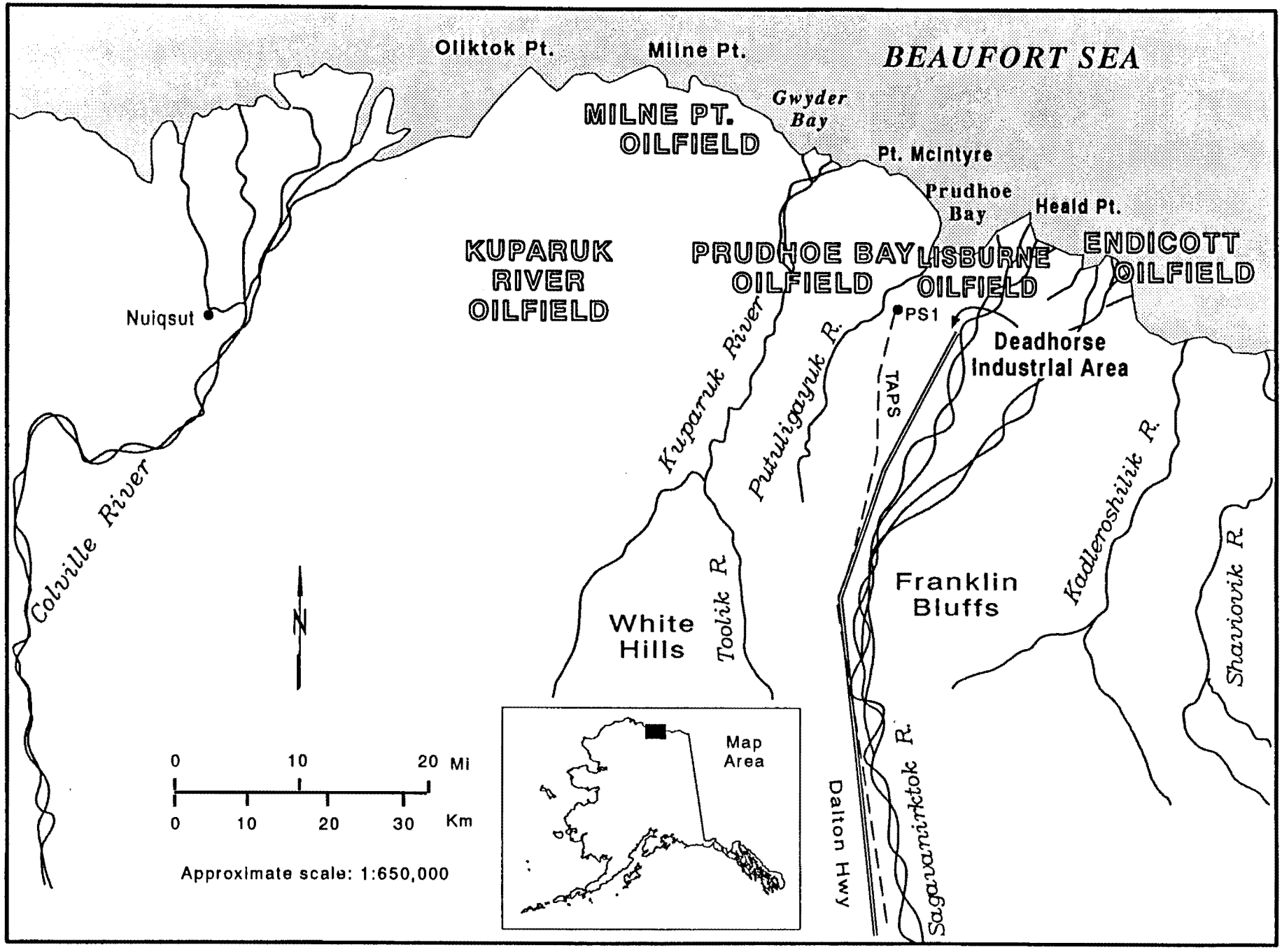

Figure 1. Prudhoe Bay region.

thaw-lake plains, permafrost-related features dominate. These include lakes and ponds resulting from thawed permafrost, "pingos" (upthrust mounds with ice cores), and ice-wedge polygons (Walker and Acevedo 1987).

The primary area consists of 5 contiguous oilfields and an oilfield service enclave (collectively called the "North Slope oilfields" in this report) located between the Colville and Sagavanirktok Rivers (Fig. 2). A network of roads and pipelines connects oil industry drill pads, processing facilities, 2 private jet airport camps, and the Deadhorse-oilfield service network (Fig. 2, 3). Deadhorse also includes commercial and private camps (hotels), a commercial jet airport, and the headquarters of the North Slope Borough government (NSB). Although Deadhorse is open to the public, access to the oilfields is restricted. Private security companies provide the safety and security functions for the oilfield and assist the NSB in Deadhorse. Private firearms are banned in the oilfields.

