1965

An Evaluation of the 1961-1963 Alaskan Brown and Grizzly Bear Management Program

Ronald J. Somerville
The University of Montana

Dick
Please accept my
graduate and appreciation for your
assistance
personal
Ron

AN EVALUATION OF THE 1961-1963 ALASKAN BROWN AND GRIZZLY BEAR MANAGEMENT PROGRAM

by

Ronald J. Somerville

B. S. Humboldt State College, 1962

Presented in partial fulfillment of the requirements for the degree of

Master of Science in Wildlife Management

UNIVERSITY OF MONTANA

1965

Approved by:

_____

Chairman, Board of Examiners

_____

Dean, Graduate School

_____

Date

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

ACKNOWLEDGEMENT

I would like to express my gratitude to Dr. Richard D. Taber for his advice and guidance in the preparation of this thesis. I would also like to acknowledge the advice and assistance received from my committee members, Gerry C. Atwell, Richard W. Behan and Dr. Robert S. Hoffmann.

I am also grateful to Dr. Albert W. Erickson for his personal inspiration and for allowing me the opportunity to work as his assistant in the Alaska Department of Fish and Game bear project.

I would like to thank the Alaska Department of Fish and Game for permission to utilize the information compiled by the bear sealing program. In addition, I wish to acknowledge the many Department employees who contributed in various means to the success of the program.

For technical assistance and encouragement, I wish to thank Dr. W. L. Pengelly and Jim E. Richard.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure Page

INTRODUCTION

With the reduction or elimination of the grizzly bear (Ursus arctos Linneaus) from most of the United States, closer attention by conservationists and sportsmen has been focused on brown and grizzly bear management in Alaska. The State of Alaska not only enjoys the densest populations presently existing on the North American continent but it also carries the major administrative responsibility for the future of the species in the United States.

This conservation burden, relinquished by the federal government in 1960, when Alaska assumed control of its fish and wildlife, has been further complicated by the relatively new economic conflicts associated with statehood, such as those concerning land-use problems, expanding human populations, need for economic growth, and shortage of funds. In addition, the new State Department of Fish and Game was confronted with the responsbility of managing a game species for which many questions on state-wide population dynamics were unanswered, so that bear harvest regulations were principally based on the inadequate fur export permits. Even the scientific classification of the brown and grizzly bear has been confused and argued since C. Hart Merriam (1896, 1900, 1914 and 1918) described over 76 species. However, for the purpose of management in Alaska, the taxonomic revision of Rausch (1963) has been generally accepted. This states that the brown and grizzly bears of North America are a single species, Ursus arctos Linneaus, and conspecific with Old World brown bear. However, in this paper any specific referral to the brown bear implies coastal populations and

to the grizzly bear, interior populations.

Despite the lack of harvest and population dynamics information, there is little doubt that the present situation in Alaska is unique in the history of brown and grizzly bear management in that the species is important as an economic resource. Besides the esthetic value of the animal which draws sight-seeing tourists and photographers into the state, this highly esteemed trophy animal has contributed to the continual increase in guides and outfitters, as well as local businesses and transportation facilities. Guiding fees, transportation and equipment costs, taxidermist fees and miscellaneous spending by hunters make up a total economic value assessed at well over one-half million dollars annually. This is discussed in more detail below.

The management of the brown and grizzly bear could well be justified by the monetary contribution to the state's economy alone. However, consideration should also be given, by the administration, to the esthetic values that are practically immeasurable at present but will undoubtedly become even more valuable to the public if the species becomes more rare.

The establishment of the Kodiak National Wildlife Refuge (1941) was accompanied by some effective biological research and detailed harvest assessments. However, many important questions about bear population dynamics remained unanswered and it was not until 1961, two years following statehood, that a state-wide program was initiated to provide harvest data. The 1961 Alaskan mandatory bear hide sealing program requiring all hides to be examined and tagged (sealed) by a designated official within 30 days of kill, resulted in more quanti-

tative and qualitative brown and grizzly bear harvest information than was ever previously accumulated, since basic data were recorded for each sealed hide. However, the accumulation of harvest data alone is not in itself an end of management. As policies and objectives are formulated the harvest data may be correlated with other biological information to develop new management measures. The general purpose of the present study, then, is to examine the operation and findings of the sealing program as they relate to the administration of brown and grizzly bear populations in Alaska. The specific objectives of this study are:

1. To present the past and current brown and grizzly bear management policies and objectives in Alaska.
2. To analyze the harvest data for the years 1961, 1962, and 1963 to ascertain the efficiency of the present sealing program in providing information pertinent to management.
3. To frame improvements in the management of brown and grizzly bear in Alaska, on the basis of the information developed in the foregoing two objectives.

RELEVANT ASPECTS OF BEAR BIOLOGY

Distribution

The brown and grizzly bear are found throughout most of Alaska including some of the heavily forested areas of Southeast Alaska (Figure 1) The species is, however, absent from the Aleutian Island chain beyond Unimak Island and from the islands south of Frederick Sound in Southeastern Alaska. Game Management Units 2 and 3 are the only Units in the state in which brown or grizzly bear do not exist.

Habitat and Food

"While the exact habitat requirements of the brown and grizzly bear are unknown, the species is seemingly most at home in open tundra and grassland areas" (Erickson 1964: 12). This appears to be true whether discussing the alpine areas of Southeastern Alaska, the taiga and tundra of Central and Interior Alaska or the alder-willow-grass associations of Kodiak Island and the Alaska Peninsula.

The grassland associations of brown and grizzly bears seem to be very important because of the omnivorous habits of the bear, especially in the critical spring period when grasses and other herbaceous growth are the most abundant food items (Clark 1957; Erickson 1964; Troyer 1961 and 1962). During the late summer and fall periods the diet is supplemented with fruits and berries which occur over much of the brown and grizzly range. Along the coastal areas salmon provides a readily available and nutritious diet for the brown bear at times during the

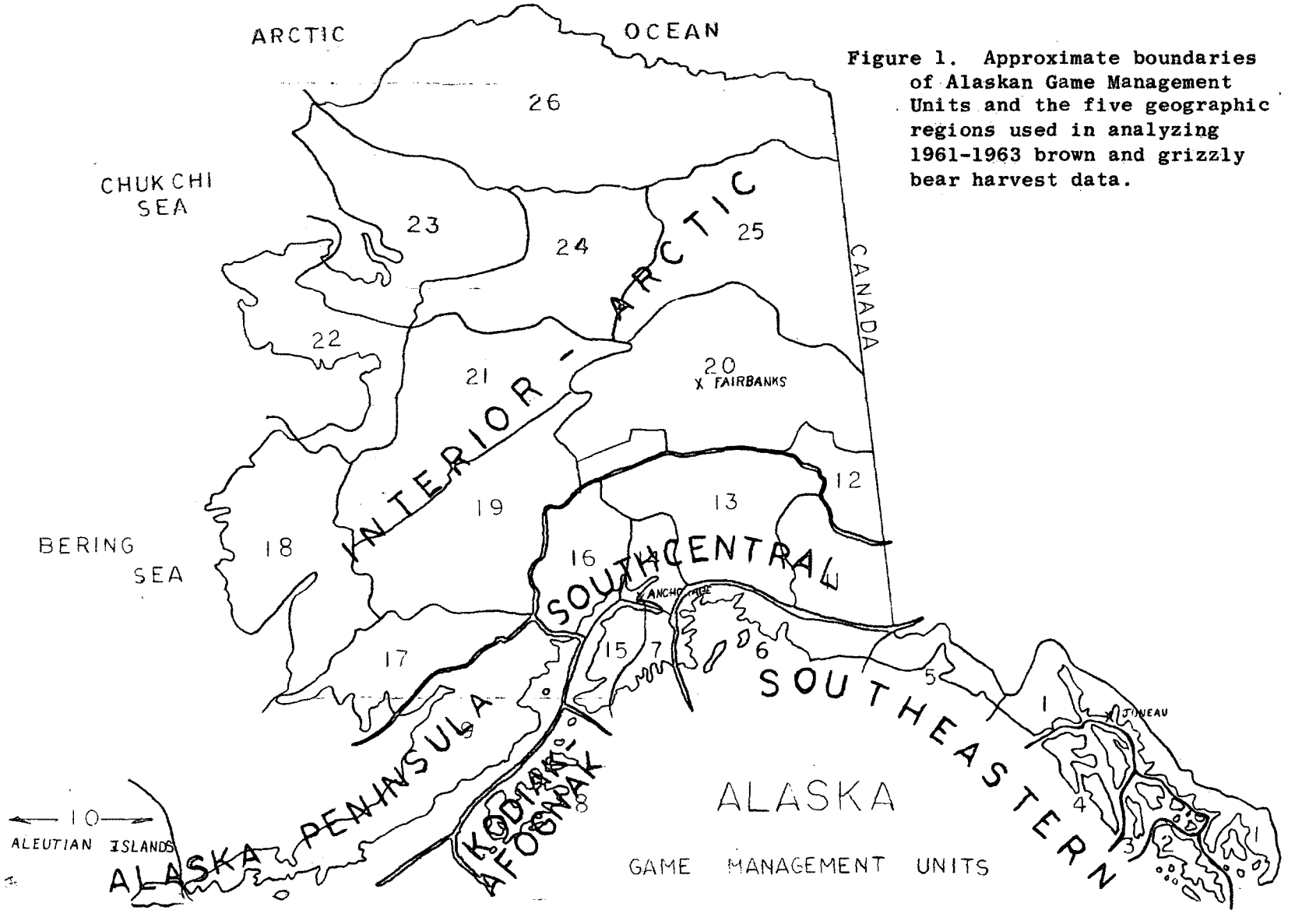


Figure 1. Approximate boundaries of Alaskan Game Management Units and the five geographic regions used in analyzing 1961-1963 brown and grizzly bear harvest data.

late summer and fall which vary according to area, salmon species and abundance. Clark (1957), Erickson (1964), and Troyer (1962) concluded that the ripe berry crops will often attract brown bears from the salmon streams even when salmon are extremely abundant and accessible. In comparison, the interior grizzly is restricted to areas subjected to shorter growing seasons, where there is a much less bountiful food source. Erickson (1964) and Rausch (1963) agreed that a restricted diet was probably responsible for the smaller size of the grizzly bear.

Regardless of habitat, it appears that brown and grizzly bears will utilize a wide variety of foods which are available and fairly easy to obtain. Besides the items mentioned above, their diet includes small rodents, insect larvae, carrion (including other bears) and occasionally larger prey.

Abundance

To date, there is little precise data on the abundance of the species in the various areas of the state. Except for the Kenai Peninsula and areas surrounding large human populations and in specific locations where land-use conflicts have occurred (i.e. cattle ranches on Kodiak Island), the brown and grizzly bears are apparently as abundant now as they ever were (Erickson 1964).

Several procedures for censusing brown and grizzly bears have been attempted by various federal and state agencies. Studies on track measurements and track counts in Southeastern Alaska (Dufresne and Williams 1932; Klein 1958 and 1959) proved to be ineffective as a

censusing procedure because it was time consuming, many areas were unsuited for counting and measuring tracks and the presence or absence of bears varied according to salmon abundance. Similarly, a cooperative U.S. Forest Service and Alaska Department of Fish and Game technique of flying aerial beach counts of bear during the peak in salmon migrations proved inaccurate because of errors introduced by limited visibility and variations in bear behavior and it was discontinued in 1963. Recent alpine aerial counts of snow trails by the Alaska Department of Fish and Game in Southeastern Alaska appear to be promising as a population index, but require more testing.

Dean (1957, 1958 and 1962) made several attempts to assess grizzly bear populations in Mount McKinley National Park by extensive ground and aerial counts. This method is deemed impractical for large areas by the Alaska Department of Fish and Game, since it is both laborious and inaccurate.

Aerial stream counts were utilized by Troyer (1962) on Kodiak Island and Erickson (1962) on the Alaska Peninsula; small aircraft were used to fly areas of bear concentrations (i.e. salmon streams and alpine areas) in an effort to establish a population index. Erickson and Siniff (1963) tested this method for its suitability in censusing brown bear by an elaborate statistical comparison of simultaneous ground and aerial counts. The conclusion was that this census technique was inconsistent and inaccurate because less than 50 per cent of the known animals along survey transects were counted due to the dense cover of alders and willows occupying the moist areas adjacent to

streams, and also because of variations in weather, observer abilities and the response of bears to aircraft.

In view of the fact that a standardized population assessment technique has not been devised and applied to all the various areas of the state, it seems unwise to attempt a comparison of regional population estimates in this analysis. However, Troyer's estimate in 1962 of the population density of the Karluk Lake (Kodiak Island) study area at 1 bear per .54 square mile is probably a reasonable estimate for optimum habitat. This estimate was based on an intensive trapping and marking program combined with aerial and ground counts on the 96 square mile study area.

Erickson and Rausch (1962) suggested that densities in certain areas of the Alaska Peninsula, such as the McNeal River, Moffitt Bay and Chignik-Black Lakes systems, probably approach those for the Karluk Lake area. This suggestion is supported by the fact that hunting pressure for large trophy bear has shifted from Kodiak Island to the Peninsula.

Denning

The winter denning habits of bears vary in time and duration by areas and the physical condition of the bears. Erickson (1964) and Erickson and Youatt (1961) expressed the opinions that bears den not as a response to the cold, snow cover and other wintery conditions alone, but rather to the lack of food accompanying such conditions. Bears of the interior and arctic spend almost half of the year in winter dens; this period extends from about October to April, or later (Erickson

1964). In contrast, Troyer (1961) mentioned that denning on Kodiak extended from November through early April. It seems that in some years there may be as much as two months difference in length of denning between the Interior-Arctic and Kodiak bears.

Yearly variations in the duration and timing of denning periods are important to management because denned bears are not available for harvest. Further, it is possible that longer denning periods might be associated with a greater natural mortality during long winters. Further research is needed to determine the relationships of summer food supply, physical condition at the onset of denning and length of winter denning. In addition, it appears that females and young den earlier in the fall and emerge later in the spring than large males (Troyer 1961 and Erickson 1964); this, of course, indicates that the large trophy males are subjected to more hunting pressure than the remaining portion of the population, in terms of length of time available. These aspects, pertinent considerations when analyzing harvest data for subsequent regulation and season changes, will be discussed in another section.

Population Dynamics

The population dynamics of the brown and grizzly bears are imperfectly known and in critical need of investigation. Certain reproductive and life history information for the species was summarized in a recent review by Erickson (1964) This summary suggests that both sexes attain puberty at about 3½ years or possibly one year later for males. Erickson referred to Dittrick and Kronberger (1963) who

determined that although some bears whelp at two years, 3½ years was the usual breeding age among 200 breeding records for captives.

The breeding period is generally from late May through mid-July. Females presumably exhibit a period of continuous heat (seasonally constant estrus) and remain in heat until bred. Gestation lasts approximately seven months but has been recorded as varying between 194 to 278 days. Brown and grizzly bears apparently exhibit a physiological phenomenon known as delayed implantation; although the corpus luteum is formed shortly after breeding, implantation of the embryo does not occur until late October or November, with birth in January or February. The next breeding apparently occurs about two years later unless the cubs (less than 4 to 5 months) are separated from the mother prior to the subsequent breeding season. Confirmation of these points, however, awaits further study.

Authorities disagree as to when weaning and family breakup occur in brown and grizzly bears. Some contend that cubs suckle for over a year (Dean 1958) but this has not been definitely established. Family breakup presumably occurs in the fall when litters are approximately 17 to 19 months of age.

Troyer (1962) made an attempt to determine survival rates, especially for the cubs and yearlings, on his Kodiak Island study area. Direct ground counts revealed that the reduction in litter size from cubs to yearlings was 7 per cent and the average age structure for the 7 year study period was 21 per cent cubs, 19.6 per cent yearlings, and 59.4 per cent older than yearlings. An examination,

on the other hand, of the method used in calculating these age ratios raises some question as to their validity. The direct ground counts provided some difficulties in assessing the cub population as it was felt by the investigator that many cubs were missed. The cub populations for any one year was then determined by taking the 7 per cent mortality, determined by the reduction in litter sizes, and adding this to the subsequent years yearling count. However, Erickson and Rausch (1962) indicated that on the Alaska Peninsula evidence suggested that cub to yearling mortalities occur primarily on entire litters, rather than within litters. In other words, litter survival is generally all or none. The implication here is that the cub to yearling mortality rate might be greater than the 7 per cent indicated by Troyer's study because only the intra-litter mortality could be evaluated from the Karluk Lake data.

On the Karluk Lake study, Troyer (1962) also determined sex ratios from the direct examination of live-trapped animals. Of the 115 bears examined, 47.8 per cent were males and 52.2 per cent were females. Although there was no significant sex differential in the $3\frac{1}{2}$ age classes and under, the females outnumbered the males 2 to 1 in the ages 4 and over. Hunting selectivity for large trophy males was presented as the possible reason for these differences. It is, however, possible that older females were more easily trapped than males.

HISTORY OF BROWN AND GRIZZLY BEAR MANAGEMENT IN ALASKA

In 1925, market hunting of bears was halted by the establishment of the Alaska Game Commission and the enactment of the Alaska Game Law prohibiting the sale of bear hides. From 1925 through 1927 the bag limit was three bears with no restrictions on season. The bag limit was reduced to two in 1928 and the first season (September 1 - June 20) was enacted in 1931. The reduction of the bag limit to one bear occurred in 1942 and a further shortening of the season on Kodiak Island was imposed in 1954. The taking of females accompanied by cubs was prohibited in 1957 and the following year cubs (stated in the regulations as being young bear in their first or second year of life) were also protected. Except for the years 1957-1959, all non-resident hunters were required to employ licensed guides.

Prior to 1961, the world renowned "Kodiak" brown bear (Ursus arctos middendorfii) sustained the greatest hunting pressure; thus, Kodiak Island received the most attention biologically as well as in initial hunting restrictions. The establishment of the Kodiak National Wildlife Refuge in 1941 and the permitting of controlled hunting on the refuge resulted in early biological research and permanent records of harvest. General research and attempts at evaluating hunter harvest figures and management were not, however, entirely restricted to Kodiak Island. Initial flights on the Alaska Peninsula were made in 1958 to determine the extent of illegal bear kills and to evaluate the bear populations. In Southeastern Alaska the United States Biological Survey (eventually part of the Bureau of Sport Fisheries

and Wildlife) and the United States Forest Service conducted cooperative and individual studies on Chichagof, Baranof and Admiralty Island. These studies were aimed at estimating population size, harvest and population trends for brown bear on the islands.

Between the years of 1950-1959, Alaska Game regulations required fur export permits before allowing shipment of bear hides from Alaska. These permits were issued by the Bureau of Sport Fisheries and Wildlife. This method provided some kill data on trophy bears being shipped from the state but effective policing was almost impossible and, as a result, areas other than Kodiak yielded only fragmentary and unreliable harvest data.

In 1959 Alaska became a state and subsequently in 1960 assumed the responsibility for managing its wildlife. The state thus became eligible for total participation in the Federal Aid in Wildlife Restoration program (P-R). This allowed greater expansion in the research and management program throughout the state than was possible under the federal administration. Between 1959 and 1961 fur export permits were not issued and adequate data on bear harvest were still unavailable until the initiation of the new compulsory bear hide sealing program in 1961. This regulation required that all brown, grizzly and polar bear hides be presented to the Alaska Department of Fish and Game for tagging within 30 days of the date of kill. The bulk of the funds required to administer this project were secured under the P-R program.

Because of several distinct geographic populations of brown and

grizzly bears and because of seasonally concentrated hunting pressure, these species are considered as occurring in five major regions of the state (Figure 1): (1) Southeastern (Game Management Units 1-6): (2) Southcentral (Units 7, 11, 13-16): (3) Kodiak-Afognak (Unit 8): (4) Alaska Peninsula (Units 9 and 10): and (5) Interior-Arctic (Units 12, 17-26).

During the period 1961-1963, brown and grizzly hunting regulations, although differing between geographical areas or management units of the state, varied only slightly between years. Except for most of Southcentral Alaska where hunting was limited to the fall, the state provided a split season, primarily because of the fact that winter denning occurs sometime between November and April. Hunting seasons were thus divided into spring and fall periods.

Regulatory changes occuring during the years 1961, 1962 and 1963 will be discussed in detail under "Results", where specific references can be made to individual Game Management Units.

From this brief history, it can be seen that definite bear management policies and objectives have developed in Alaska since 1925. The 1925 regulation against market hunting of bears was the first federal documented policy concerning bear and appeared to be directed toward management objectives of establishing sport hunting over commercial hunting. Bag limit reduction in 1925, 1928 and 1942 were policies which were aimed at equalizing hunting opportunities and appeared to indicate some concern by the federal government over the possibility of area over-harvest. The protection of sows and

cubs in 1957 and 1958 seemed to be a policy directed toward the objective of managing brown and grizzly bear for trophies.

When the state assumed control of its wildlife in 1960, the previous federal objectives of bear management were generally accepted. In addition, a major objective of the state was to increase the efficiency of the statewide management program. This included the acquisition of more detailed information for the purpose of managing brown and grizzly bears by natural regions because of varying densities of bears and individual management problems in each region.

BEAR HIDE SEALING PROGRAM

Objectives and Significances

The primary objective of the hide sealing program was to obtain detailed harvest data on the brown and grizzly bear in Alaska. It was hoped that not only would a known harvest figure be available but additional information such as sex ratios and hide and skull measurements could be properly analyzed to determine their feasibility for use as population indices. The hypothesis was that exploitation would reduce average hide and skull sizes in the harvest and in addition, result in a trend toward a greater percentage of females in the harvest since the larger males are generally preferred by hunters. The purpose was to assess the effects of hunting on the various bear populations and subsequently to propose pertinent and prompt changes in hunting regulations. The basic assumption was that the mandatory sealing regulation and legal affidavit requirement would provide these data.