Of particular relevance to bear conservation is the management of solid waste in the area. There are 15 camps in the oilfields and Deadhorse. These range from a few small (<50-person) facilities operated by support industry contractors, to large (>500-person) complexes owned by the oilfield operators. The NSB operates an incinerator in Deadhorse and a 35-acre landfill in the oilfield and requires that all solid waste, including putrescible waste such as garbage, be disposed of at its facility. The NSB also is responsible for most of the solid waste collection at drillsites and facilities connected to the road system and at the camps. Individual contractors also haul their non-putrescible waste directly to the dump. Active production drill sites and exploration drill sites often have a dumpster in which small amounts of unauthorized garbage (usually lunch and snack remains) can be found. Garbage at the camps is stored for up to a week in open dumpsters outside the kitchen area, collected periodically

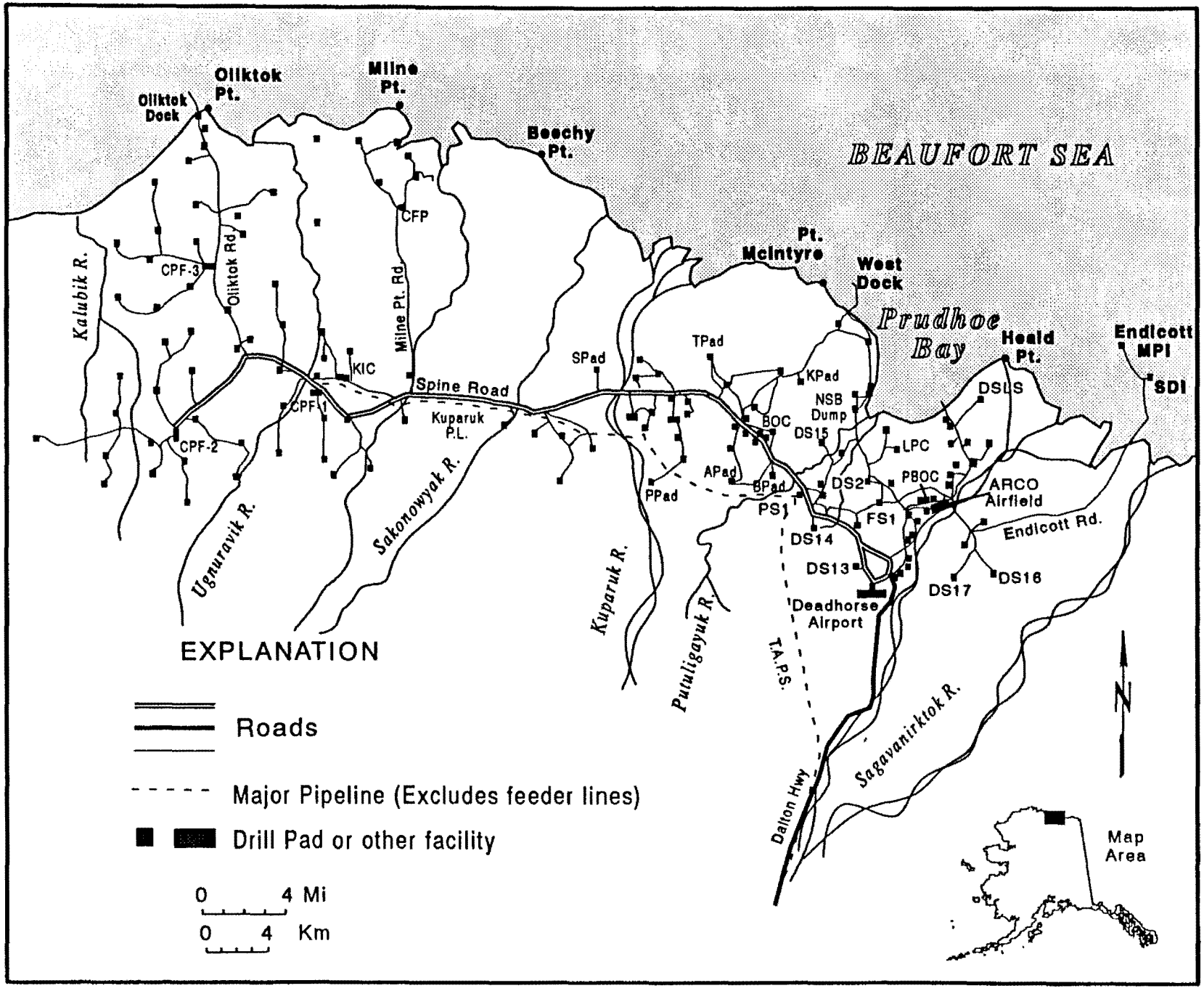

Figure 2. Prudhoe Bay regional development.

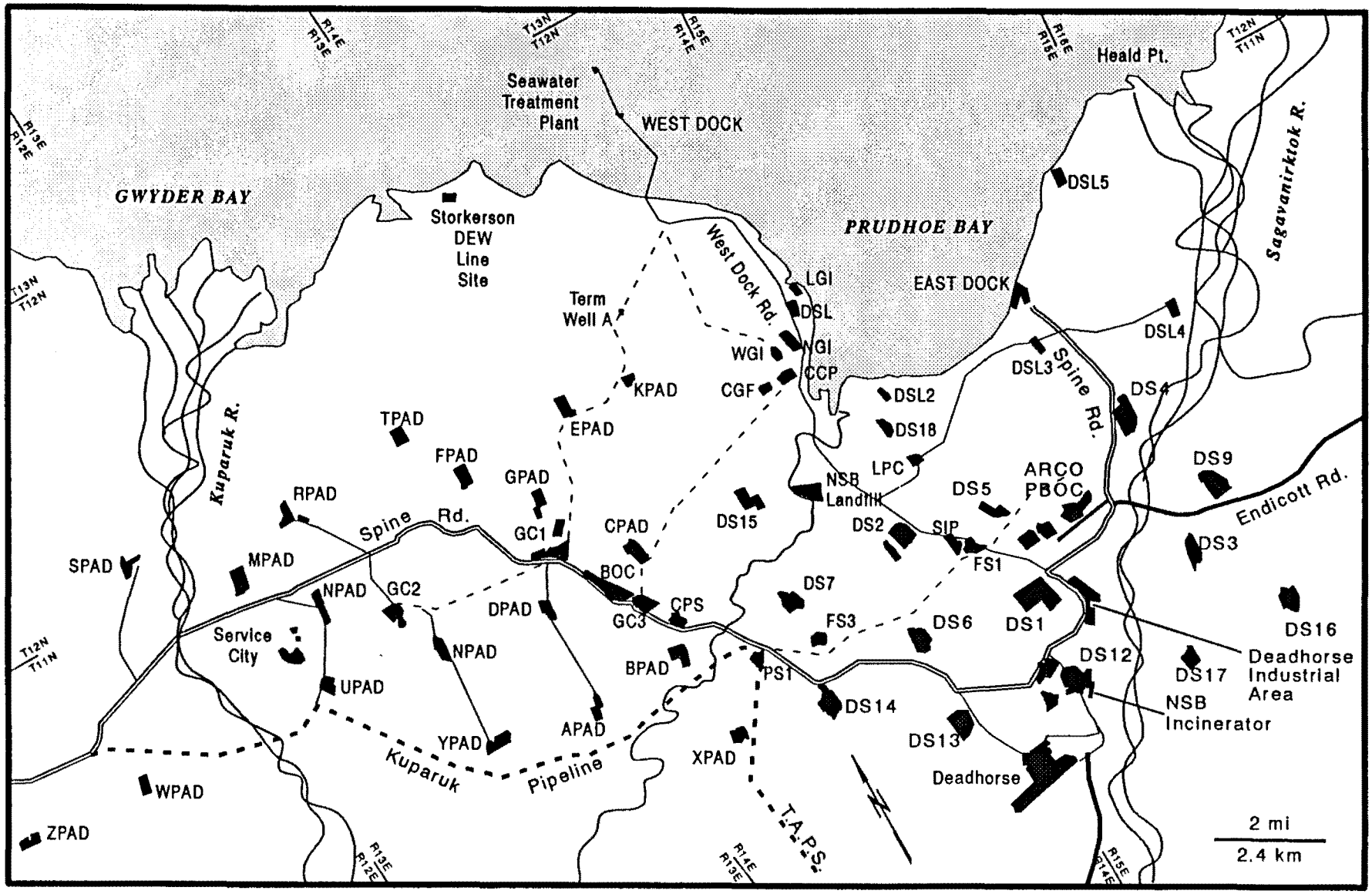

Figure 3. Prudhoe Bay oilfield and Deadhorse industrial area.

by the NSB, and temporarily stored at a yard adjacent to the incinerator. Incinerator ash is then disposed of in the landfill.

METHODS

Capture and Radio-collaring

Bears were captured from a helicopter (bear no. 002) or with a culvert trap (bear nos. 001, 003, 004). Cubs of the year (COY's) of bear no. 002 were not captured. All captured bears were immobilized with Telazol (A. H. Robbins Co., Richmond, VA), a mixture of equal parts by weight tiletamine hydrochloride (a central nervous system depressant with anticonvulsant and antianxiety properties) and zolazepam hydrochloride (a tranquilizer). Standard measurements (skull size, total length, heart girth, mammae length and diameter) and weight were recorded, and a vestigial premolar was removed for later sectioning to determine the bear's age. The upper lip was tattooed with the bear's capture number. A blood sample was taken.

Each captured bear was fitted with a VHF radiocollar (Telonics, Mesa, AZ), numbered plastic ear tags, and vinyl-colored ear flags for ready identification in the field.

Radio-tracking

Radio-tracking was conducted from the air and ground. Aerial tracking was from a Piper Super Cub equipped with a directional "H" antenna (Telonics, Mesa, AZ) on each wing.

Ground-tracking away from the road system was on foot with a hand-held "H" antenna (Telonics, Mesa, AZ) or along the road system from a four-wheel drive vehicle with a cab-mounted "whip" antenna, or hand-held "H" antenna. In the latter case, tracking was conducted from the bed of the truck using the antenna mounted on a 2-m pole to increase the range of reception. Total antenna

height was then approximately 3 m above the ground. Bears were located by triangulation of the strongest signal from 2 or more separate points, and then located visually once the approximate radio location was determined.