The sealing program was also designed to serve as an enforcement tool. The presentation of the hide for sealing and the signing of the legal affidavit made it possible to enforce other regulations, the violations of which had often escaped detection. Examples would be the enforcement of closed spring hunting areas and the regulations protecting cubs and sows with cubs. Additionally, the program gave the Department of Fish and Game a cross check on guide regulations concerning required guide-client reports.

Besides the above mentioned purposes of the program, it provided an opportunity to examine each hide and personally contact guides and hunters to obtain biological data and samples. These materials are to be presented in a separate report.

Methods and Procedures

Although any Department of Fish and Game employee was a legal sealing official, a Departmental policy required that a game biologist, enforcement officer or U.S. Fish and Wildlife Service agent perform the sealing. Overlapping studies and jurisdictions prompted cooperation between state officials and federal agencies (e.g. Kodiak National Wildlife Refuge) for sealing hides and acquiring harvest data.

Before a hide could be officially sealed, the hunter was required to provide the following information: license number, non-resident tag number, location and date of kill, hunter's name and address, and guide's name. Additional information required to complete the form (Figure 2) was obtained from the hide by the sealing officer. Upon completion of the sealing form a colored metal tag (numbers continuous from year to year) was affixed to the hide.

The techniques used for measuring hides and skulls were standard throughout the 1961-1963 seasons (Figures 3 and 4). Hides were measured by stretching the open-skinned hide to the full length and width and measuring the distances from the tip of the nose to the center of the anus (designated as length), from the center of the anus

FG-78A

ALASKA DEPARTMENT OF FISH AND GAME
BEAR SEALING CERTIFICATE

(for department use only) No. 6996

(Seal number) _____ (Place of sealing) _____ MONTH / DAY / 19 (Date of sealing)

SPECIES		SEX		SKULL	
BROWN	(1)	MALE	(1)	LENGTH	in.
GRIZZLY	(2)	FEMALE	(2)	WIDTH	in.
POLAR	(3)	UNKNOWN	(3)	TOTAL	in.

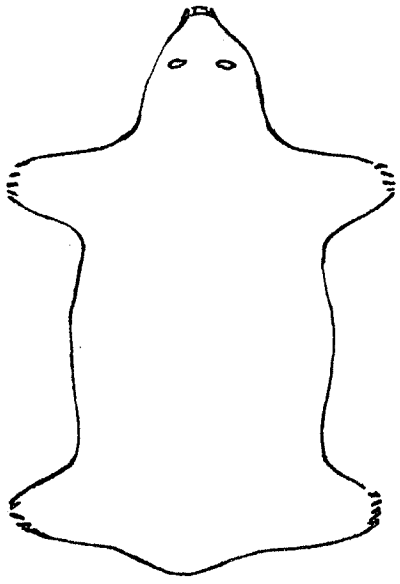
LICENSE NUMBER		TAG NUMBER	GUIDE'S NAME
RESIDENT	(1)		
NON-RES.	(2)		

HIDE PREPARATION		HIDE CONDITION		HIDE MEASUREMENTS	FEET	INCHES
FLESHED	(1)	RUBBED	(1)			
UNFLESHED	(2)	UNRUBBED	(2)	LENGTH	/	
UNKNOWN	(3)	UNKNOWN	(3)	WIDTH	/	
SALTED	(1)	(Sketch rubbed areas on hide outline below)		FLAP	/	
UNSALTED	(2)			TOTAL	/	
UNKNOWN	(3)					

SPECIFIC LOCATION OF KILL: _____ UNIT

I certify that the above-described boar was legally taken by _____ (Hunter's name) **on** _____ (Month) / (Day) / 196

(Hunter's address) _____ (City) _____ (State or Country)



(Signature of hunter or his agent)

(Sealed by)

Sex Identifiers:

Penis Sheath (1) _____

Vaginal Orifice (2) _____

Teats (3) _____

Remarks _____

Figure 2. Sample bear sealing certificate

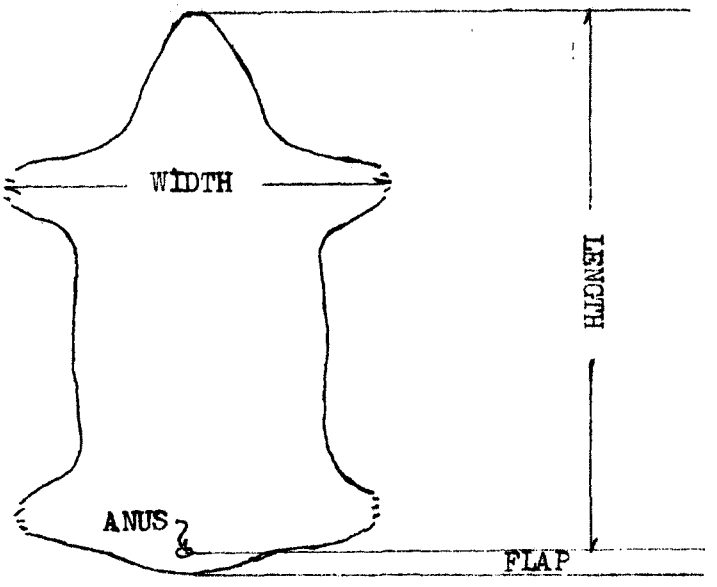


Figure 3. Length, width and flap measurements for brown and grizzly bear hides.

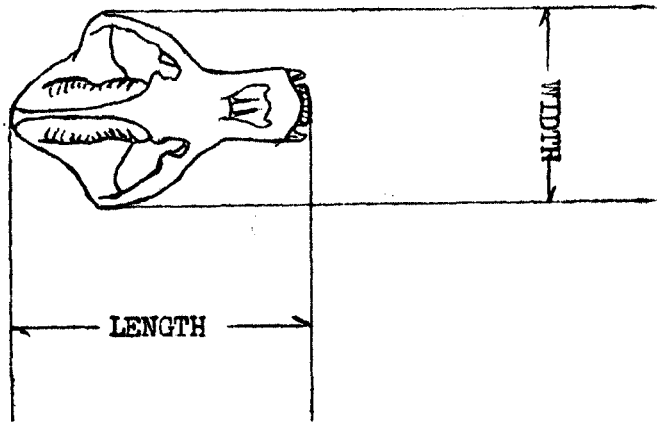


Figure 4. Length and width measurements for brown and grizzly bear skulls.

to the edge of the hide (flap) and the width between the tip of the middle claws on opposite forelegs (width). All measurements were then totaled for a combined figure. Skull measurements were made with large calipers and included the length (a straight line from the outer edge of the incisor row to the furthest protrusion of the saggital crest) and width (straight line between the two most outer portions of the zygomatic arches). These measurements were also added together to give the total skull figure.

In an effort to accomodate hunters and expedite the sealing program, a temporary sealing document (Figure 5) was distributed to guides, taxidermists and Fish and Game field offices. These forms, if properly completed, were legal affidavits and accompanied the hides when being transported for sealing. The temporary form sufficed for a signature on the original sealing form and as a result, did not require the actual presence of the hunter or guide during the actual sealing process.

Materials required for sealing hides were provided, prior to each season, to every field office concerned. The type of form provided, somewhat altered since the advent of the program, is illustrated in Figure 2. In addition to the sealing forms, temporary sealing documents, a supply of metal seals and complete sealing instructions were forwarded to each office. The instructions included: measurement requirements for hides and skulls, areas of form to check and subsequent form distribution. As seal numbers were never repeated, it was possible to associate and identify each individual form and hide

Date: _____

_____ Brown Bear _____ Male Hunter License No. _____

_____ Grizzly Bear _____ Female ____ Resident

_____ Polar Bear ____ Nonresident

Guide's name (Print)_____ Tag No. _____

SKULL

Length Width

_____ in. _____ in.

(lower jaw removed)

HIDE

Length Width

_____ ft.____ in. _____ ft. _____ in

Total

_____ ft. _____ in.

Length of hair _____ in.

Color: _____

Game Management Unit: _____

Specific Location of kill: _____

Drainage: _____

Mountain Range: _____

I HEREBY CERTIFY that the above bear was legally taken by _____
(hunter's name)

of _____
(hunter's mailing address)

on _____/_____/_____.
Mo. Day Year

_____ _____

Signature of Guide Signature of hunter or agent

Figure 5. Sample temporary bear sealing certificate

by this number.

The actual sealing of hides was accomplished in many different places. During seasonal harvest peaks, field trips by bear project personnel were made to guide camps and convenient bases of operation (e.g. King Salmon on the Alaska Peninsula). Because these trips were limited by project funds, the majority of the sealing was done at taxidermist shops, guide's main headquarters, local residences, airline freight offices and Department of Fish and Game offices.

After sealing was completed, each form, with temporary sealing document attached (if applicable), was forwarded to the central bear project office located in Anchorage. Forms were then checked for completeness by the bear project personnel. A copy of each form was filed in Anchorage for temporary use, for cross-checking with originals and for possible use by the Enforcement Division. The completed original forms were coded and forwarded to the I.B.M. section in Juneau for data processing.

The copies of the sealing forms filed in the Anchorage office were often utilized before data summaries were available. Consequently, during the season a running harvest tally was kept for each game management unit. This provided the management staff with information necessary for any possible adjustments within the season. The location of kill was hand plotted on maps to illustrate the distribution of the harvest (Figures 6 through 29).

Limitations of Data Collection

Alaska is a large state and the limited man-power of the Fish and Game Department made it impossible to canvas hunting areas as extensively as might be desired for any one year. This resulted in a few tardy reports filtering in after data were compiled.

There are undoubtedly innumerable variables related to each individual hunt that could be relevant to management and yet are unidentified due to the design of the sealing program. A few examples might be: weather conditions and corresponding hunter success, crippling loss, varying hunter abilities, guide quality relating to their ability in selecting large bears and their efficiency in hunting and methods of hunting (i.e. on foot, boat trips, cross-country vehicles, etc.). Certain of these variables will, in the course of the presentation, be shown to be unimportant; further, it will be assumed that most of these conditions average out between seasons and years.

Weather conditions influence success in all areas and yet the high success enjoyed by guided hunters indicates that during the long season improvements in weather usually occur to allow for an average harvest. The high percentage of hunts which are guided also tends to militate against a large incidence of crippling losses.

One of the most variable factors concerned with the sealing program is the sealing official. Throughout the three-year period a number of Department of Fish and Game and U.S. Fish and Wildlife Service officials have either sealed bear hides or had the oppor-

tunity to do so. On occasions officials may not actually examine a hide but utilize the hide and skull measurements, sex and other information provided by the guides or hunters. However, an examination of the harvest data indicated that guides and hunters tended to exaggerate hide and skull measurements as well as falsely report females as males.

A system was devised to detect these discrepancies where verified sealing officer data were compared to non-verified sealing officer information from the same geographical areas. The verified sealing officer consisted of three bear project personnel permanently assigned to the Anchorage field office who accomplished most of the sealing for the area. Consistency was stressed between these individuals and often two of the verified officers would seal hides together. All of the remaining sealing officers were classed as non-verified. The primary reason for this separation was to compare the sex ratios and hide and skull measurements for various areas to determine the accuracy of field personnel.

RESULTS

Harvest Data

Size of the Kill

The total sport kill of the brown and grizzly bear in Alaska for calendar years 1961, 1962 and 1963 numbered 473, 547 and 567 bears, respectively (Table 1). Spring season harvests for the three years were 216, 265 and 221, respectively, and comparable fall season harvests were 257, 282 and 346. Each year the harvest increased and particularly for the fall season. This increased harvest was apparently due to increased hunting pressure.(Table 3). The only seasonal drop in harvest was the spring of 1963 when only 221 bear were taken in comparison to 265 for 1962.

Kill Distribution

On a regional basis, there was a marked difference between seasonal harvests. Spring kills were confined largely to Kodiak-Afognak Islands (37 per cent), the Alaska Peninsula (35 per cent) and to Admirality, Baranof and Chichagof Islands in Southeastern (18 per cent) (Table 1). Kills for the fall seasons were more uniformly distributed. This difference between spring and fall kill can be attributed to two factors: (1) a large segment of the fall kill was made incidental to other hunting (Erickson 1964). This is illustrated by the fact that the major non-incidental harvest areas such as Kodiak-Afognak exhibited a composite (1961-1963) drop in kill from 37 per cent in the spring to

TABLE 1

1961-63 BROWN AND GRIZZLY BEAR HARVEST IN ALASKA[1]

Area District	Mgt. Unit	Spring Season 61	62	63	1961-63 No.	Area %	Fall Season 61	62	63	1961-63 No.	Area %
Southeast	1	6	7	4			7	5	5		
	2	-	-	-			1	-	-		
	3	-	-	-			-	-	-		
	4	28	32	18	-	-	9	14	13		
	5	4	1	4			5	6	2		
	6	6	9	11	-	-	7	15	21	-	-
Subtotal		44	49	37	130	18	29	40	41	110	13
Southcentral	7	-	-	-			1	1	1		
	11	-	-	-			5	14	9		
	13	-	-	-			42	33	41		
	14	-	-	-			16	9	13		
	15	-	-	-			4	5	4		
	16	8	3	3	-	-	20	15	23	-	-
Subtotal		8	3	3	14	2	88	77	91	256	29
Kodiak-Afognak	8	82	98	79	259	37	36	33	31	100	11
Alaska Peninsula	9	69	97	75			51	61	88		
	10	1	3	-	-	-	-	-	-	-	-
Subtotal		70	100	75	245	35	51	61	88	200	23
Interior & Arctic	12	3	3	5			11	16	18		
	17	-	-	-			2	3	3		
	18	-	-	-			-	-	-		
	19	-	-	-			13	11	11		
	20	7	5	8			9	21	34		
	21	-	1	-			4	6	3		
	22	-	1	-			1	-	-		
	23	-	2	5			6	4	6		
	24	-	3	3			3	3	6		
	25	1	-	1			3	4	6		
	26	1	-	4	-	-	-	2	6	-	-
Subtotal		12	15	26	53	8	52	70	93	215	24
Unidentified Areas[2]				1	-	-	1	1	2		
Grand Total		216	265	221	701	100	257	282	346	881	100

[1]Based on bears presented for compulsory sealing.

[2]Not included in combined year totals.

TABLE 1--Continued

Area	Mgt. Unit	Both Seasons 61	62	63	1961-63 No.	Area %
Southeast	1	13	12	9		
	2	1	-	-		
	3	-	-	-		
	4	37	46	31		
	5	9	7	6		
	6	13	24	32	-	-
Subtotal		73	89	78	240	15
Southcentral	7	1	1	1		
	11	5	14	9		
	13	42	33	41		
	14	16	9	13		
	15	4	5	4		
	16	28	18	26		
Subtotal		96	80	94	270	17
Kodiak-Afognak	8	118	131	110	359	23
Alaska Peninsula	9	120	158	163		
	10	1	3	-		
Subtotal		121	161	163	445	28
Interior & Arctic	12	14	19	23		
	17	2	3	3		
	18	-	-	-		
	19	13	11	11		
	20	16	26	42		
	21	4	7	3		
	22	1	1	-		
	23	6	6	11		
	24	3	6	9		
	25	4	4	7		
	26	1	2	10		
Subtotal		64	85	119	268	17
Unidentified Areas		1	1	3		
Grand Total		473	547	567	1587	100

11 per cent in the fall; and (2) the preference of most guides for spring hunts because of the opinion that spring pelts were superior to fall pelts.

Sealing form information on specific location of kill was utilized to plot kill distribution for different areas which could be analyzed individually. This technique provided a visual comparison of seasonal and yearly shifts in harvests. Figures 6 through 23 show most of the 1961-63 spring and fall kill locations for Game Management Units 4, 8, 9 and 10, plus a state-wide map on which the harvests of the previous four Units are excluded. Each dot on these maps represents one kill.

The 1961 through 1963 locations of kill for Game Management Unit 4 are illustrated in Figures 6 through 11. Generally, this area shows no apparent differences in harvest pattern between seasons and years. However, as was mentioned previously, more bears were taken during the spring seasons. Admiralty Island appears to sustain the greatest percentage of the kill for the three large islands in Unit 4. The kill locations clearly illustrate the hunting method used in this area where almost all the hunting is done near harbors and bays which are accessible by boat. Although some of the kills are inland, the majority are taken from the island periphery.

Kill distribution maps for the Kodiak-Afognak area (Figures 12-17) seem to illustrate more variety in kill patterns than was shown for the Southeastern area. More kills are made in the spring than in the fall and areas like Karluk Lake, Olga Bay, Uyak Bay, Uganik Bay and

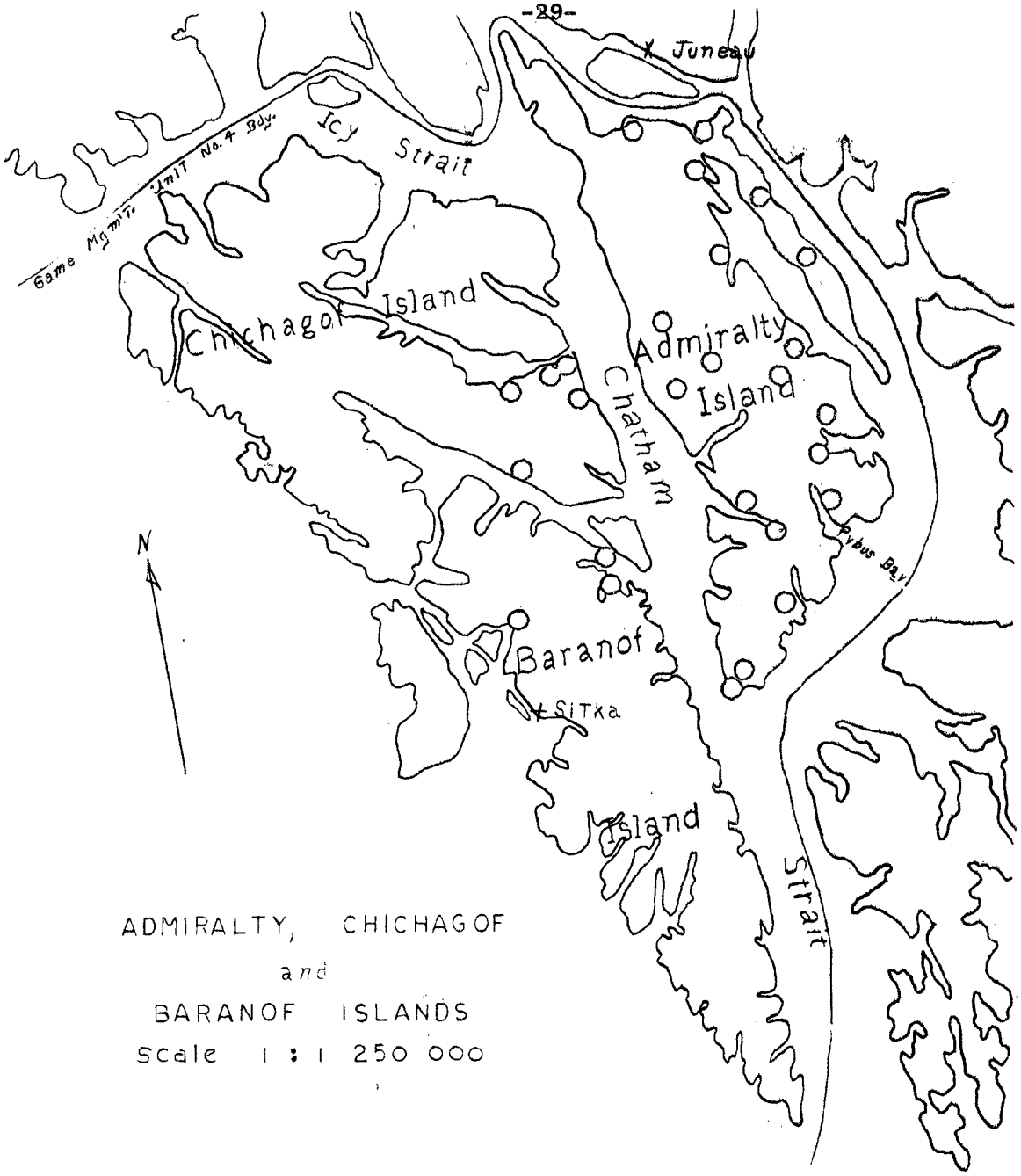


Figure 6. Distribution of bear kills in Game Management Unit number 4 during the 1961 spring season. Each dot represents one kill.