Visual Observation

Visual observations using binoculars or spotting scope were made on the ground or from a vehicle. A few observations were made after dark with a night vision scope. Aerial observations were made from the radio-tracking aircraft or, in a few cases, from a Bell 206B helicopter as part of other activities. Bear locations were plotted on 1:63,360-scale USGS topographic maps, and Loran coordinates were noted.

Scat Collection

Scats were collected on an opportunistic basis to qualitatively describe the bears' use of natural and anthropogenic foods. Scats were run through a fine-mesh sieve and air-dried for subsequent identification of contents.

Interviews

Oilfield workers, and security, industry, and environmental agency personnel were interviewed about observations of bears using the oilfield. Information from these interviews will be transferred to standard format and converted to computer files during Phase I.

RESULTS AND DISCUSSION

Captures

Sex and Age Composition of Grizzly Bear Population Using the Oilfield:

Although intensive efforts to collar bears using the oilfield will not begin until 1991, we took advantage of opportunities to

get a head start by collaring 4 bears during 1990 (Table 1). An adult female accompanied by 3 COYs, 2 subadult females, and 1 subadult male were collared.

With these collared animals, we were able to determine that there were more bears using the oilfield than we first suspected. Reports of pairs of young bears traveling together were first assumed to be a single pair of siblings; however, we collared 1 each of 2 pairs of siblings, 2 and 3 years old. A lone 4-year-old female was also collared. Including collared individuals, the unmarked bears sighted with them, and a reliable concurrent report of an additional single bear along the Kuparuk River, there was a minimum of 10 bears using the oilfield in 1990. In addition, we had a number of seemingly reliable reports of another adult female with 2 COY's. Ages of the young bears we collared strongly suggested that another reproductively active adult female that may have weaned bear no. 003 and his sibling and bred in 1990 may be using the field. Reports of large, lone bears moving through the oilfield indicate at least 1 adult male may use the oilfield, possibly during the breeding season. However, it is also possible the females could breed with males that never use the oilfield.

Field work during 1991 will help determine the sex and age structure of the bear population using the oilfield. However, based on captures, sightings of unmarked bears, and other discussions with environmental and security personnel, a reasonable estimate of the population might be 5 COY's, 0 yearlings, 2 2-year-olds, 2 3-year-olds, 1 4-year-old, 2 to 3 adult females, and 1 adult male. The total number may be 13-14 bears.

Age-weight Relationships:
Although the sample size is small, the bears captured so far appear to weigh significantly more than grizzlies captured in the Arctic National Wildlife Refuge (ANWR) during 1982-88

Table 1. Grizzly bear capture data, Prudhoe Oilfield, Alaska, 1990.

Id. no.	Capture date	Sex	Age	Year of birth	Weight lb	Weight (kg)	Ear flag color right	Ear flag color left	Capture location	Comments
001	9/25/90	F	3	1987	410	(186)	orange	orange	NSB Landfill	w/single bear (presumed sibling)
002[a]	6/13/90	F	14	1976	315	(143)	lt. blue	lt. blue	Deadhorse	w/3 COY's[b]
003	10/11/90	M	2	1988	300	(136)	lime	lime	Deadhorse	w/single bear (presumed sibling)
004	10/12/90	F	4	1986	340	(155)	yellow	yellow	NSB Landfill	

[a] Tattoo no.=0000

[b] COY=cubs of year

(M. Masteller, pers. commun.). Bear no. 002, a 14-year-old female with 3 COY's, weighed 315 lbs. (143 kg) on 13 June 1990, compared with a mean weight of 225 lbs. (102 kg) for 52 captures of similar 10+ year-old females in ANWR.

Comparisons of the 3 subadults are more difficult because our captures were from late fall and the ANWR data were from spring and early summer. However, even allowing for seasonal weight gains of an additional 50% over spring weights, Prudhoe bears were much heavier. Bear no. 003, a 2-year-old male, weighed 300 lbs. (136 kg) on 11 October 1990. Spring weights for ANWR 2-year-old males averaged 97 lbs. (44.3 kg), and a 300 lb. (136 kg) fall weight would be more equivalent to that of a 4- or 5-year-old ANWR male (about 198 lbs. (90 kg) in spring). Likewise the weights of our 3- and 4-year-old females (410 lbs. (186 kg) and 340 lbs. (155 kg), respectively) are much higher than would be expected of ANWR 3- and 4-year-old females (spring weights 133 lbs. (60.5 kg) and 161 lbs. (73.4 kg), respectively) and are closer to weights of ANWR females greater than or equal to 5 years old (spring weights 187-224 lbs. (85-102 kg)).

Distribution

Distribution, movements, and use of the oilfields were determined by ground and aerial observations and reports from reliable individuals. Over 45 hours of direct observations of the bears from the ground and 14 aerial observations were made between mid-June and late October. Ground observations were primarily in the Prudhoe Bay oilfield and Deadhorse area and are therefore biased because many of our observations in late summer were during trapping operations or in response to potential bear problems.

In 1990 bears were observed or reported in all the oilfields and in Deadhorse. Reports indicated that the few bears observed in the Kuparuk oilfield were primarily near outlying drillsites or occasionally crossing the Spine Road in the eastern part of that oilfield and along the Kuparuk River. In the Endicott oilfield,

most observations were of bears north of the Endicott Road. On 22 September 1990 a bear that had been in the drillsite (DS) 9 to DS 17 area (Fig. 3) for several days was ground-tracked from DS 9 to DS L5 in the Lisburne oilfield. The bear had spent considerable time digging for ground squirrels in the dune area of the Sagavanirktok River delta and was last reported heading west along the coast west of East Dock.

In the Prudhoe Bay oilfield and Deadhorse, numerous bears were reported or observed, primarily within a few miles of the Putuligayak River or in the Deadhorse area between the Sagavanirktok River west channel floodplain and DS 13 and 14. These 2 areas encompass a concentration of anthropogenic attractants, including the NSB dump, the NSB incinerator yard, and numerous camps with accompanying dumpsters.

Movements

Only one bear, no. 002 (with 3 COY's), was marked prior to the end of September. Therefore, reliable movement data for summer through fall are available only for this family group. For each of the other 3 radio-collared bears, movement data are available for only a few weeks in the fall. The following 2 summaries of movements are representative:

> Female no. 002 and COY's: Summer movements of this family group are plotted in Fig. 4. Bear no. 002 and her cubs were reported on 7 June in the Deadhorse area. They spent several days in the floodplain of the Sagavanirktok River entering Deadhorse generally after 2200 hrs. to forage in the NSB dumpster storage yard and other Deadhorse dumpsters. She was captured and radio-collared ca. 2 miles SE of the Deadhorse airport on 13 June. The group then moved west and spent most of June and July moving up and down the Putuligayak River from south of B Pad to the river's mouth. They remained in areas away from facilities during the day