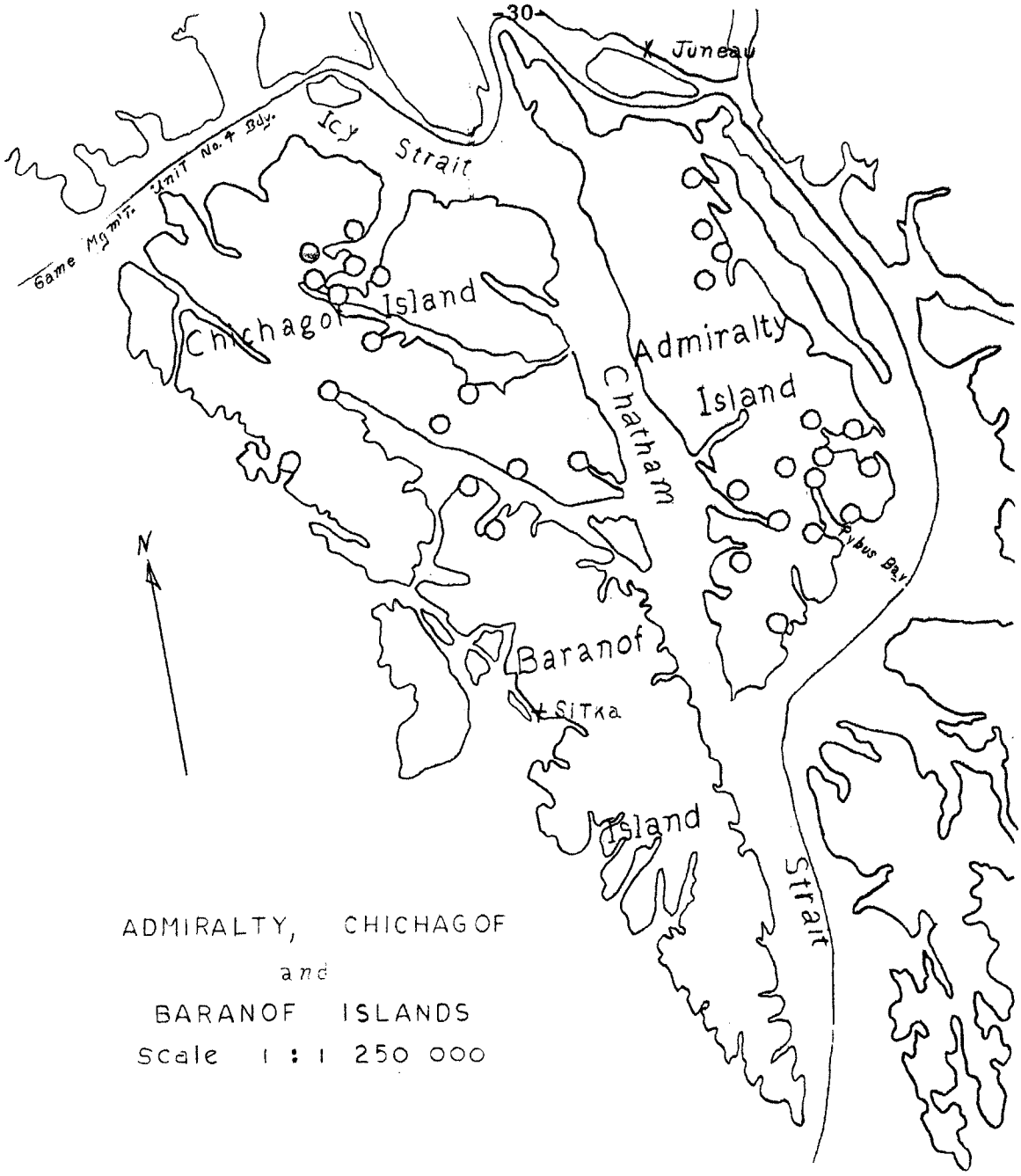


Figure 7. Distribution of bear kills in Game Management Unit number 4 during the 1962 spring season. Each dot represents one kill.

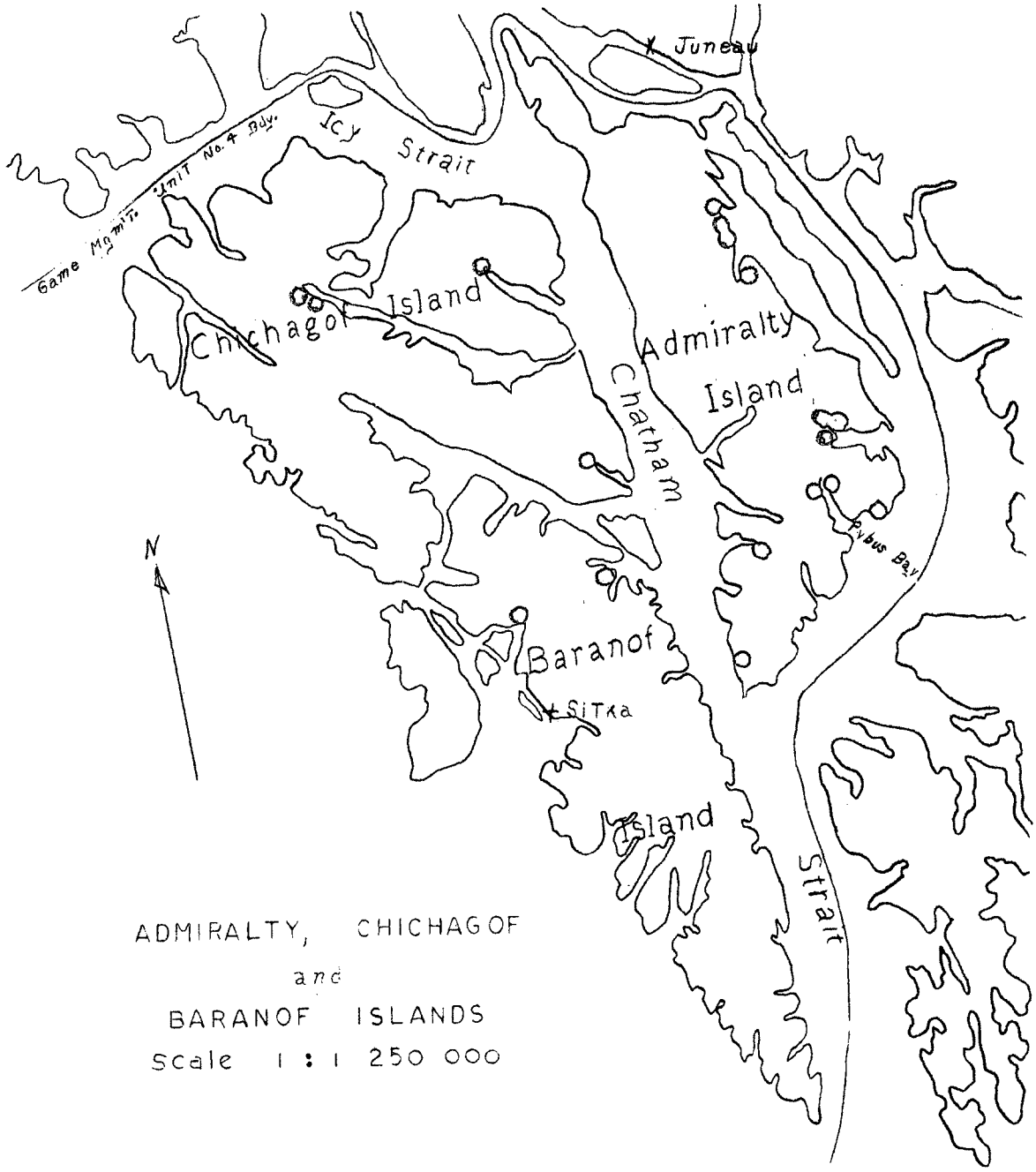


Figure 8. Distribution of bear kills in Game Management Unit number 4 during the 1963 spring season. Each dot represents one kill.

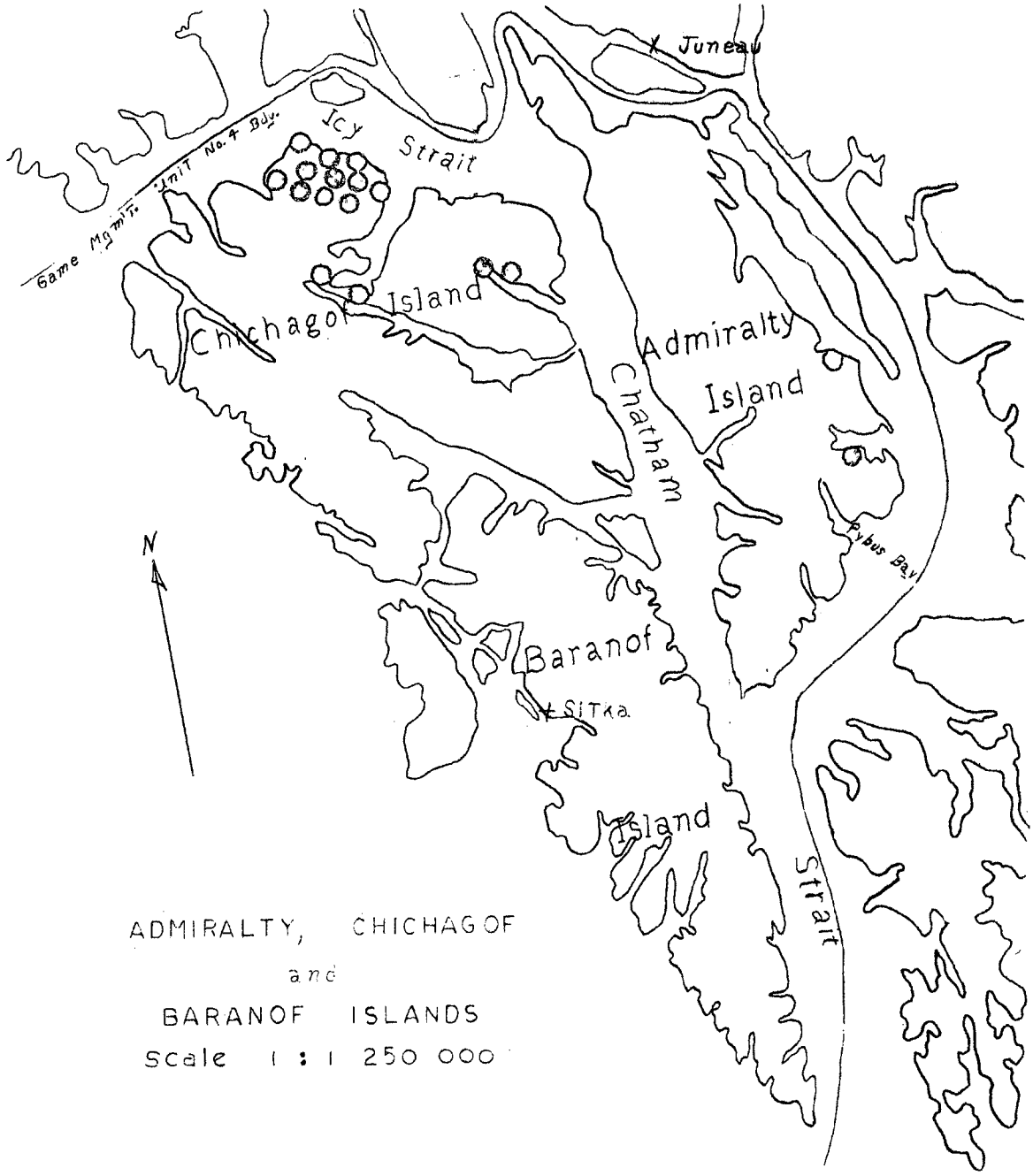


Figure 9. Distribution of bear kills in Game Management Unit number 4 during the 1961 fall season. Each dot represents one kill.

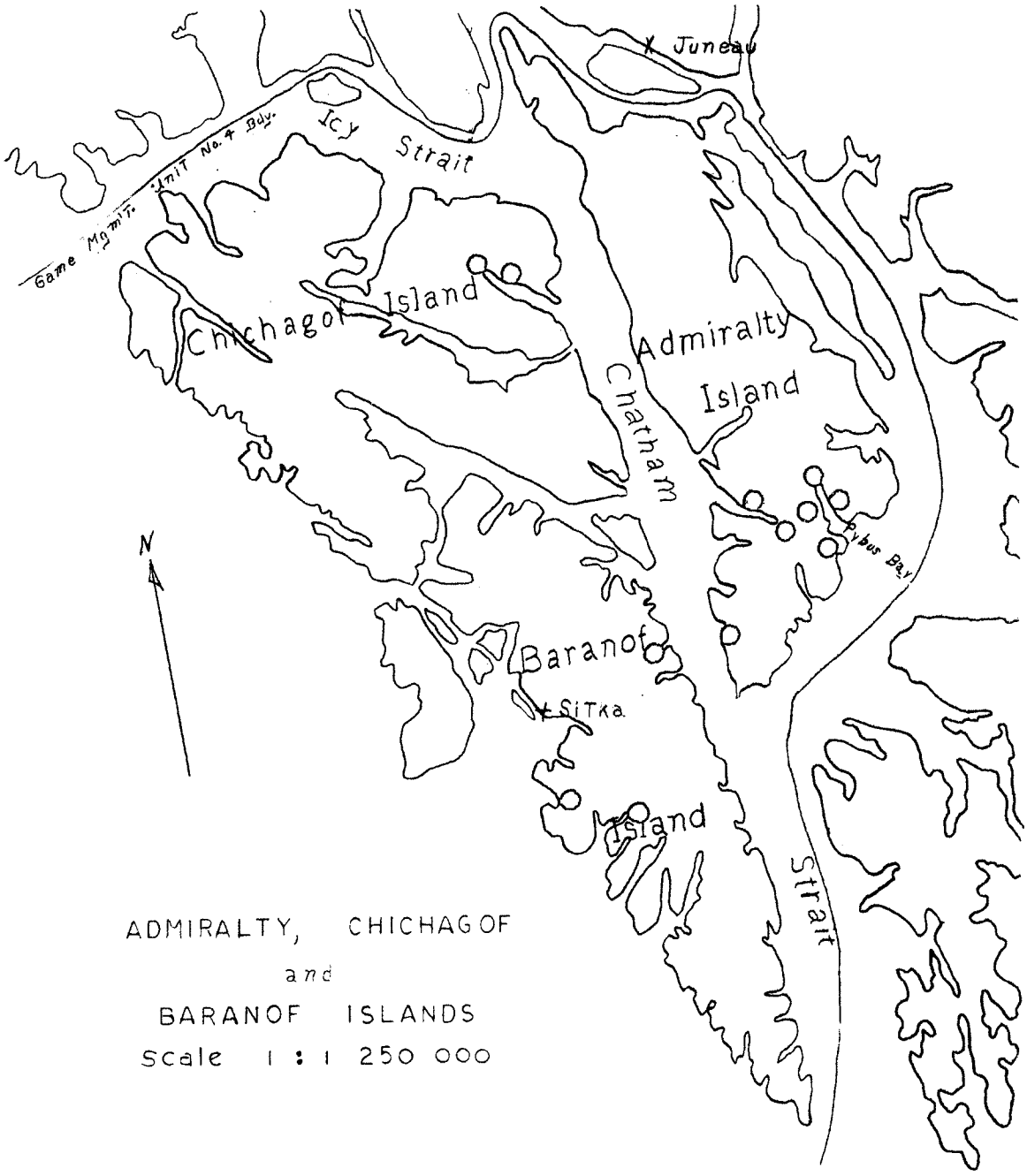


Figure 10. Distribution of bear kills in Game Management Unit number 4 during the 1962 fall season. Each dot represents one kill.

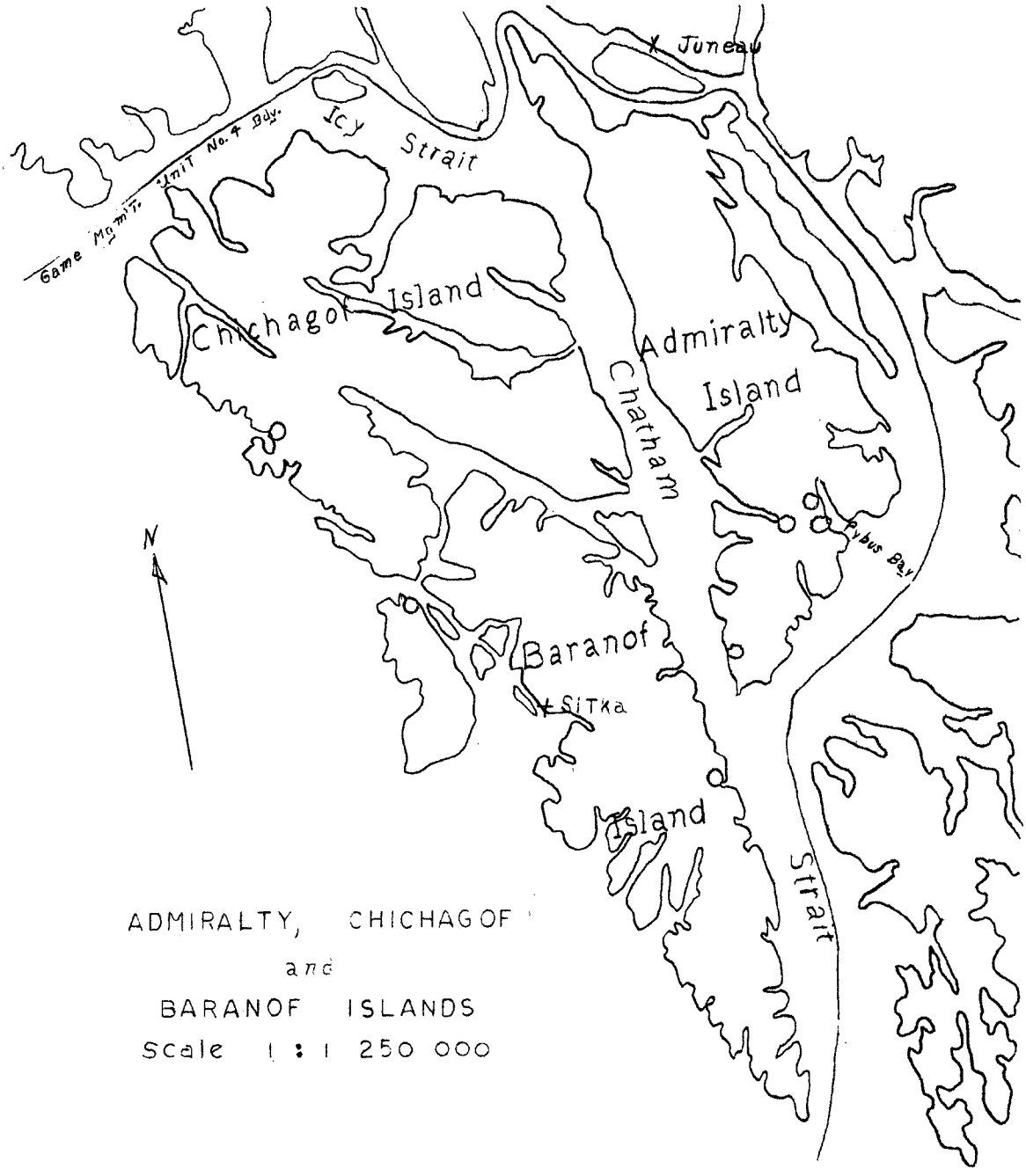


Figure 11. Distribution of bear kills in Game Management Unit number 4 during the 1963 fall season. Each dot represents one kill.

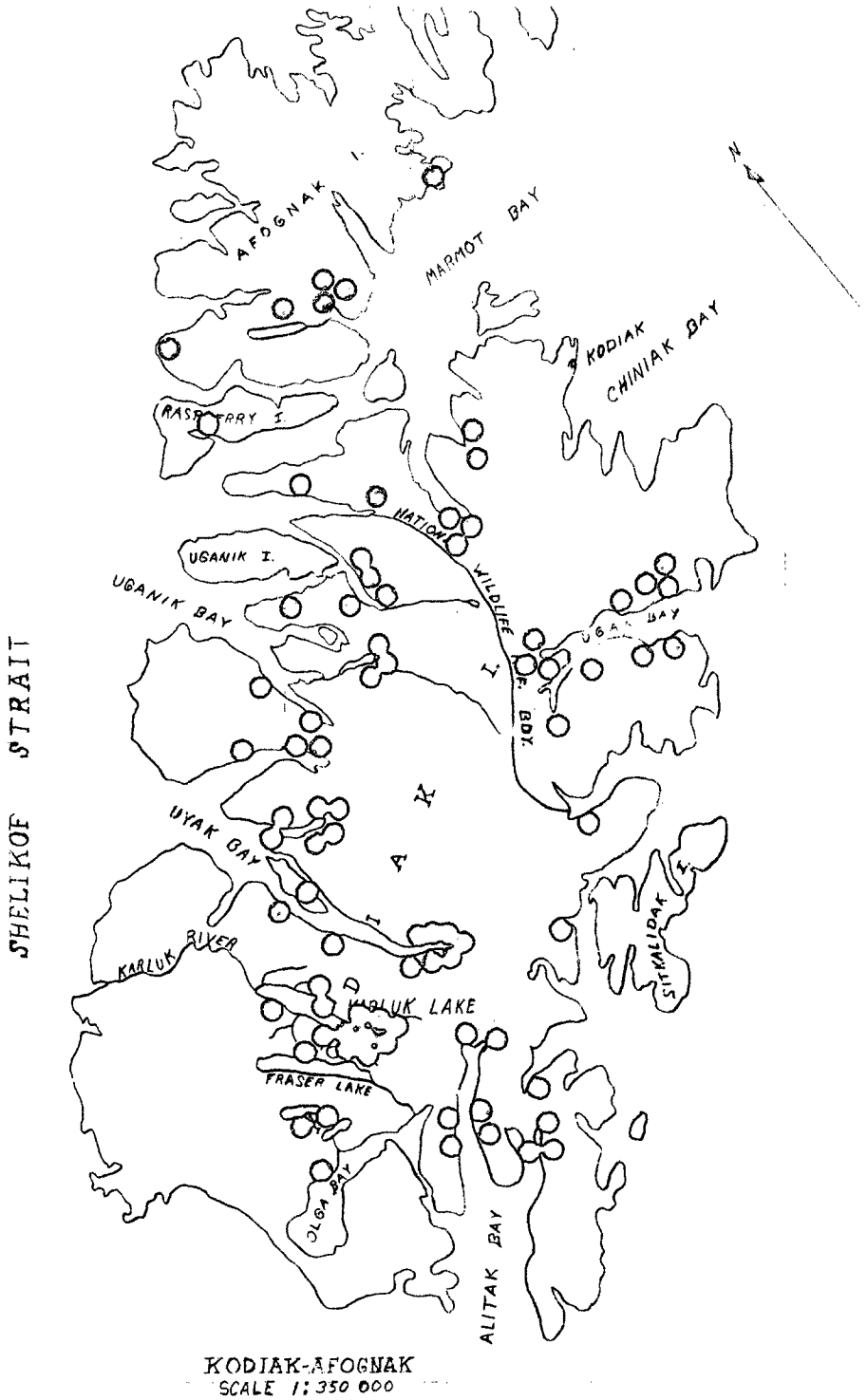


Figure 12. Distribution of bear kills in Game Management Unit number 8 during the 1961 spring season. Each dot represents one kill.