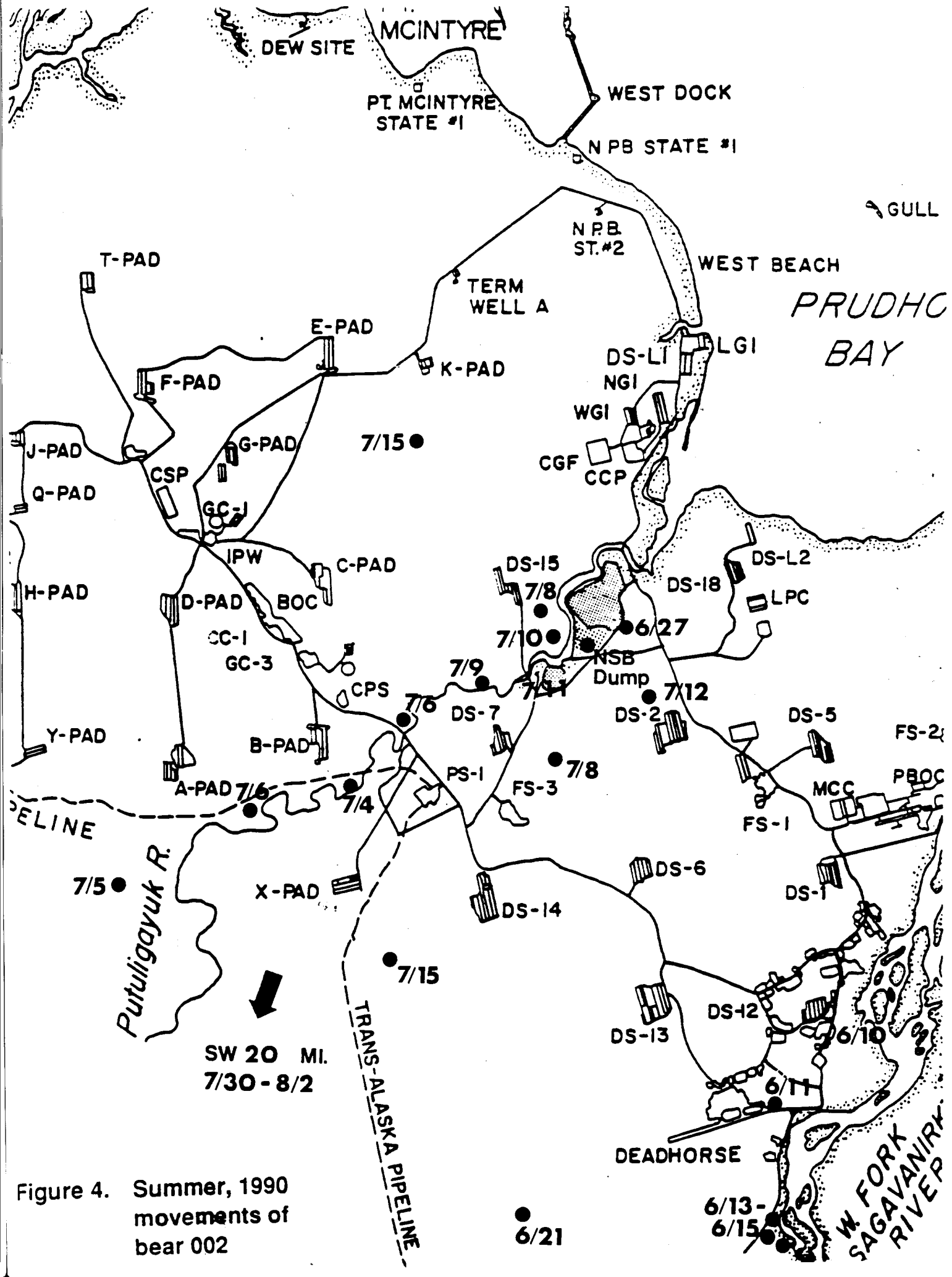

Figure 4. Summer, 1990 movements of bear 002

and entered the dump at night. Between 30 July and 2 August they moved south along the Kuparuk River to the mouth of the Toolik River (Fig. 1), where they remained until late August, when they were reported near the Spine Road crossing of the Kuparuk River (Fig. 2). They were apparently not within ground radio-tracking range of the Prudhoe Bay oilfield again in 1990 and were not observed again until 7 October, when they were located along the Kuparuk River north of the White Hills. They denned on the north side of the White Hills.

Male no. 003: No. 003, an independent subadult, was first observed in the Deadhorse area in late August. He was usually accompanied by another male bear about the same size, presumably his sibling. During our observations these bears spent the day away from facilities in the DS 13/14 and Deadhorse airport area and moved into Deadhorse at night to forage in camp dumpsters. After evading capture in the culvert trap on several occasions between late August and early October, bear no. 003 was trapped on 11 October in Deadhorse. He was observed alone just southwest of Deadhorse during the day on 12 October, and his signal was heard again that night. No further radio-tracking was conducted until the denning aerial survey on 19 October, when his signal was not heard. No signal was heard during a ground survey in the oilfield on 29 November.

Reports and observations of bear no. 001 and her presumed sibling indicated movement patterns similar to bear no. 002 while in the oilfield, i.e., up and down the Putuligayak River near the NSB dump. Bear no. 004 was only observed for a few days near the time of her capture and was traveling with bear no. 001 and her presumed sibling.

Movement patterns of marked bears and incidental observation and reports of other bears indicate that the 2 larger river systems--the Sagavanirktok and Kuparuk Rivers--and the smaller Putuligayak River are major travel corridors into and out of the oilfields and Deadhorse.

Use of the Oilfield

Facilities:

"Facility," in the sense used in this report, consists of a building or structure and its 1-3 m high compacted gravel pad which serves as a thermal and structural foundation for the building, as well as pipelines and roads. Bears used facilities with and without attractants present and with or without nearby human activity. Bears appeared to treat these features as "natural" parts of their environment, especially when no humans were visible, or when humans were visible but in vehicles or on foot several hundred meters away. In most cases, bears merely crossed the pad or investigated structures on it. In contrast with several reports from previous years, no bears were reported or observed to enter buildings in 1990. Bears did not appear to be reluctant to cross under pipelines or over or along roads unless traffic or parked vehicles were present. Bears were observed on at least 12 occasions resting or foraging within 1,000 ft (320 m) of active drillsites and the Deadhorse area. An unidentified bear, likely no. 003 or his presumed sibling, bedded down on a pile of gravel among some stored drill rigs on the back edge of a large pad used by a major oilfield contractor in Deadhorse. The bear was 200-300 yards from an active heavy equipment garage and warehouse. On several occasions bears were observed to wander around buildings and camps near the Deadhorse airport after dark or late at night when human activity declined.

Bear use of facilities with attractants present is best represented by 3 situations: (1) drillsite dumpsters; (2) camp dumpsters, especially in Deadhorse; and (3) the NSB dump. Again, our observations are biased toward the Deadhorse area and the NSB dump because most of our observations in late summer and fall were made during trapping attempts or in response to calls from oilfield security personnel about potential nuisance bears. The distribution of dumpsters at drillsites is dependent on the presence of work crews for activities such as production drilling, well workover, or pad maintenance. Most production drillsites are unmanned and have no attractants present until one of the above activities occurs. Therefore, drillsites are not a predictable source of food. Even when human activity is present, the food source is usually small, i.e., a few lunch remains, juice cans, etc.

In contrast, both the NSB dump and camp dumpsters in Deadhorse were predictable sources of food. At least 7 different bears were known to be using the NSB dump. Bear no. 002 and her COY's frequented the dump at night during late June and July. Bear no. 001 and her presumed sibling and bear no. 004 also used the dump. At least 2 additional bears likely used the dump. The dump was closed, except to the NSB drivers, between 1800 and 0600 hours. Bears seldom entered the dump before 2000 hours or left after 0600 hours, even when darkness occurred after or before the open period. Although small amounts of garbage were present in the dump as part of drillsite waste, the bears preferred incinerator ash. On at least 12 occasions bears which had been sporadically foraging along the uncovered line of recent trash moved to the newly dumped incinerator ash as soon as the truck left the dump. In one case, Bear no. 001 and her sibling left a pile of older ash and moved to the new ash where they foraged for over an hour. Although NSB efforts

to cover the trash improved over the summer, the availability of food in incinerator ash remained a problem until the bears left the oilfield in October.