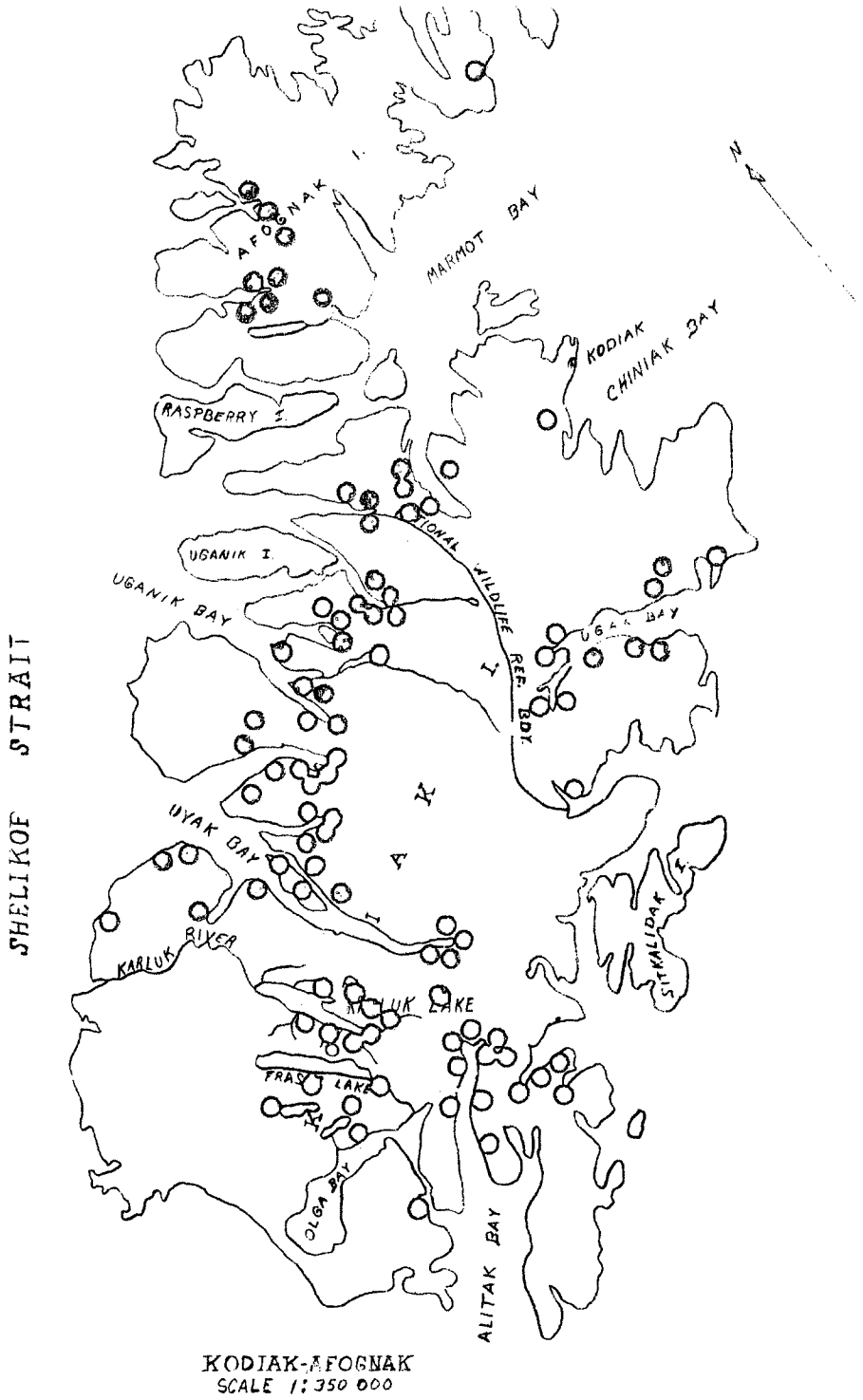


Figure 13. Distribution of bear kills in Game Management Unit number 8 during the 1962 spring season. Each dot represents one kill.

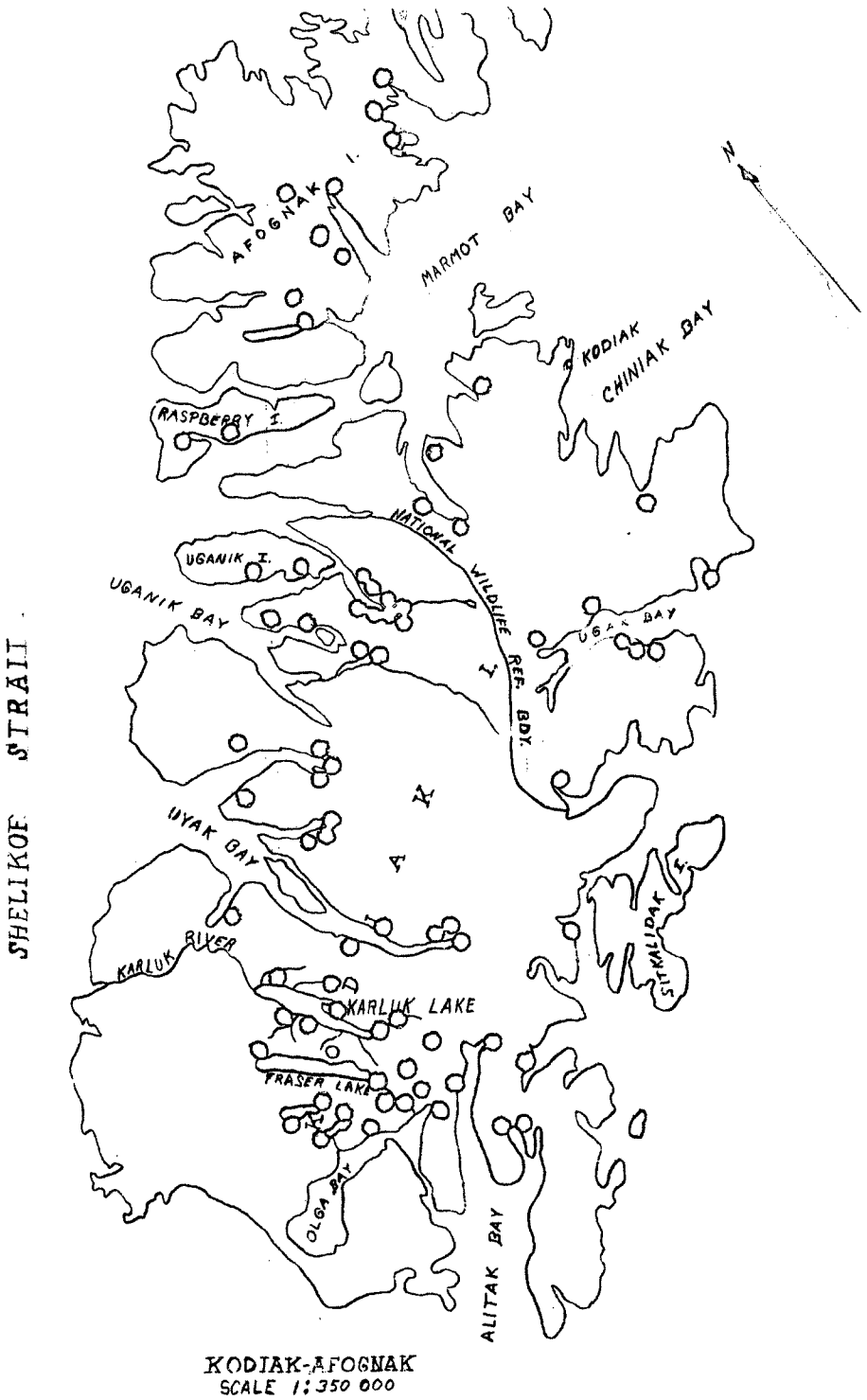


Figure 14. Distribution of bear kills in Game Management Unit number 8 during the 1963 spring season. Each dot represents one kill.

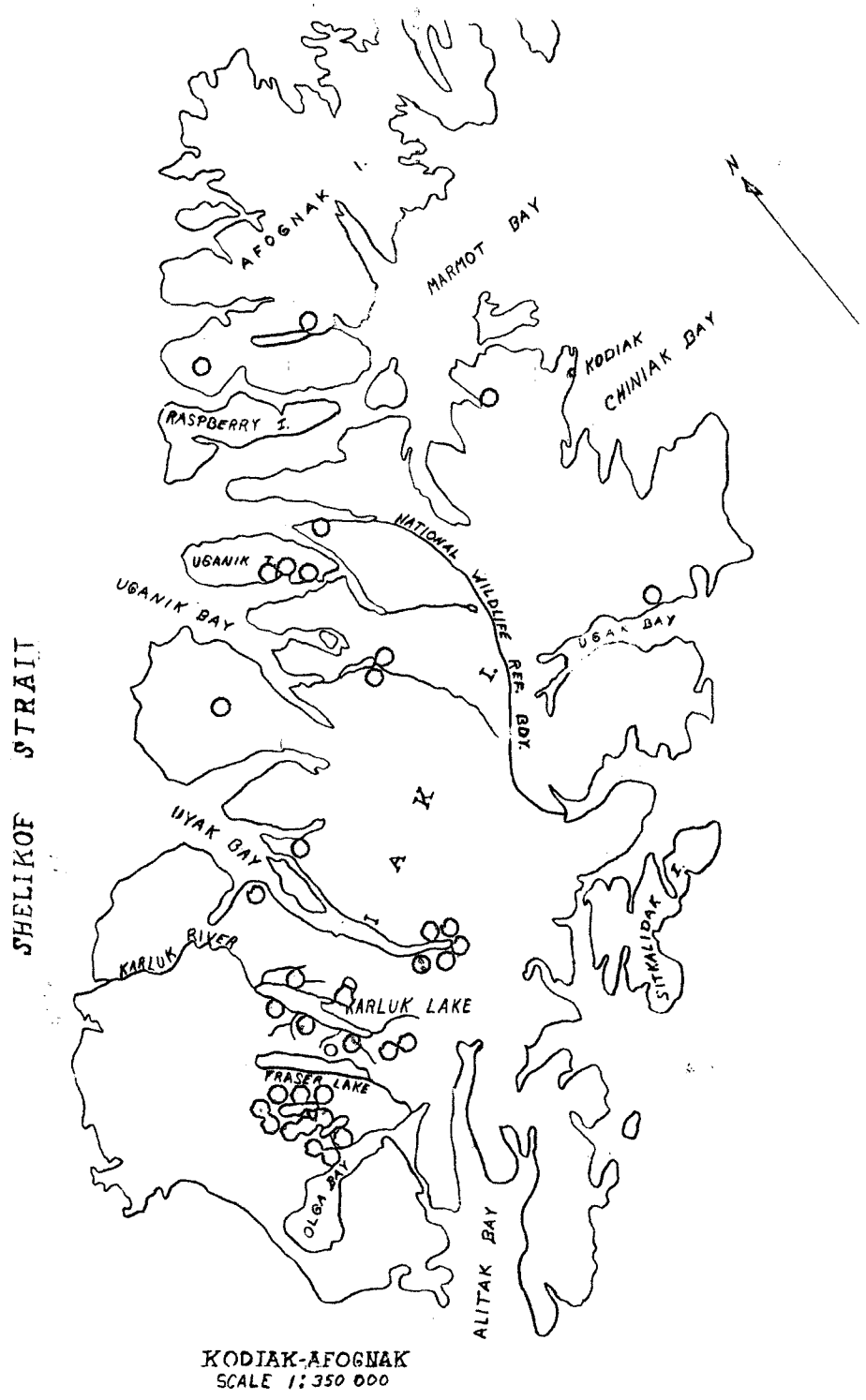


Figure 15. Distribution of bear kills in Game Management Unit number 8 during the 1961 fall season. Each dot represents one kill.

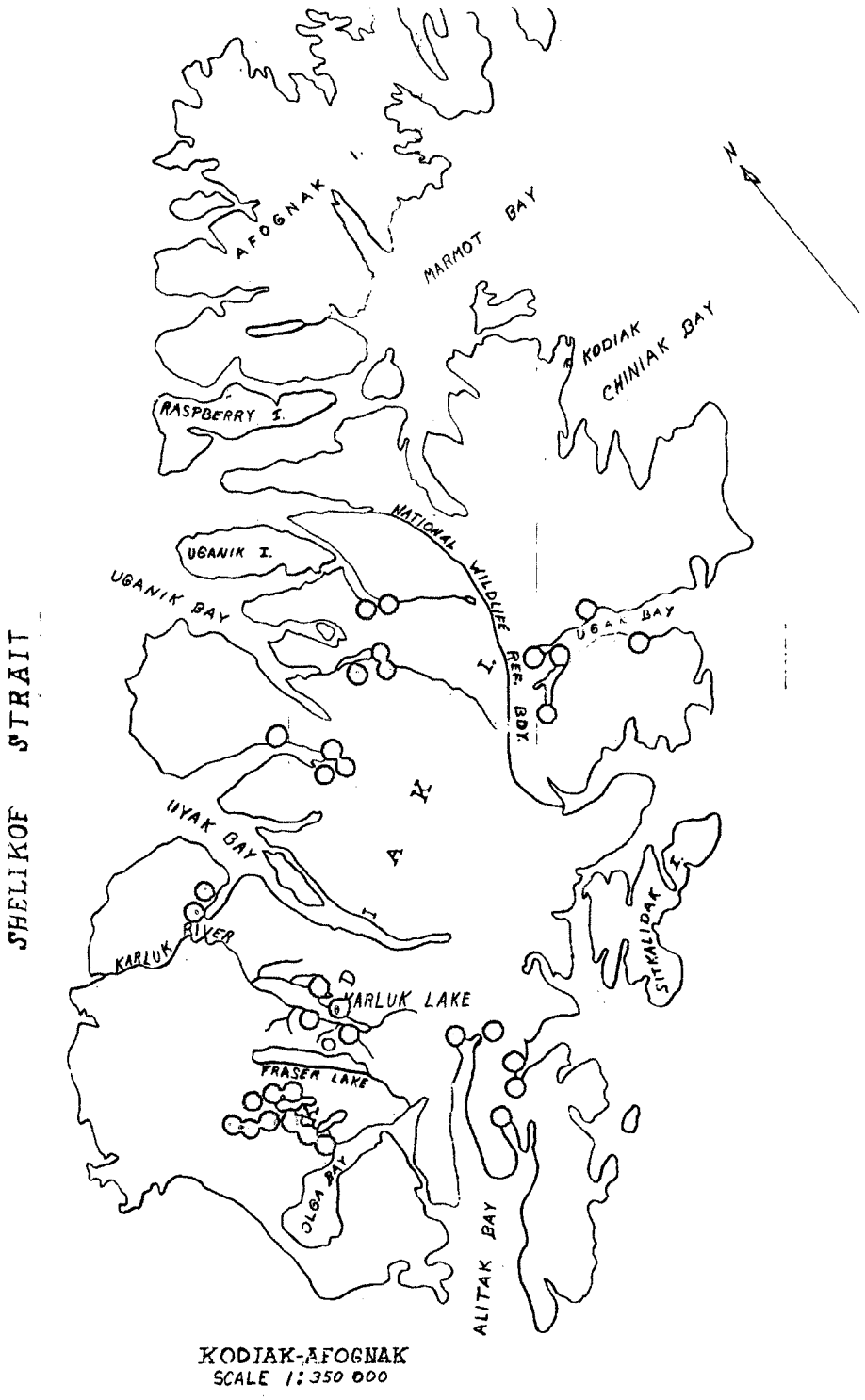


Figure 16. Distribution of bear kills in Game Management Unit number 8 during the 1962 fall season. Each dot represents one kill.

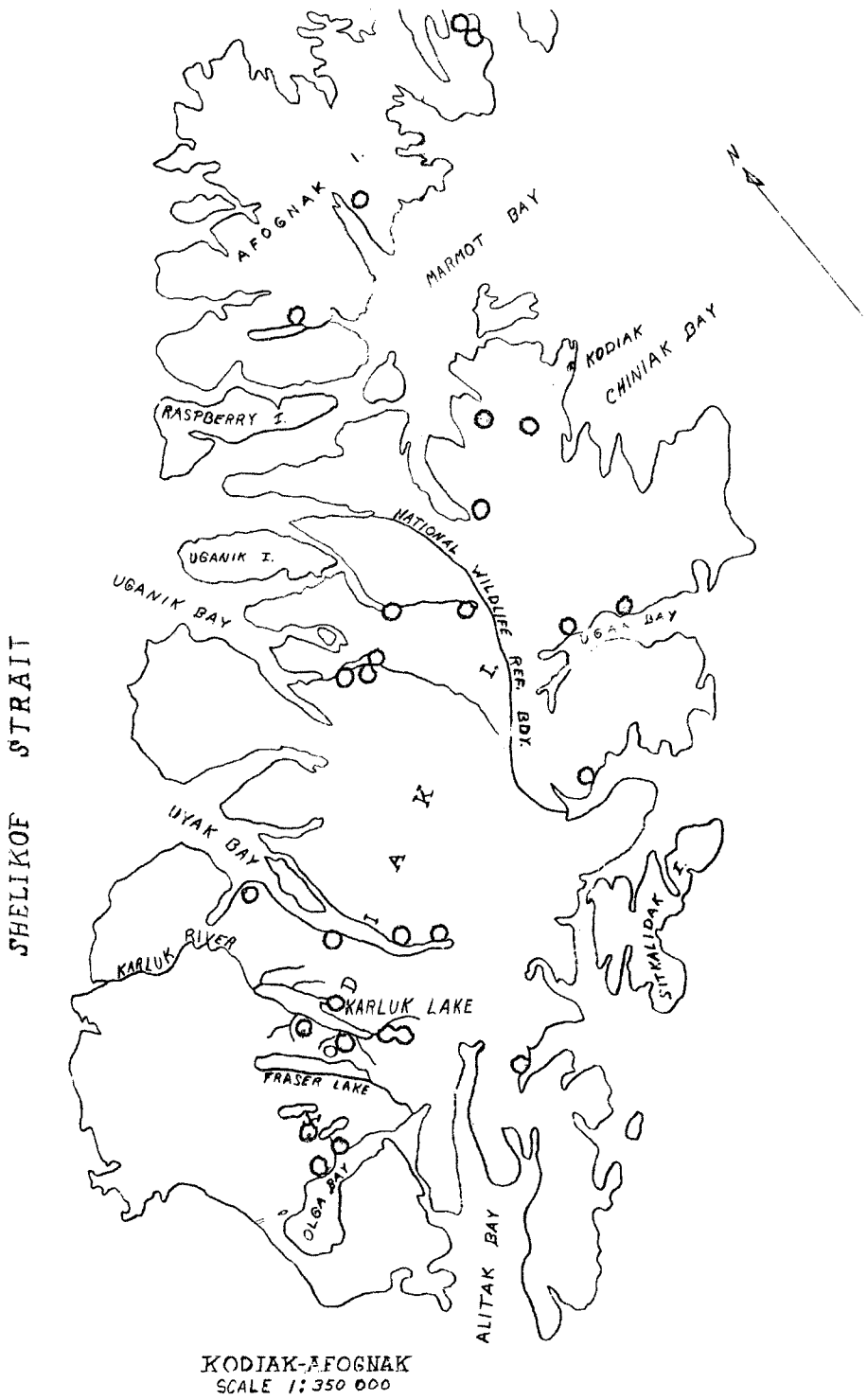


Figure 17. Distribution of bear kills in Game Management Unit number 8 during the 1963 fall season. Each dot represents one kill.

Ugak Bay seem consistently to be the areas from which the heaviest harvests are taken. In addition, the Kodiak National Wildlife Refuge located on the southern portion of Kodiak Island sustained the greatest percentage of the kills for both seasons and all three years with more bears being taken in the spring than the fall. However, more kills appear to have been made off the Refuge in the spring. This is significant because it refutes the reasonable assumption that more incidental kills of bear would be made in areas near the city of Kodiak and on the Chiniak Peninsula when the fall deer season was in progress. Apparently almost all the Kodiak-Afognak sport kills were taken by hunters who are specifically hunting bear.

The patterns of harvest distribution around Kodiak Island were similar to those around Admiralty Island in southeastern Alaska. Troyer (1961) explained that most of the hunting was done mainly by cruising around the bays and large lakes until bear were spotted. Then the stalking was done on foot.

The larger number of kills on the Alaska Peninsula also seem to portray more distinct patterns of kill distribution (Figures 18-23). Port Moller, Port Heiden (Meshik River area), Chignik Bay (Chignik-Black Lakes drainage), Becharof Lake and Ugashik Lake appeared to be the most popular hunting areas during both spring and fall seasons. This is because of accessibility and the fact that most of the guides had established camps in these areas. According to the plotted kill locations, the area between Port Heiden and Chignik Bay was the most heavily hunted area, especially during the spring and fall of 1963.

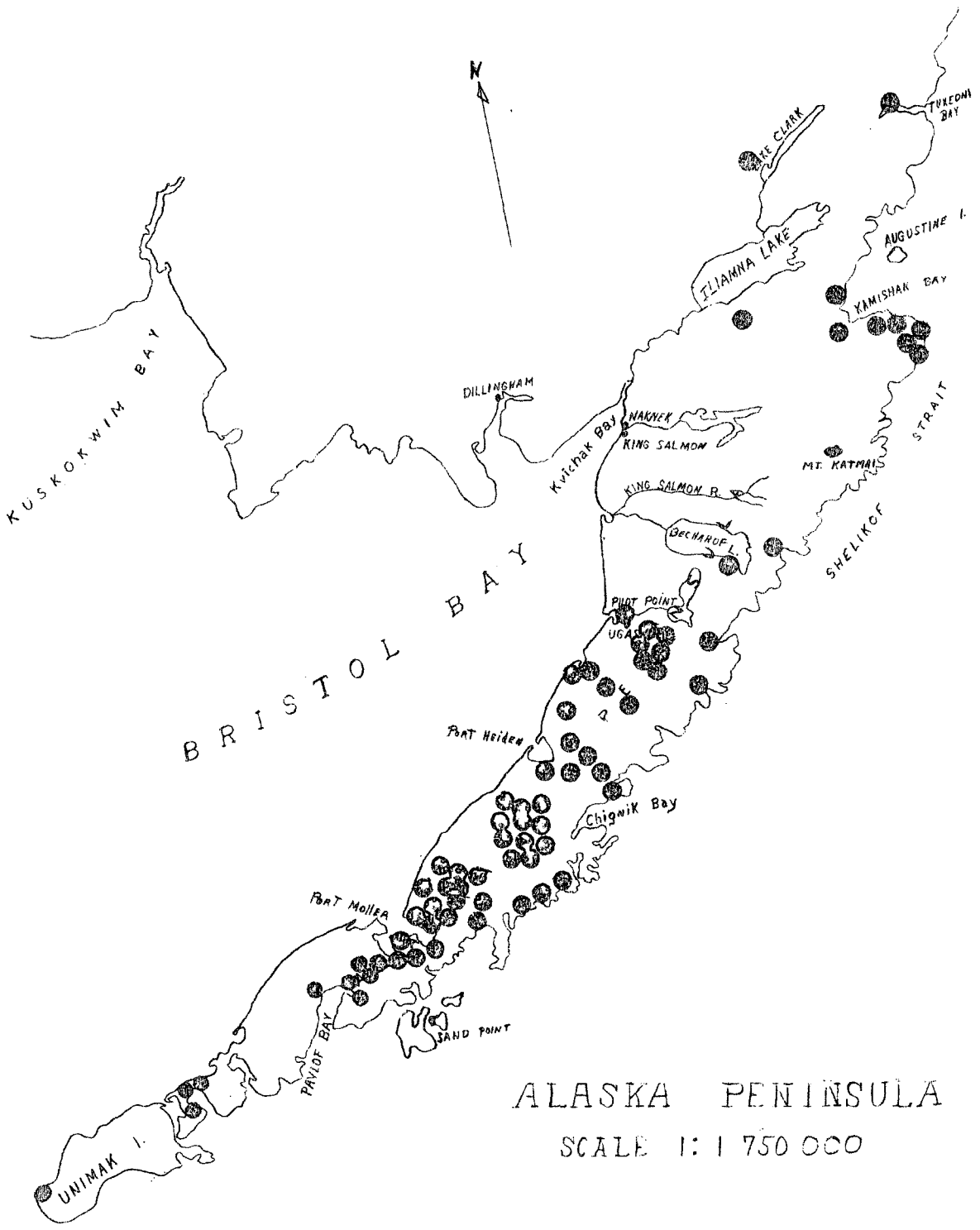


Figure 18. Distribution of bear kills in Game Management Unit number 9 and Unimak Island (Unit 10) during the 1961 spring season. Each dot represents one kill.

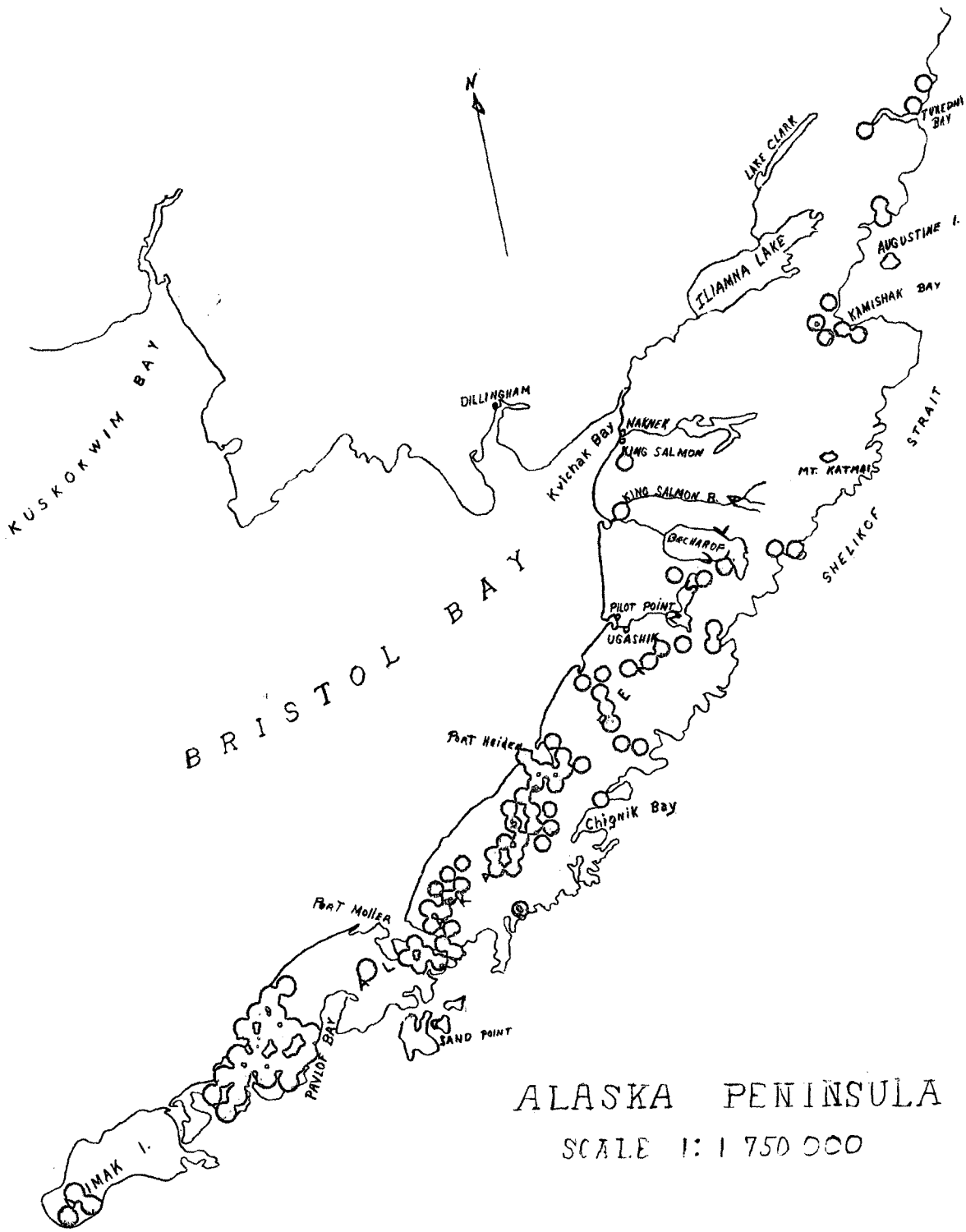


Figure 19. Distribution of bear kills in Game Management Unit number 9 and Unimak Island (Unit 10) during the 1962 spring season. Each dot represents one kill.

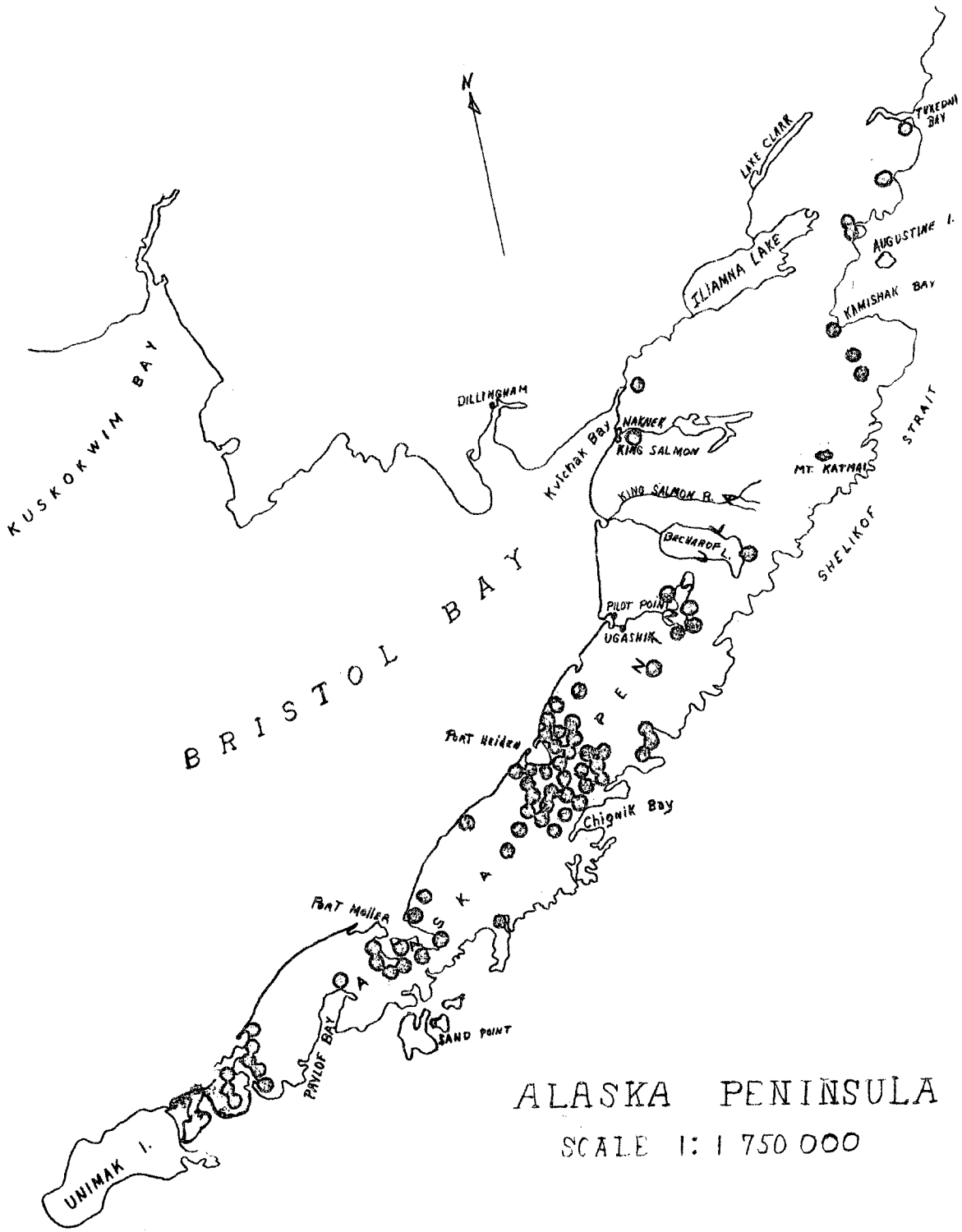


Figure 20. Distribution of bear kills in Game Management Unit number 9 and Unimak Island (Unit 10) during the 1963 spring season. Each dot represents one kill.

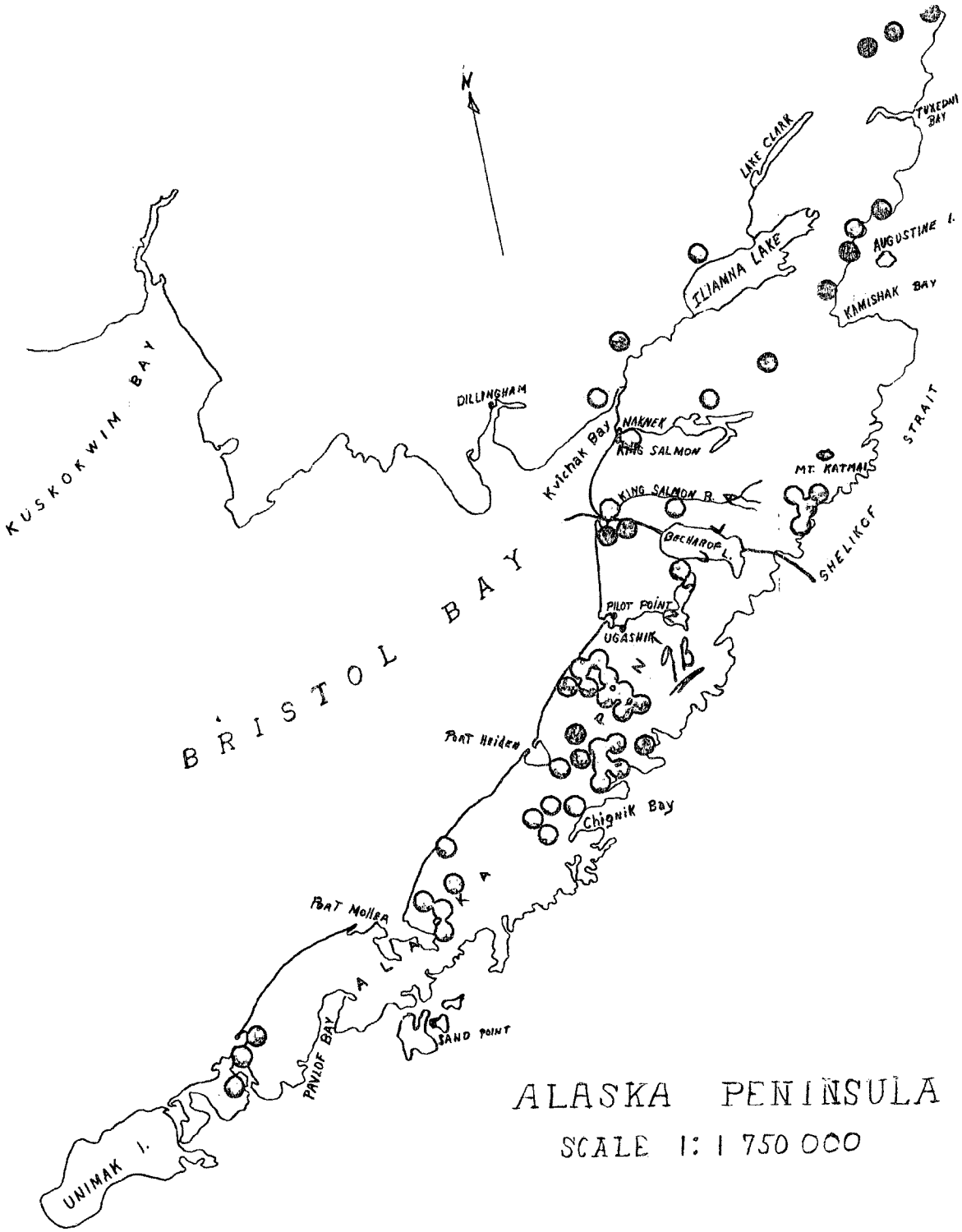


Figure 21. Distribution of bear kills in Game Management Unit number 9 and Unimak Island (Unit 10) during the 1961 fall season. Each dot represents one kill.

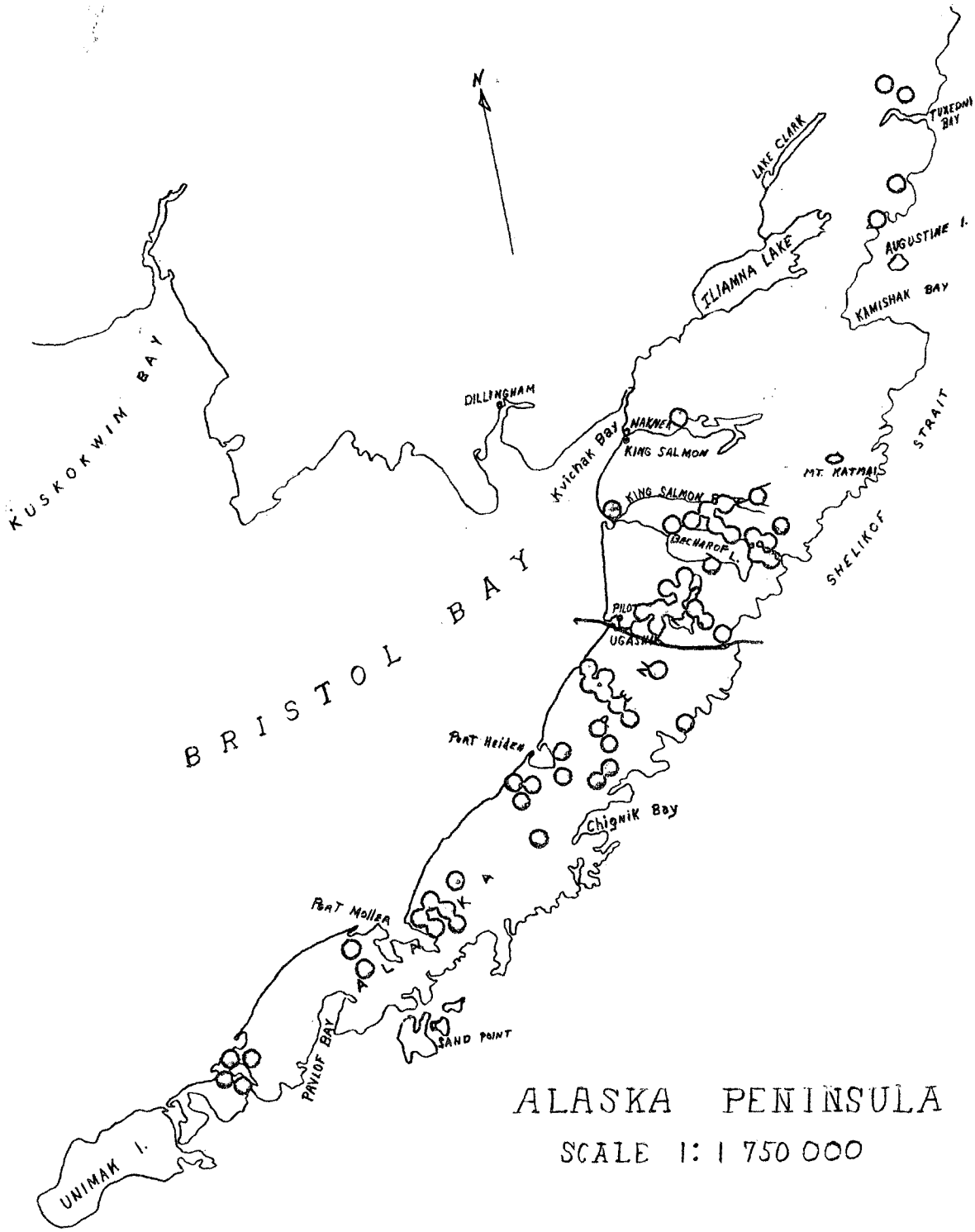


Figure 22. Distribution of bear kills in Game Management Unit number 9 and Unimak Island (Unit 10) during the 1962 fall season. Each dot represents one kill.

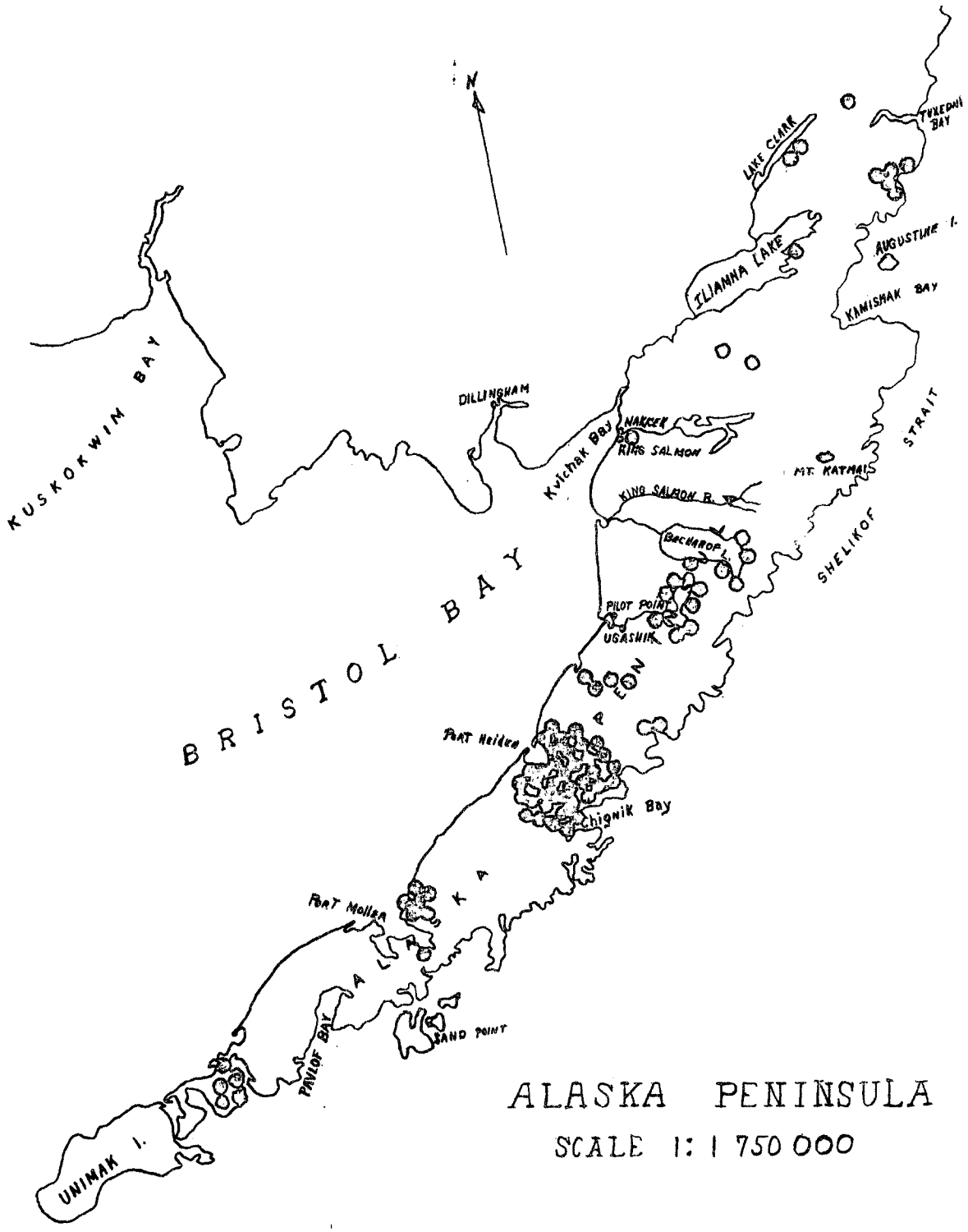


Figure 23. Distribution of bear kills in Game Management Unit number 9 and Unimak Island (Unit 10) during the 1963 fall season. Each dot represents one kill.