Likewise, the availability of garbage in Deadhorse dumpsters was a strong attractant. Bear no. 003 and his presumed sibling spent several weeks in late summer and fall in the Deadhorse area and were regular visitors at several camp dumpsters. The lack of bear-proof covers and the sporadic collection schedule resulted in garbage bags full of kitchen scraps being available for days at a time. This situation is also potentially the most dangerous because the Deadhorse area consists of a dense concentration of buildings with a high level of human activity where bears could easily surprise people and vice versa. The density of facilities and activity will also make this area the most difficult in which to conduct an aversive conditioning program.

Human Interactions

Bears encountered humans in a variety of situations, ranging from bear no. 002 and her COY's crossing a road and stopping traffic, to bears being surprised in dumpsters. Watching bears in the NSB dump became evening entertainment early in the summer until the NSB blocked vehicle access around the dump. In most situations, spectators remained a few hundred yards away and interactions were neutral. In at least one incident, spectators threw rocks at Bear no. 002 and her COY's. In 2 other cases, bears moved toward spectators as the bears were fleeing the dump from an approaching dumptruck.

In 1990 there were at least 2 incidents, both in Deadhorse, where camp employees throwing trash into the dumpsters surprised bears foraging in the dumpster. In both cases the bears retreated. Although these examples are representative of bear/human interactions in the oilfield area, they are

not exhaustive. Nevertheless, in 1990 there were no observed or reported incidents of bears threatening or injuring humans in the oilfields or at Deadhorse.

Denning

Dens were located for the 3 female radio-collared bears on 19 October. All three denned at least 31 miles (49 km) away from the oilfield. Bear no. 001 denned 31 miles (49 km) south of the oilfield, near the mouth of the Toolik River. Bear no. 002, the female with 3 COY's, denned at the northern edge of the White Hills, ca. 47 miles (75 km) south of the oilfield. Bear no. 004 denned near the Kadleroshilik River, ca. 35 miles (56 km) southeast of the oilfield. Aerial observations indicated that den sites included a bank along a dry lake bed (bear no. 004), and a low willow-covered "mound" near a river (bear no. 001). No particular slope or aspect appeared to be preferred. Numerous sites that appear similar are available much closer to the oilfield.

The timing of den selection and entrance is noteworthy. Bear no. 002 and her COY's were last observed in the oilfield on 28 August, and were seen north of the White Hills on 7 October, with no sign of den preparation. Bears no. 001 and 004 were observed in the oilfield as late as 10 October and 12 October, respectively. All six of these bears were in or just outside their dens when located on 19 October. Although the proximal stimulus for denning cannot be certain, temperatures had steadily dropped over the first 2 weeks of October. Between 11 and 12 October, the temperature rapidly dropped to between 0°F and the low teens, and substantial snow began to fall. This may have stimulated the bears to move to den sites.

Bear no. 003, a young male, was last observed in the oilfield on 12 October. He had spent most of the previous 3 weeks accompanied by another young male, presumably his sibling. He was not relocated on the 19 October den survey flight, and

neither bear was seen during several subsequent ground-tracking surveys around the oilfield, nor reported by oilfield security personnel.

Knowledge of den locations proved to be useful in minimizing potential human disturbance around the dens. Exploratory drilling and seismic programs are scheduled for winter 1990-91 in the vicinity of the dens of bears no. 001 and 002. Three seismic lines and a proposed ice road were relocated to minimize disturbance to these denning bears.

Food Habits and Behavior

No systematic efforts to analyze feeding activity or food habits of the bears were undertaken during 1990, but a number of observations and reports indicated that bears made use of both natural and human food sources.

Natural food sources used included lush green vegetation, vole caches of Eriophorum rhizomes, ground squirrels, and caribou carcasses. Other undocumented natural food sources in the area may include Hedysarum roots, waterfowl eggs and young, caribou calves, microtine rodents, marine mammal carcasses, and berries.

Anthropogenic food sources used by the bears included food and garbage left improperly at worksites or around Deadhorse, dumpsters at camps in Deadhorse, the dumpster storage area behind the NSB incinerator, and putrescible wastes (including incinerator ash) at the NSB dump.

Observations of bears near Deadhorse during fall 1990 indicated they would rest and feed on caribou remains or dig up vole caches during the day, and when human activity decreased and/or darkness provided additional security, they would raid dumpsters at camps. Two late fall scats collected in Deadhorse confirmed the use of both natural food and human foods--both contained Eriophorum rhizomes mixed with garbage. The unusually rapid growth and

large size of the oilfield bears indicate that a large part of their diet may be coming from human refuse; however, other sources are used as well.

IMPLICATIONS

Although the study will not officially begin until spring 1991, insights from preliminary work in 1990 have some important implications. These include:

1. Bears using the oilfields are more numerous than anticipated. There was a minimum of 10 bears present during 1990, and the actual number may have been 12-15.

2. The oilfield bear population can be expected to begin growing rapidly. Between 1 and 3 reproductively active females were present and at least 2 more subadult females are close to, or have already reached, sexual maturity. Because bear productivity is related to nutrition and all the bears were in excellent condition, each female's productivity may also be higher than other North Slope grizzlies.