(Figures 20 and 23). It is possible that special regulations might be needed to curb the hunting in such particular areas if the hunting pressure does not become self-limiting by forcing guides and hunters into other areas. In this instance, hides sealed for this area might be analyzed separately in the future to determine if the population is being seriously over-harvested.

It is interesting to note that the Unit 9 spring and fall kill distributions seemed to become more restricted in area from 1961 to 1963. During both seasons of 1961 and 1962, the kills were somewhat dispersed but during the spring and fall of 1963 the kills were located primarily around Port Heiden, Port Moller, Ugashik and Chignik Bay. It is not known exactly why this shift in hunting pressure occurred but possibly it was due to the fact that larger bear were being continually taken in these areas, thus drawing guides and hunters to central locations. It is more probable that a new regulation in 1963 was responsible for the congregation of guides and hunters into fewer areas, which would account for the fall shift. This regulation stated that aircraft could not be used in Game Management Unit 9 in any manner as an aid in taking big game except for transportation to a pre-existing camp or to a site for the purpose of establishing a camp. This meant that previously random harvesting accomplished by the frequent use of aircraft was now replaced by hunting from pre-existing camps. Of course, the most accessible and best hunting sites were most heavily utilized. If this is the case, the conclusion is that the regulation controlling an unethical harvest method could

be responsible for creating a localized over-harvest of brown bear.

The 1961 through 1963 state-wide harvest distributions for the spring and fall seasons are illustrated in Figures 24 through 29. These maps exclude the kills for Game Management Units 4, 8, 9 and 10 which have been presented individually. All Units except 7, 13, 14 and 15 provided spring and fall seasons. The most obvious comparison of these maps is between the spring and fall seasons, as was also shown in Table 1. Erickson (1964) attributed the increased fall harvest to incidental kills taken during the concurrent fall hunting, especially for sheep. This seems reasonable as Units 7, 11, 12, 13, 14 and 15 are areas where sheep hunting is the heaviest. Units 7, 13, 14 and 15 only had fall seasons and thus the data cannot be compared to a spring season. Management Units 11, 12, 16 and 20 did, however, provide spring and fall hunting and show much larger fall harvests. These increases could be due to incidental kills while caribou, moose or sheep hunting and possibly due to fall guided multiple bag hunts where hunters (particularly non-residents) buy more than one game tag with hopes of filling them all. Without tag requirements, resident hunters probably take bears whenever the opportunity arises.

Kill Chronology

The kill chronologies for the spring and fall seasons, including the combined totals for 1961 through 1963, are presented in Figure 30. The harvest patterns are essentially alike for each year with

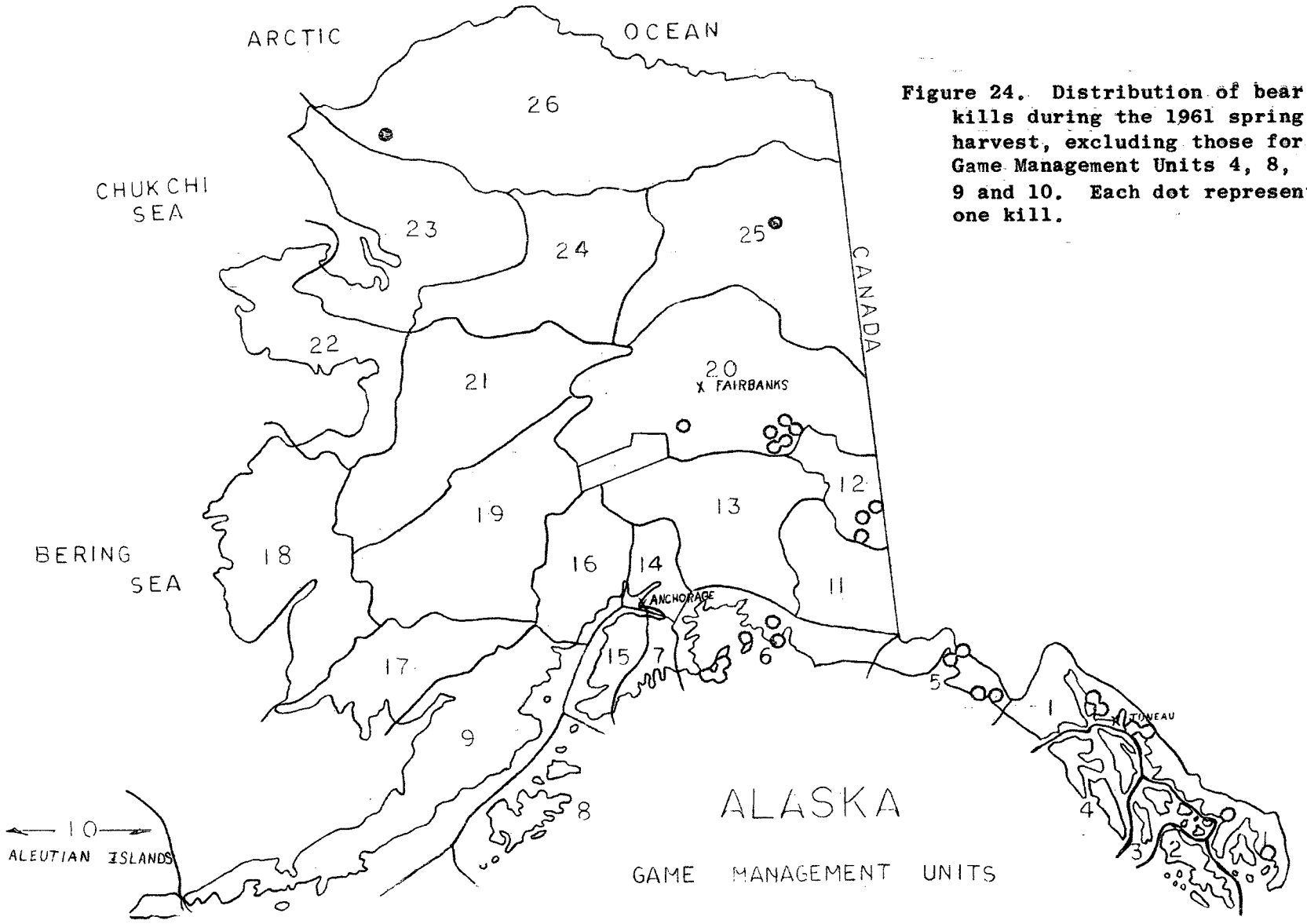


Figure 24. Distribution of bear kills during the 1961 spring harvest, excluding those for Game Management Units 4, 8, 9 and 10. Each dot represents one kill.

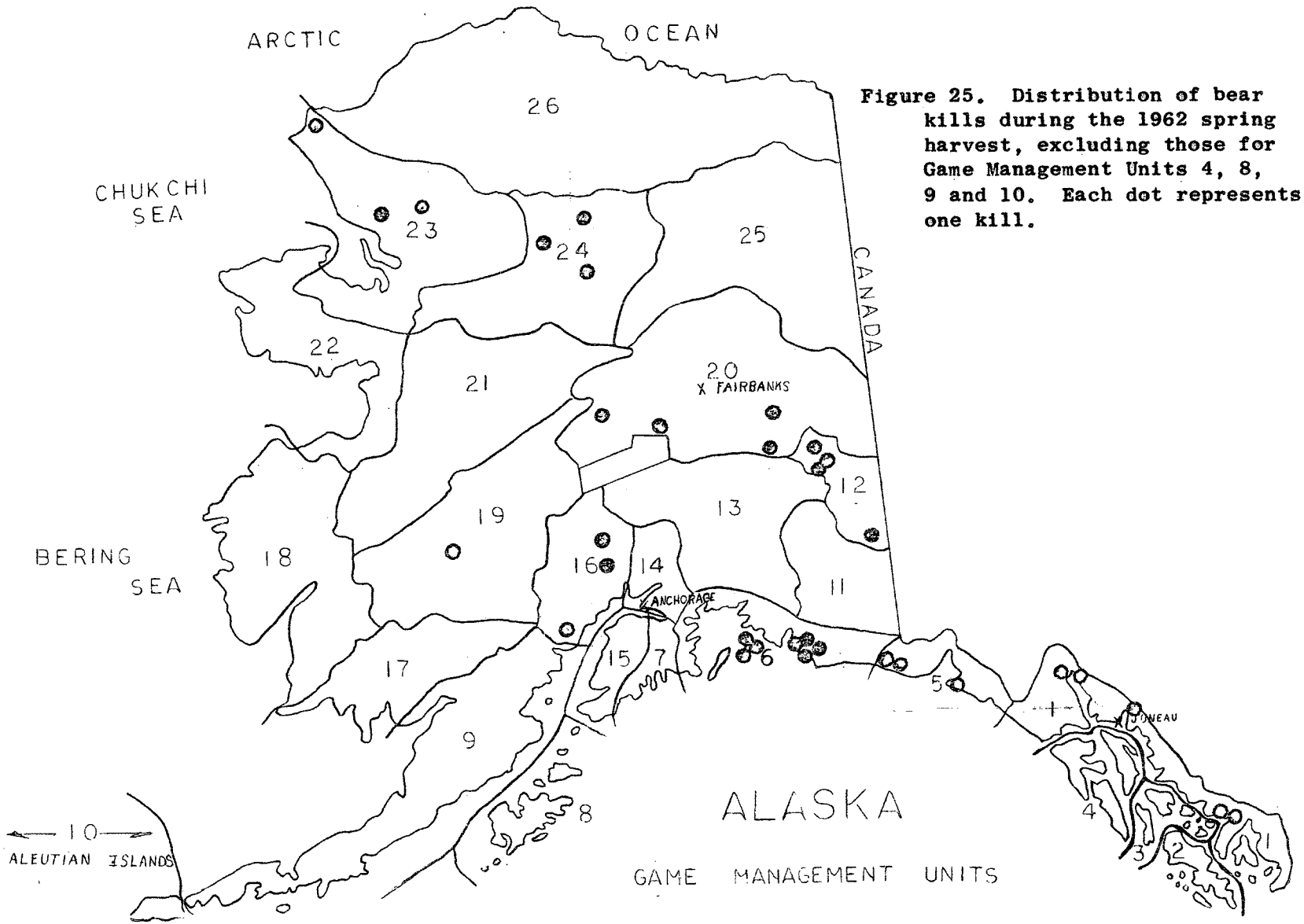


Figure 25. Distribution of bear kills during the 1962 spring harvest, excluding those for Game Management Units 4, 8, 9 and 10. Each dot represents one kill.

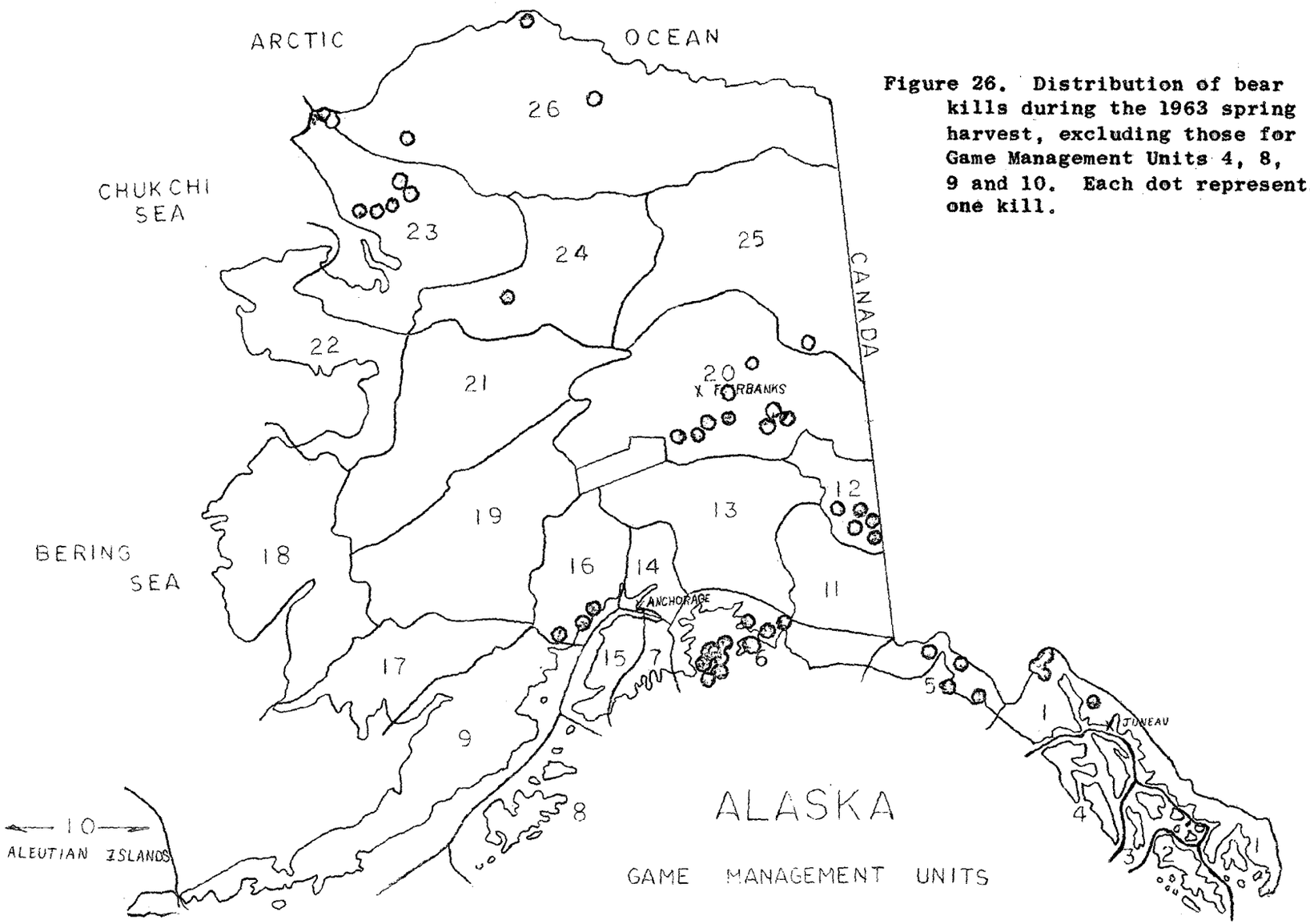


Figure 26. Distribution of bear kills during the 1963 spring harvest, excluding those for Game Management Units 4, 8, 9 and 10. Each dot represents one kill.

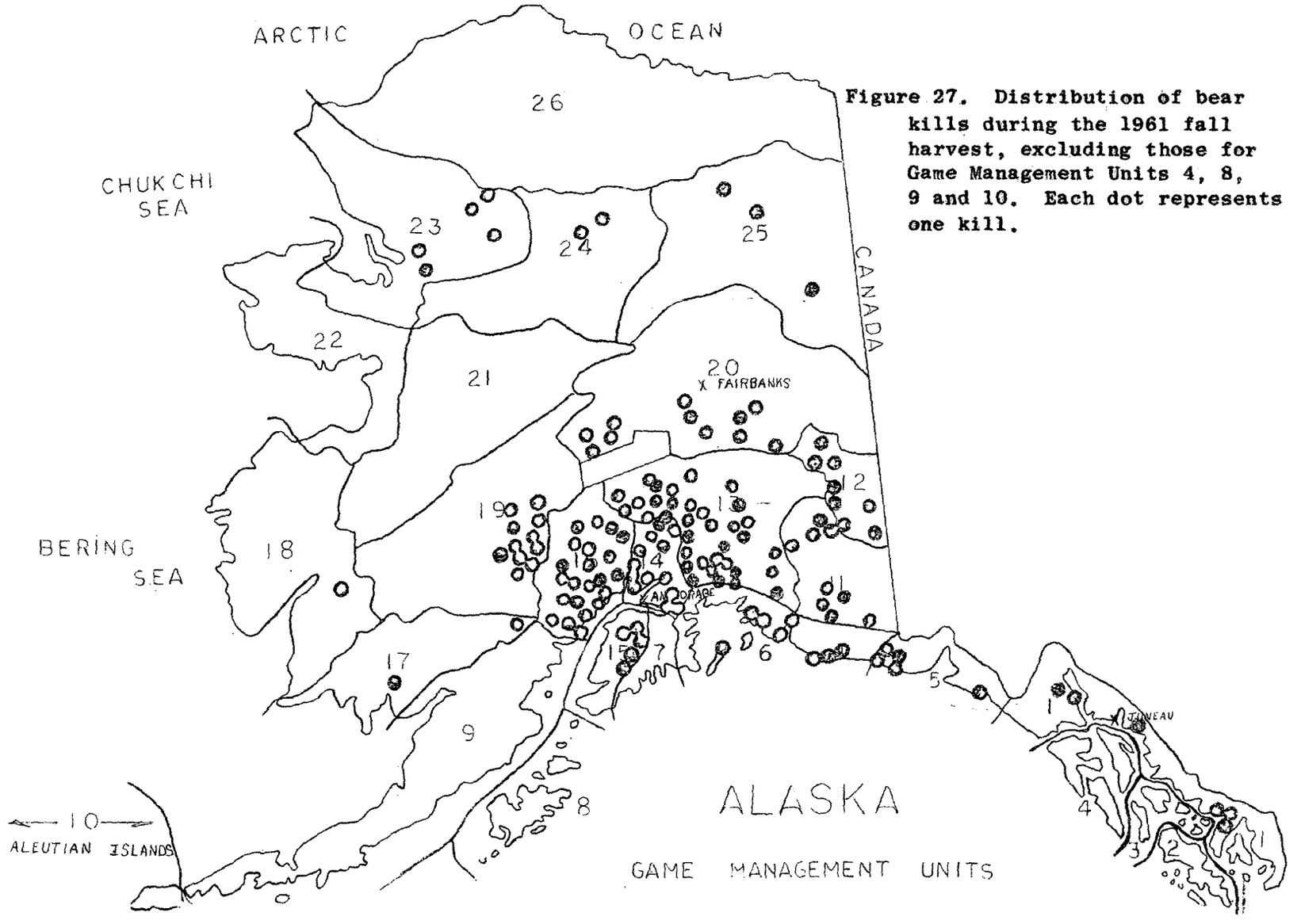


Figure 27. Distribution of bear kills during the 1961 fall harvest, excluding those for Game Management Units 4, 8, 9 and 10. Each dot represents one kill.

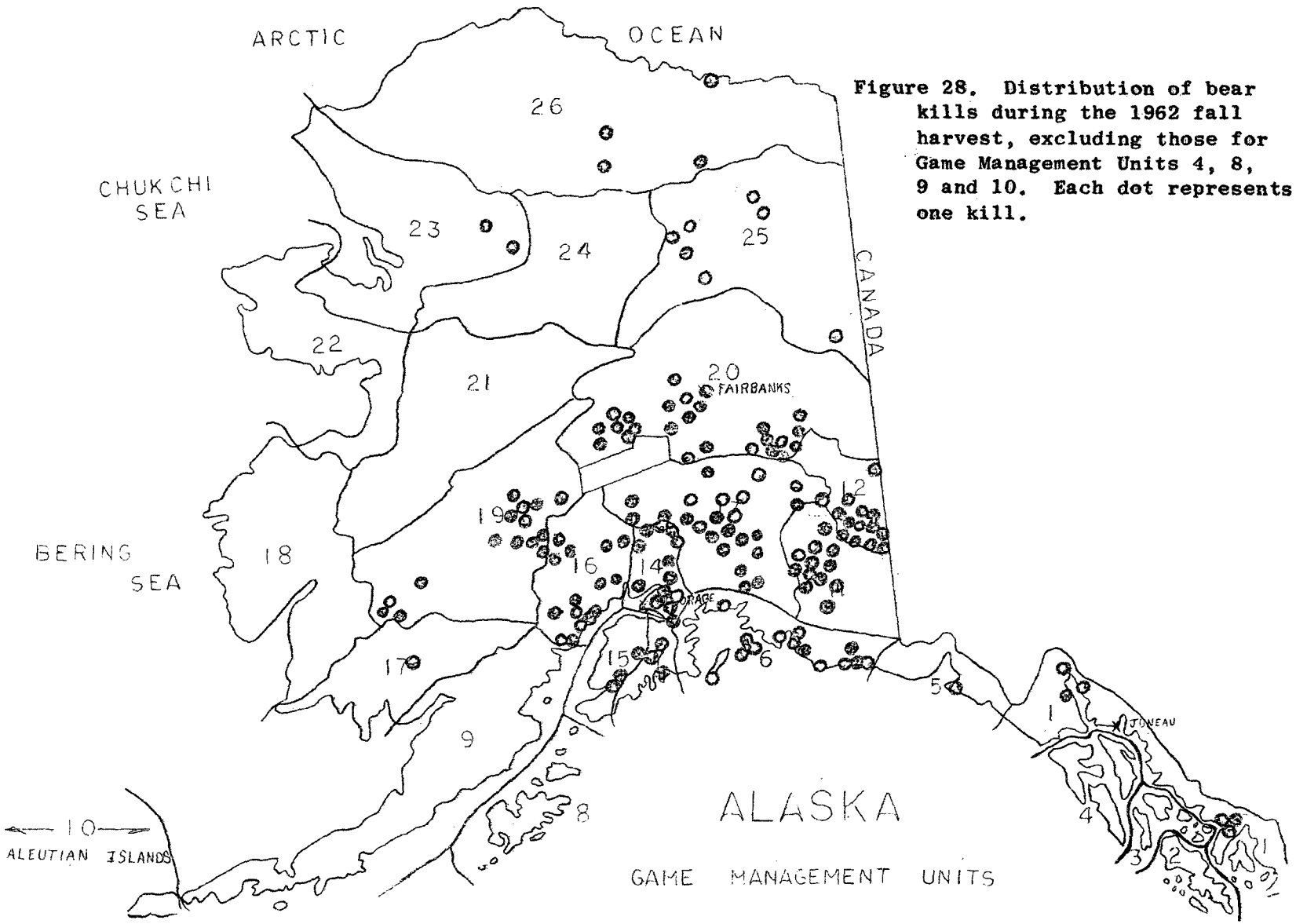


Figure 28. Distribution of bear kills during the 1962 fall harvest, excluding those for Game Management Units 4, 8, 9 and 10. Each dot represents one kill.

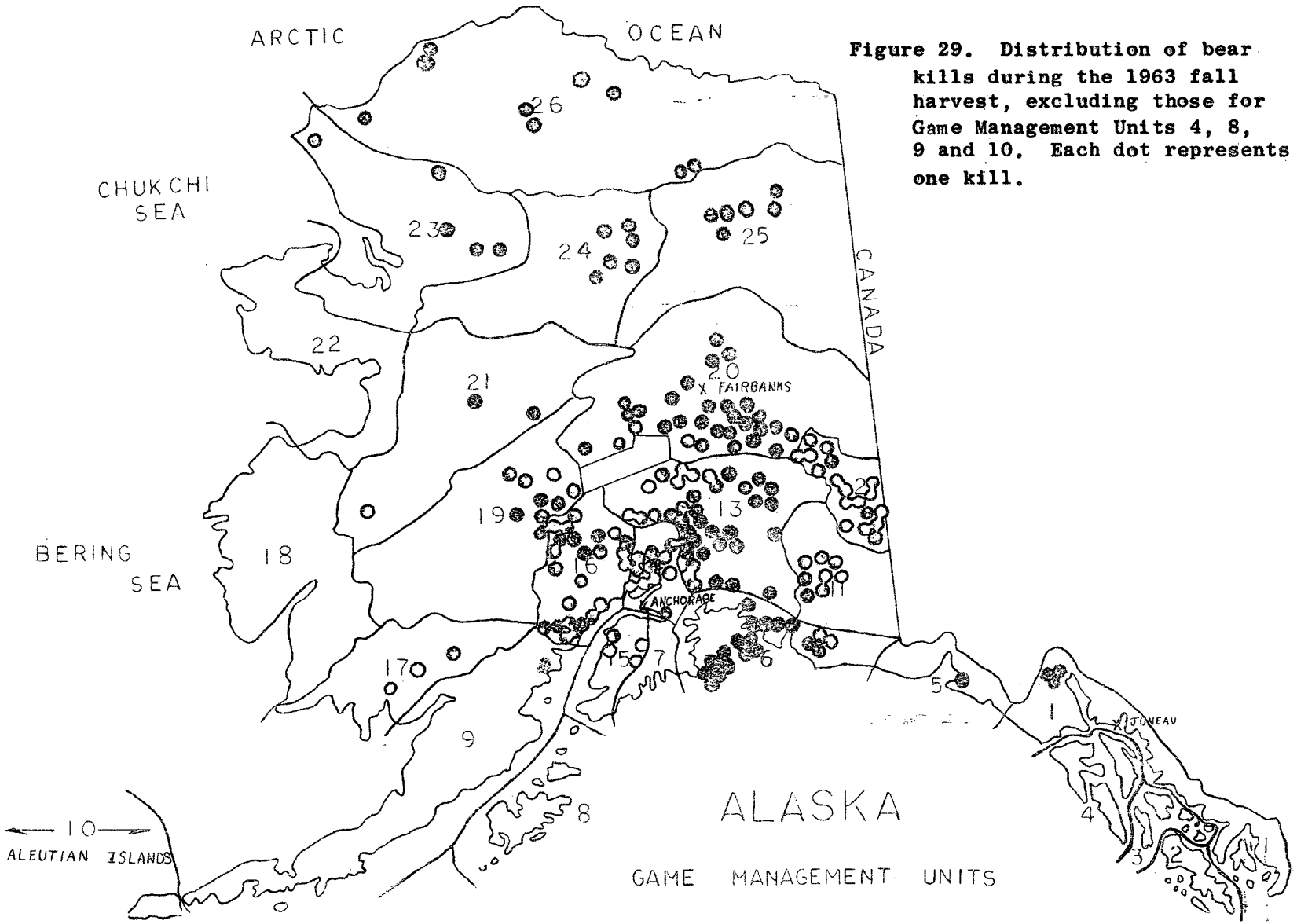


Figure 29. Distribution of bear kills during the 1963 fall harvest, excluding those for Game Management Units 4, 8, 9 and 10. Each dot represents one kill.

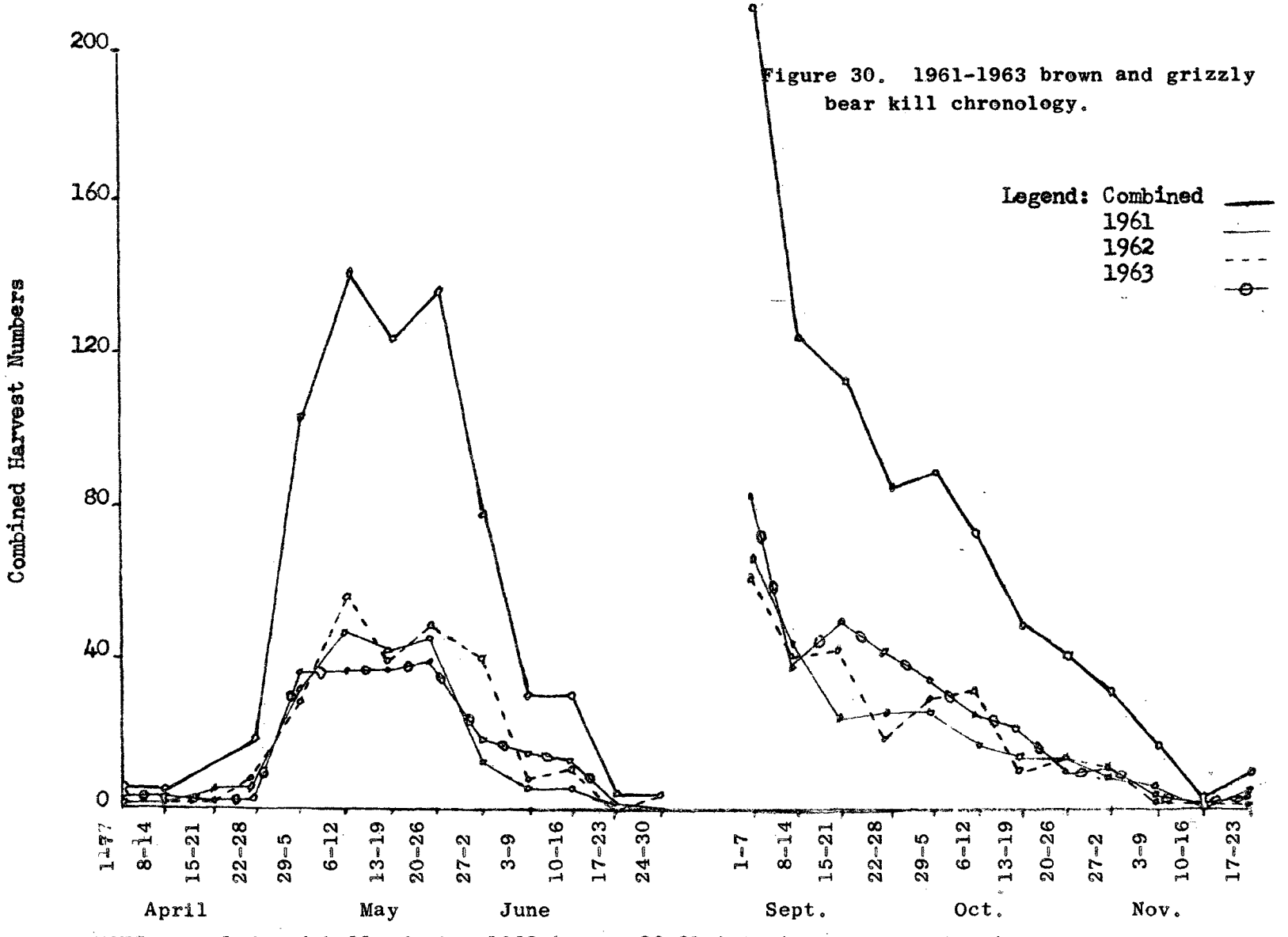


Figure 30. 1961-1963 brown and grizzly bear kill chronology.

NOTE: Excludes 4 kills during 1963 August 20-31 interior season extension.

the bulk of the spring harvest occurring in May and the heaviest kill during the fall season occurring during the first few weeks. Composite data for the years 1961 through 1963 indicate that 80 per cent of the spring kills were made in May and approximately 10 per cent during both April and June. Twenty-four per cent of the composite fall harvests were for the opening week and 51 per cent of the fall harvest occurred during the initial three weeks (Table 2). Of the 212 animals harvested during the first week of the combined fall seasons, 171 (81 per cent) were taken from the Southcentral and Interior-Arctic regions. These same two areas accounted for 79 and 76 per cent of the two and three week kill totals, respectively; comparatively, these two areas represented only 53 per cent of the total combined fall harvests (Table 2).

Hunter Residence

As indicated by sealing affidavits, non-resident hunters took about 53 per cent of the bears killed during the combined (1961-1963) period. Non-residents harvested 49 per cent of the spring kills as compared to 57 per cent for the fall kills (Table 3). Hunter success for non-residents, derived by comparing bears sealed to tag sales, was: 59 per cent for 1961, 64 per cent for 1962, 61 per cent for 1963 (Table 3) and 70 per cent for the spring seasons as compared to 58 per cent for the fall seasons. Resident hunter success could not be calculated since species tags are not required for resident hunters.

TABLE 2

THE PERCENTAGE OF BROWN AND GRIZZLY BEAR TAKEN IN EACH AREA THROUGH THE FIRST THREE WEEKS OF THE 1961-1963 FALL SEASONS

Area	September 1-7 No.	%	September 1-14 No.	%	September 1-21 No.	%	Total Fall Seasons No.	%
Southeastern	26	24	36	33	52	47	110	100
Southcentral	88	34	140	55	187	73	256	100
Kodiak-Afognak[1]	0	0	0	0	0	0	100	100
Alaska Peninsula	14	7	35	18	53	27	200	100
Interior-Arctic[2]	83	39	126	59	159	74	215	100
Unknown Area	1	25	1	25	2	50	4	
Combined All Areas	212	24	338	38	453	51	885	100
Combined Southcentral and Interior-Arctic[3]	171	81	266	79	346	76	471	53

[1]Kodiak National Wildlife Refuge opening date was October 1 but in 1962 and 1963 the remainder of the area opened September 1.

[2]Does not include 4 animals taken in Units 24 and 25 between August 20-31 in 1963.

[3]These percentages are calculated from the total harvest for each week.

TABLE 3

THE 1961-1963 BROWN AND GRIZZLY BEAR KILL BY RESIDENT AND NON-RESIDENT HUNTERS[1,2,3]

Spring	License sales			Number of Kills			Percent of Kill			Percent Success		
	1961	1962	1963	1961	1962	1963	1961	1962	1963	1961	1962	1963
Resident Hunters	--	--	--	103	134	119	48	51	55	--	--	--
Non-resident Hunters	--	162	155	112	131	97	52	49	45	--	81	63
Fall Season												
Resident Hunters	--	--	--	112	126	143	44	45	42	--	--	--
Non-resident Hunters	--	285	319	145	155	194	56	55	58	--	54	61
Both Seasons												
Resident Hunters	37,524	34,609	36,415	215	260	262	46	47	47	--	--	--
Non resident Hunters	437	447	474	257	286	291	54	53	53	59	64	61

[1]Brown and grizzly bears presented for compulsory sealing.

[2]Excludes 16 kills unidentified to residency as follows: 1961, 1; 1962, 1; and 1963, 14.

[3]Non-resident success determined from brown and grizzly bear tag sales. Non-resident license sales were as follows: 1961 - 3,940; 1962 - 3,946; and 1963 - 3,895.

As seen in Table 4, the proportion of resident and non-resident hunters who were successful varied not only between areas of the state but somewhat between seasons. Overall, the Southcentral region appeared the most stable with residents and non-residents taking about the same number of bears during both seasons. Southeastern and the Interior-Arctic areas showed a definite tendency toward heavier harvests by resident hunters for both seasons. The Kodiak-Afognak and the Alaska Peninsula regions had even a greater percentage of non-resident kills. This high percentage of harvest by non-residents is accredited to the fact that many guided hunts are booked to the coastal areas on the Alaska Peninsula and Kodiak Island by hunters seeking bears of the larger trophy size.

Guided hunter success for non-residents is also illustrated in Table 5 where the spring harvest for non-residents was 80 per cent males as compared to 60 per cent males for residents. Fall ratios were essentially the same for both resident and non-resident hunters. Although the resident hunter success could not be determined from the sealing information, these data tend to support the assumption that non-residents were generally more successful. This, of course, is related to the fact that non-residents were required to employ guides and, in addition, non-residents probably expended more time actually hunting bears.

TABLE 4

1961-63 BROWN AND GRIZZLY BEAR HARVEST BY RESIDENT AND NON-RESIDENT HUNTERS AND AREA OF KILL[1]

Area and Residency	Composite 1961-63 Kills: Spring Seasons No.	Spring Seasons Percent of area kill	Fall Seasons No.	Fall Seasons Percent of area kill	Both Seasons No.	Both Seasons Percent of area kill
Southeastern						
Res. Hunters	75	58	62	57	137	58
Non-Res. Hunters	54	42	47	43	101	42
Southcentral						
Res. Hunters	8	57	116	46	124	46
Non-Res. Hunters	6	43	138	54	144	54
Kodiak-Afognak						
Res. Hunters	125	49	20	20	145	41
Non-Res. Hunters	131	51	78	80	209	59
Alaska Peninsula						
Res. Hunters	105	43	57	29	162	37
Non-Res. Hunters	139	57	141	71	280	63
Interior & Arctic Alaska						
Res. Hunters	42	81	122	58	164	62
Non-Res. Hunters	10	19	90	42	100	38

[1]Excludes unknown areas and hunter residency.

TABLE 5

1961-1963 SEX RATIO OF BROWN AND GRIZZLY BEAR KILLED BY RESIDENT AND NON-RESIDENT HUNTERS[1]

	Spring Season		Fall Season		Both Seasons	
	Res.	Non-Res.	Res.	Non-Res.	Res.	Non-Res.
Male						
Number	246	271	203	264	449	535
Percent of kill	69	80	53	53	61	64
Female						
Number	97	64	161	216	258	280
Percent of kill	27	19	42	44	35	34

[1] Verified and unverified reports combined.

Population Characteristics

Sex Composition of the Harvest

A summary of the sex ratio reports of bears killed during the 1961 through 1963 seasons is shown in Table 6. The reports are listed as verified and unverified; verified reports are those where the sexes of bears were positively confirmed from hide examination by the "Bear Project" leader or one of two assistants. Previous examinations of hides revealed that hunters and guides sometimes reported female bears as males. No discrepancies of the opposite nature were noted.

Verified reports show spring bear kills for the years 1961-1963 to be 79, 78 and 71 per cent males, respectively. Unverified reports for the same years and season were 79, 74 and 76 per cent males. In contrast, verified reports for the fall seasons of the same years show 37, 50 and and 54 per cent to be males and 62, 64 and 62 per cent males indicated by unverified reports. Although the per cent males reported by both verified and unverified sealing officers for the composite period was the same for the spring season, the fall season verified reports showed 49 per cent males for the three years as compared to 62 per cent males indicated on the unverified reports. These data indicate that in the spring the high percentage of males in the kill tends to obviate any necessity or tendency for misrepresentation of the sex of the kill. However, the greater percentage of females in the fall kill creates a situation where females are often misrepresented as males. This is possibly due to the sealing officers failing to check for sex identifiers (i.e. teats, vaginal orifice, or penis sheath).

TABLE 6

VERIFIED AND UNVERIFIED SEX RATIO REPORTS FOR BEARS KILLED

BY HUNTERS DURING THE 1961-63 SEASONS[1]

	Number of Reports								Per Cent Males							
	Verified			Unverified					Verified				Unverified			
	61	62	63	Total 61-63	61	62	63	Total 61-63	61	62	63	Composite % 61-63	61	62	63	Composite % 61-63
Spring Season	31	96	71	198	185	169	149	503	79	78	71	76	79	74	76	76
Fall Season	104	142	176	422	153	139	168	460	37	50	54	49	62	64	62	62

[1]Excludes forms not reporting sex.

Because of the distortion in the unverified fall sex ratios, data were compiled to compare particular areas that contained the greatest percentage of verified reports, as an area check on the verified officers (Table 7). It was found that 86 per cent of all the fall verified reports for the three year period came from two areas: Southcentral and the Alaska Peninsula. During the fall periods, 343 verified reports were filed as compared to 100 unverified reports. Among the verified reports 50 per cent were males and among unverified reports 66 per cent were males. These percentages are approximately the same as those for the entire state where 49 per cent verified males and 62 per cent unverified males were reported.

Erickson (1964) speculated as to the reasons why more males are killed in the spring and females in the fall harvest. He attributed this to: (1) more selective hunting in the spring when bears were the only game animal being hunted; (2) regulations which afford protection to sows accompanied by cubs or yearlings likely affects kill sex ratios since a segment of the female populations was not subjected to hunting during either season; and (3) an additional portion of the female population was presumably subject to hunting in the fall since family breakup is believed to occur before this time but following the spring season.

Unfortunately, there are not enough consecutive data available to determine whether sex ratio trends exist in the harvest. However, the data indicates that if restrictions on kill are necessary, the fall season should be reduced first because of the greater percentage

TABLE 7

1961-1963 FALL VERIFIED AND UNVERIFIED SEX RATIOS REPORTED FOR BEARS KILLED FOR THE SOUTHCENTRAL AND THE ALASKA PENINSULA REGIONS

Area	Number of Reports		Percent Males	
	Verified	Unverified	Verified	Unverified
Southcentral	204	46	50	63
Alaska Peninsula	139	54	49	69
TOTAL	343	100	50	66

of females in the fall harvest. In addition, the sealing information illustrates the need for increased efforts to acquire more verified reports in more areas so that the most accurate sex ratios can be used for trend analysis.

Size Composition of the Kill

The mean composite hide sizes reported for bears killed during the 1961 through 1963 spring and fall seasons were 15.5 and 13.6 feet, respectively. These measurements remained essentially constant between years despite apparent regional differences (Table 8). Of all the areas, Kodiak-Afognak and the Alaska Peninsula had the largest average spring hides, 16.0 and 16.3 feet, respectively. During the fall season, the Kodiak-Afognak average rose to 16.2 feet and the Alaska Peninsula average dropped to 14.7 feet; this drop can be attributed to the fall harvest shift of sex ratios towards a greater percentage of females. As would be expected, the Southcentral and Interior-Arctic maintained the lowest hide size averages for both the spring and fall seasons.

Composite skull sizes of bears taken during the years 1961 through 1963 showed mean spring and fall season values of 24.8 and 22.3 inches, respectively. Since only the skulls of large bears were generally saved by hunters, the skull data were biased towards larger animals. A comparison of Tables 8 and 9 show a relative correlation between regional hide and skull sizes. Both the Southcentral and Interior-Arctic regions had the lowest average skull sizes for both seasons, whereas the Alaska Peninsula and Kodiak-Afognak presented the largest

TABLE 8

THE HIDE SIZES OF SEALED BROWN AND GRIZZLY BEAR TAKEN

BY HUNTERS DURING THE YEARS 1961-63

Area	Spring Season							Fall Season						
	No. of Hides			Average Size				No. of Hides			Average Size			
	61	62	63	61	62	63	61-63 Ave.	61	62	63	61	62	63	61-63 Ave.
Southeastern	41	45	36	14.8	14.5	14.2	14.5	24	39	41	13.5	14.2	13.6	13.8
Southcentral	8	3	3	12.2	14.5	14.8	13.3	83	75	89	12.7	12.6	12.6	12.6
Kodiak-Afognak	79	94	76	16.0	16.2	15.9	16.0	36	33	31	16.3	15.8	16.4	16.2
Alaska Peninsula	65	93	72	16.7	15.9	16.5	16.3	47	59	88	14.9	15.4	14.1	14.7
Interior-Arctic	11	14	24	12.5	11.8	13.3	12.7	50	66	90	12.4	12.6	12.3	12.4
Grand Total	204	251	211	15.6	15.4	15.5	15.5	240	272	339	13.7	13.8	13.4	13.6

TABLE 9

THE SKULLS SIZES OF SEALED BROWN AND GRIZZLY BEAR TAKEN

BY HUNTERS DURING THE YEARS 1961-63

Area	Spring Season							Fall Season						
	No. of Skulls			Average Size				No. of Skulls			Average Size			
	61	62	63	61	62	63	61-63 Ave.	61	62	63	61	62	63	61-63 Ave.
Southeastern	18	11	13	24.2	22.0	23.3	23.3	5	8	10	21.4	24.5	20.3	22.0
Southcentral	2	0	0	21.6	-	-	21.6	6	5	11	21.9	19.5	21.9	21.4
Kodiak-Afognak	40	55	46	23.9	24.9	24.4	24.5	12	18	16	23.7	21.7	23.4	22.8
Alaska Peninsula	33	26	39	26.0	26.6	26.8	26.4	3	11	19	21.3	25.0	24.0	24.1
Interior-Arctic	2	2	12	20.4	23.0	21.8	21.8	7	10	17	19.6	21.4	20.8	20.7
Grand Total	95	94	110	24.6	25.0	24.8	24.8	33	52	73	22.0	22.6	22.3	22.3

averages. The small skull sample and relatively large average skull sizes for the fall Alaska Peninsula harvest illustrates that only the larger skulls are brought out and possibly explains why the Peninsula showed larger average fall skull sizes than Kodiak-Afognak; the opposite was true of the average fall hide sizes. The greater selectivity for trophies, particularly males, during the spring, is further illustrated by the fact that both skull and hide measurement data show the sizes of spring killed bears to exceed fall kills.