3. The age structure appears highly skewed toward young animals. These young bears were probably raised in the area, tend to be less wary of people and facilities, have been exposed to food from human sources their entire life, and will be a major potential source of bear/human problems for many years.

4. The bears using the oilfield are larger, grow faster, and mature earlier than comparably aged bears of other North Slope populations, strongly suggesting extensive use of anthropogenic foods.

5. Bears collared in 1990 ranged more widely than anticipated. Female no. 002 and her cubs spent most of August and September at least 30 mi (48 km) from the oilfields, and bears no. 001, 002, and 004 dispersed to denning areas up to 40 mi (64 km) away. This is encouraging from the standpoint of their use of natural foods and chances of weaning them from garbage.

6. Observations of marked and unmarked bears indicate that they continue to use natural as well as anthropogenic sources of food. This is also encouraging.

As the study progresses and our knowledge of actual conditions is refined, we will be better able to expand on the above facts. Furthermore, we assume, although we have no direct evidence in this study, that mortality of these bears may be lower and that the pattern of emigration and immigration of individuals may be different than for other populations. The following assumptions may apply:

1. Major sources of mortality in most bear populations are from humans and from other bears. Mortality rates for the oilfield bears are probably low because hunting is prohibited in the oilfields and few people are allowed to carry weapons for bear protection; therefore, bears are not liable to be killed in defense of life or property. Furthermore, if few adult males are present, cub mortality and cannibalism may be uncommon.

2. The immigration/emigration balance may also be skewed if there is an abundance of high-quality human garbage and bears are below carrying capacity. Young bears raised in the area may be less inclined to disperse and

young bears dispersing from other areas may be more inclined to remain (especially if there are few resident adult males).

In subsequent years we should gain a better understanding of the extent to which these factors are contributing to the management problems in the oilfield.

LITERATURE CITED

Dalle-Molle, J. L., and J. C. Van Horn. 1989. Bear-people conflict management in Denali National Park, Alaska. Pages 121-127 *in* M. Bromley, ed. Bear-people conflicts: proceedings of a symposium on management strategies. Northwest Territ. Dep. Renew. Resour., Yellowknife. 246pp.

Follmann, E. H., and J. L. Hechtel. 1990. Bears and pipeline construction in Alaska. Arctic 43:103-109.

Hammond, F. M., C. M. Peterson, C. L. Hunt, and H. Carriles. 1989. Behavioral responses of Yellowstone Ecosystem grizzly bears to applications of aversive conditioning techniques: 1988 progress report. Wyoming Game and Fish Dep., Cody. 58pp.

Harding, L., and J. A. Nagy. 1980. Responses of grizzly bears to hydrocarbon exploration on Richards Island, Northwest Territories, Canada. Int. Conf. Bear Biol. and Manage. 4:277-280.

Hunt, C. L. 1983. Deterrents, aversive conditioning, and other practices: an annotated bibliography to aid in bear management. Rep. by Univ. Montana Coop. Wildl. Res. Unit to U.S. Natl. Park Serv. 136pp.

Knight, R. R., B. M. Blanchard, and L. L. Eberhardt. 1988. Mortality patterns and population sinks for Yellowstone grizzly bears, 1973-85. Wildl. Soc. Bull. 16:121-125.

McCullough, D. R. 1982. Behavior, bears, and humans. Wildl. Soc. Bull. 10:27-33.

McLellan, B. M. 1989a. Dynamics of a grizzly bear population during a period of industrial resource extraction. I. Density and age-sex composition. Can. J. Zool. 67:1856-1860.

_____. 1989b. Dynamics of a grizzly bear population during a period of industrial resource extraction. II. Mortality rates and causes of death. Can. J. Zool. 67:1861-1864.

_____. 1989c. Dynamics of a grizzly bear population during a period of industrial resource extraction. III. Natality and rates of increase. Can. J. Zool. 67:1865-1868.

_____. 1990. Relationships between human industrial activity and grizzly bears. Int. Conf. Bear Res. and Manage. 8:57-64.

_____, and D. M. Shackleton. 1988. Grizzly bears and resource-extraction industries: effects of roads on behavior, habitat use and demography. J. Appl. Ecol. 25:451-460.

_____, and _____. 1989a. Grizzly bears and resource-extraction industries: effects of roads on behavior, habitat use and demography. J. Appl. Ecol. 26:371-380.

_____, and _____. 1989b. Immediate reactions of grizzly bears to human activities. Wildl. Soc. Bull. 17:269-274.

Shults, B. 1990. Bear management in Denali National Park and Preserve. In V. G. Barnes, Jr., Compiler. Third Alaska Interagency Bear Workshop, Anchorage, 11-12 April 1990.

Wahrhaftig, C. 1965. Physiographic divisions of Alaska. U.S. Geol. Surv. Prof. Pap. No. 482.

Walker, D. A., and W. Acevedo. 1987. Vegetation and a Landsat-derived land cover map of the Beechey Point Quadrangle, Arctic Coastal Plain, Alaska. U.S. Army Cold Regions Res. and Eng. Lab. Rep. 87-6. Hanover, N.H. 63pp.