Unfortunately, hide and skull data, as well as sex composition data, furnished by guides and hunters are subject to misrepresentation because of the tendency to exaggerate the sizes of trophies taken. Figure 31, which deals with a comparison of verified and unverified data for the same bears, illustrates the degree of hide exaggeration as being inversely proportional to the actual size of the bear. Some consideration should be given to the fact that an average of 11.7 days (Table 10) elapsed between the date of kill and the actual sealing date by a verified sealing officer. Because of this time lag there exists a possible hide shrinkage problem; a shrinkage factor cannot be determined from this data due to the influence of many variables such as temperature, humidity, hide care and condition and the effects of salting. However, the fact that the lowest per cent of exaggeration occurs when the hides are the largest indicates that some variable other than a shrinkage factor is involved.

The trend of hide and skull size could be an excellent technique for detecting changes in the size, and consequently the approximate

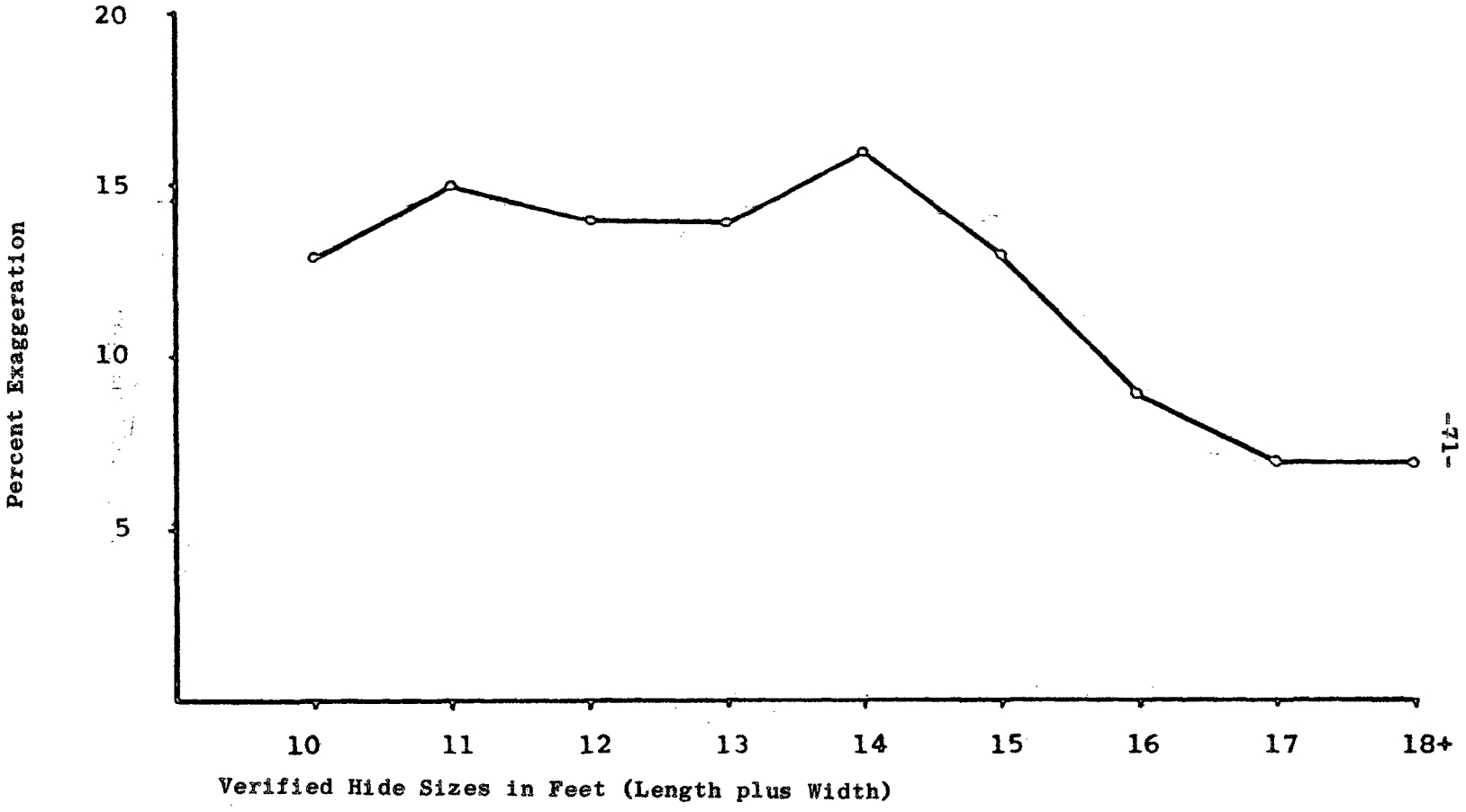


Figure 31. Composite 1961-63 brown and grizzly bear hide size exaggeration by guides and hunters.

TABLE 10

1961-1963 AVERAGE DAYS BETWEEN KILL DATE AND SEALING

DATE OF BROWN AND GRIZZLY BEAR HIDES

Season	Number of Days Between Kill and Sealing	Number of Bears	Average Days Between Kill and Sealing
1961			
Spring	283	28	10.1
Fall	1324	101	13.1
1962			
Spring	848	93	9.1
Fall			
1963			
Spring	1712	133	12.9
Fall	585	66	8.9
TOTAL	6949	592	11.7

[1]Data compiled from only verified officer reports.

age composition of the population. This assumes a correlation between age and size. Hide and skull size data, as well as sex composition data, can be considered more valuable if actually verified by sealing officers. Assuming that this was accomplished, a trend toward smaller skull and hide measurements would signify younger average kill and, therefore, more intensive harvest. Although the hide size data is believed to be biased toward larger hide sizes, except those areas with a high percentage of verified reports, it appears that for this three year period the hide size data are more accurate than the skull data. For this reason, only the hide size averages are related to the sex and area of kill (Table 11). For Southcentral Alaska and the Alaska Peninsula, only data from verified officers are used. As mentioned earlier, these areas were the ones in which the highest percentage of verified hides were sealed. The spring seasons show some variations for the three years, especially for regions like Southcentral and Interior-Arctic which sustained a low spring harvest and consequently had small sample sizes. Kodiak-Afognak and the Alaska Peninsula had the largest hide sizes for both sexes; the Kodiak-Afognak female hides were reported to be even larger than those taken on the Alaska Peninsula, and this also held for fall hides. This could be due to the fact that only those taken on the Alaska Peninsula were subject to analysis by verified reports.

The fall seasons show some major fluctuations in both female and male hide sizes. For example, the Southeastern average female hide sizes dropped from 13.7 feet in 1961 to 12.9 feet in 1963 and the

TABLE 11

1961-1963 BROWN AND GRIZZLY HIDE SIZE AS RELATED TO

SEX AND THE AREA OF HARVEST

	Spring Season						Fall Season					
	Number of Hides			Average Size			Number of Hides			Average Size		
	1961	1962	1963	1961	1962	1963	1961	1962	1963	1961	1962	1963
Southeastern												
Male	35	35	26	15.1	14.9	14.8	10	23	21	13.1	15.3	14.2
Female	6	10	7	13.2	13.4	12.5	14	13	19	13.7	13.1	12.9
Southcentral[1]												
Male	3	1	2	13.7	16.8	16.0	25	31	44	13.0	13.1	12.9
Female		2	1		13.4	12.3	44	30	25	12.5	12.0	12.1
Kodiak-Afognak												
Male	57	70	53	16.6	16.7	16.6	20	17	21	17.4	16.1	16.5
Female	22	24	23	14.5	15.0	14.3	16	16	9	14.8	15.6	16.3
Alaska Peninsula[1]												
Male	15	54	26	18.0	16.5	17.2	9	25	33	16.1	16.8	15.0
Female	5	16	11	13.7	13.1	13.6	6	25	40	13.4	13.9	13.2
Interior-Arctic												
Male	9	8	13	12.7	12.6	13.7	27	41	52	12.7	12.9	12.8
Female	2	5	9	11.6	10.9	12.4	20	25	30	11.8	12.1	11.7

[1] Data compiled from only verified reports.

average male hide sizes rose from 13.1 feet in 1961 to 14.2 feet in 1963. No reason can be formulated for these changes since few verified sex and hide measurements were available for this region. These changes might be due to some misrepresentation of sex on the sealing forms by unverified officers. On Kodiak-Afognak the opposite was true where the average male hide sizes went from 17.4 feet in 1961 to 16.1 feet in 1962 and to 16.5 feet in 1963; the average female hide sizes for 1961, 1962 and 1963 were 14.8 feet, 15.6 feet and 16.3 feet, respectively. In comparison, the Alaska Peninsula average male hide sizes for 1961, 1962 and 1963 were 16.1, 16.8 and 15.0 feet, respectively. The drop in average male hide sizes for Kodiak-Afognak and the Alaska Peninsula and the rise in the Kodiak-Afognak average female hide sizes is unexplainable at present. The Kodiak-Afognak data could be biased by sealing officer misrepresentation of sex but on the Alaska Peninsula this isn't the case as only verified sealing officer data were used. The drop in average male hide sizes on the Peninsula will be discussed below. The most reasonable conclusion is that there is not enough consecutive data available to determine true trends in hide sizes for each sex. This seems to be true for both seasons.

The decrease in Alaska Peninsula male fall hide sizes in 1963 is believed to be partially due to the 1963 regulation restricting use of aircraft. This was briefly mentioned in the "Kill Distribution" section where it was noticed that the Port Heiden and Chignik-Black Lakes area of the Peninsula sustained fairly concentrated hunting pressure. An examination of the harvest data (verified and unverified

reports combined for larger sample) showed that of the 15 males found to have been killed in this area, the average hide size was only 14.1 feet or .9 foot less than the mean for the Peninsula that fall. This is .6 of a foot less than the three year fall average for both sexes combined (Table 8). Out of the 17 females that were taken in the same area, the average was 14.0 feet or .8 above the fall mean female hide size for the Peninsula. It would be adviseable to maintain a close watch on the future spring and fall kills and compare them to the 1963 data. Should the male hide size averages continue to decrease, and possibly the female hide sizes too, a seasonal restriction might have to be incorporated for this one area. More than likely the guides and hunters will move, however, in search of larger trophy bear.

Hide Quality

The most important aspect of brown and grizzly bear hunting is probably for the trophy value, so some emphasis was placed in the sealing program on determining hide quality (color of hide and rubbed pelt percentages). The objective was to determine what regions and seasons produced the best hides and possibly the selectivity of hunters for better quality hides.

The coat color of the brown and grizzly bears is highly variable but as a general rule, coastal forms are uniformly medium to dark brown in color, whereas interior bear appear more frequently mottled in color. Occasional specimens are creamy white (Erickson 1964).

Table 12 presents a breakdown of the coat colors of a sample of

TABLE 12

PELT COLORS OF BROWN AND GRIZZLY BEARS KILLED IN ALASKA BY HUNTERS DURING THE 1961 AND 1962 SEASONS[1,2]

Area	Pelt Color: Blond No.	Blond Percent for Area	Light Brown No.	Light Brown Percent for Area	Med. Brown No.	Med. Brown Percent for Area	Chocolate No.	Chocolate Percent for Area	Total No.	Total Percent for Area
S. E. Alaska	3	2	22	14	43	28	88	56	156	100
S. C. Alaska	23	13	36	21	54	31	60	35	173	100
Kodiak-Afognak Is.	15	6	37	15	88	36	106	43	246	100
Alaska Peninsula	27	10	55	20	92	33	103	37	277	100
Interior & Arctic Alaska	30	21	32	22	46	32	35	25	143	100
TOTALS	98	10	182	18	323	33	392	39	995	100

[1]As determined by sealing officers.

[2]Excludes kills of unidentified area or color.

bear taken by hunters during the 1961 and 1962 seasons. As is apparent from these data, coat color is quite variable throughout the state although bears from Southeastern Alaska are generally darker than those from other areas.

It appears that pelt colors tend to vary according to age (Erickson 1964) (Table 13), season of year and sex, with males tending to be darker than females (Table 14). Erickson also stated that pelt colors tend to fade from the new coat in the fall to the time of shedding the following spring. Smaller bears (younger age classes) tend to be lighter in color than the older animals. This is particularly true for males which also attain a greater size than females.

Of particular interest to management is the hide condition with respect to the shedding period and whether hides are rubbed. Hides which were in poor condition and extensively rubbed have prompted some hunters to salvage only capes (head and shoulder of pelt). As seen in Table 15, 31 per cent of the bears taken by hunters in the spring hunting season of 1961, 1962 and 1963 showed rubbed areas as compared to only 6 per cent among fall kills. The greatest proportion of rubbed hides were for Southeastern Alaska where almost half were appreciably disfigured. This could be due to the earlier spring and generally warmer weather which might contribute to an earlier initiation of the shedding period. A cursory examination of the data indicates that rubbed hides occur through the entire spring season which suggests that shedding begins before bears leave their winter dens.

In the spring there was a slightly higher percentage of rubbed

TABLE 13

1961 AND 1962 BROWN AND GRIZZLY PELT COLOR OF

HUNTER KILLS BY TOTAL HIDE SIZE[1,2,3]

	Hide Size															
	8'-9.9'		10'-11.9'		12'-13.9'		14'-15.9'		16'-17.9'		18'-19.9'		20'+		Total	
Pelt Color	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Blond	4	4	38	41	29	31	17	18	3	3	2	2	1	1	94	100
Lt. Brown	4	2	36	21	61	34	37	21	26	15	10	6	1	1	175	100
Med. Brown	5	2	52	17	74	24	69	22	70	23	31	10	7	2	308	100
Chocolate	0	0	36	10	89	24	87	23	95	26	45	12	20	5	372	100

[1]Total hide size equals length plus width plus flap (Figure 3).

[2]Data compiled by two-foot intervals.

[3]Excludes forms not reporting hide sizes or pelt color.

TABLE 14

1961 AND 1962 BROWN AND GRIZZLY PELT COLORS AS RELATED TO SEASON AND SEX OF KILL[1]

Season and Sex	Blond		Lt. Brown		Med. Brown		Chocolate		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Spring										
Male	22	6	64	18	127	35	148	41	361	100
Female	25	24	30	28	28	26	23	22	106	100
Subtotal	47	10	94	20	155	33	171	37	467	100
Fall										
Male	17	6	25	9	96	35	140	50	278	100
Female	32	13	59	25	68	29	77	33	236	100
Subtotal	49	10	84	16	164	32	217	42	514	100
Total										
Male	39	6	89	14	223	35	288	45	639	100
Female	57	17	89	26	96	28	100	29	342	100
Total	96	10	178	18	319	32	388	40	981	100

[1] Excludes kills of unidentified sex or color.

TABLE 15

THE PELT CONDITION OF SEALED BEAR HIDES[1,2]

Spring Season

Area	Number of Hides Examined	Percent Rubbed
Southeastern	127	50
Southcentral	14	43
Kodiak-Afognak	258	29
Alaska Peninsula	242	26
Interior-Arctic	52	10
TOTAL	693	31

Fall Season

Area	Number of Hides Examined	Percent Rubbed
Southeastern	100	10
Southcentral	250	6
Kodiak-Afognak	98	8
Alaska Peninsula	194	6
Interior-Arctic	206	4
TOTAL	848	6

[1]As determined by sealing officers for the years 1961, 1962 and 1963.

[2]Excludes kills unidentified to area, season or rubbed areas.

males harvested in comparison to rubbed females (Table 16). The difference cannot be directly accounted for except for a possible preference of hunters for larger bear consisting of a greater percentage of males. Smaller bear were apparently taken only when the pelt was in good condition, and the smaller age classes would, of course, contain a greater percentage of females.

During the 1961 and 1962 period, sealing officers were requested to sketch the areas of the hide being rubbed. Hides could be rubbed in one or more of the following areas of the pelt: (1) head and shoulder; (2) back; (3) rump; or (4) flank (Figure 32). A summary of these data (Table 17) indicates equal distribution of rubbed areas for males but a tendency for females to be rubbed on the rump and flank. The reason for this difference is unknown but a possible explanation might well be that the rubbed areas on the rump area of females are the result of some pre-mating activity in the spring.

Data were compiled for the composite period to determine whether rubbed pelts occurred more often in any single size class. Although there appeared to be slight variations in the percentage occurrence of rubbed areas by size, the differences were too slight to indicate any definite conclusions (Table 18).

Regulation Changes

During the initial three year period of the sealing program, there were very few changes in the hunting regulations for bears other than minor Unit boundary changes and the restriction of aircraft use on the

TABLE 16

1961-1963 BROWN AND GRIZZLY RUBBED HIDE

FREQUENCY BY SEASON AND SEX[1]

Season and Sex	Number of Hides Examined	% Rubbed
Spring		
Male	519	31
Female	158	25
Fall		
Male	461	7
Female	361	6
Total		
Male	980	20
Female	519	12

[1]Excludes reports which did not indicate rubbed or unrubbed.

TABLE 17

RUBBED AREAS OF BROWN AND GRIZZLY BEAR HIDES AS RELATED TO SEX AND SEASON DURING THE YEARS 1961 AND 1962[1,2]

Season and Sex	Area Rubbed: Head-Shoulder No.	%	Back No.	%	Rump No.	%	Flank No.	%	Totals No.	%
Spring										
Male	40	24	41	24	48	29	38	23	167	100
Female	5	14	6	16	17	46	9	24	37	100
Fall										
Male	2	13	4	25	5	31	5	31	16	100
Female	2	19	3	27	3	27	3	27	11	100
Total										
Male	42	23	45	25	53	29	29	43	183	100
Female	7	14	9	19	20	42	42	12	48	100

[1] More than one area of the hide could be indicated as rubbed.

[2] Refer to Figure 32.

TABLE 18

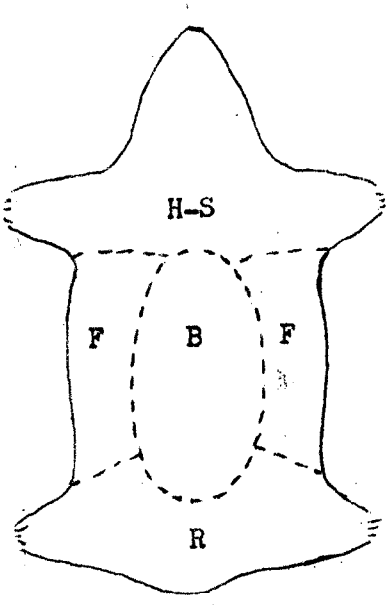
1961-1963 BROWN AND GRIZZLY BEAR PELT CONDITIONS AS RELATED TO HIDE SIZE[1,2,3]

	Hide Size													
	8'-9.9'		10'-11.9'		12'-13.9'		14'-15.9'		16'-17.9'		18'-19.9'		20'+	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Spring														
Rubbed	1	25	12	21	40	30	46	28	63	38	24	23	9	26
Unrubbed	3	75	44	79	92	70	119	72	102	62	80	77	25	74
Total	4	100	56	100	132	100	165	100	165	100	104	100	34	100
Fall														
Rubbed	0	0	9	4	14	5	15	8	8	8	3	9	1	14
Unrubbed	23	100	194	96	256	95	171	92	97	92	30	91	6	86
Total	23	100	203	100	270	100	186	100	105	100	33	100	7	100

[1]Total hide size equals length plus width plus flap (Figure 3).

[2]Data compiled by two foot intervals.

[3]Excludes forms not reporting hide sizes and rubbed or unrubbed.



Legend: H-S = Head and Shoulder

B = Back

F = Flank

R = Rump

Figure 32. Designated brown and grizzly bear hide breakdown for pelt areas.

Alaska Peninsula which has already been discussed. Several Game Management Unit season changes did occur and the resulting harvest data were evaluated accordingly.

Unit 9 - In 1961 the northern portion of this Unit (9A Figure 21) had a season which opened September 10, whereas, the southern portion (9B) opened on October 1. In 1962 the northern area was enlarged as seen in Figure 22 but the opening dates remained the same. In 1963 the season opened on September 1 for the entire Unit.

The harvest was 51, 61 and 88 during the years 1961, 1962 and 1963, respectively (Table 1). The increase in area 9A in 1962 caused very little change in the September harvest. In 1961 20 bears were killed and in 1962 there were 25 harvested. The 1963 earlier opening resulted in a kill of 41 September animals. The September harvest represented 40, 41 and 47 per cent of the total fall harvests during the years 1961, 1962 and 1963, respectively. The increase in 1963 is understandable because of the increased length in season and earlier openings.

Figures 21, 22 and 23 show the general fall kill distribution for the Alaska Peninsula for years 1961, 1962 and 1963, respectively. Of the total plotted kills (51) in 1961, 19 (37 per cent) were taken in area 9A. In 1962 the total plotted kill was 59 of which 29 (49 per cent) were taken in area 9A; this shows an increase in harvest possibly due to an enlargement of the area and/or an increase in hunting pressure.

The 1963 earlier opening date for the entire Unit resulted in an increase for September of 16 kills over the same month in 1962. It should be kept in mind that the Unit 9 fall harvest increased by 27

animals between the two years. The portion of the Peninsula referred to as 9A in 1962 opened 9 days earlier in 1963 and 30 days earlier for area 9B. In 1962 the average harvest per day (20 days) in September was 1.2 animals and the average per day in 1963 was 1.4 animals (30 days) for the same month. The point illustrated is that even though in 1963 there was about twice the area available for September hunting and both 9A and 9B had earlier openings, the daily average kill for the month only increased by 17 per cent.

It appears that the increased area sizes and earlier openings were responsible in part for an increase in harvest for Unit 9. The fact that the over-all seasonal harvest did increase indicates that additional hunting pressure was also involved and not just a shift in pressure to the earlier opening. Whether or not the increased length of season detrimentally affected the Peninsula population is not determined but the opinion expressed here is that it did not. However, as mentioned previously, there were concentrations of kills during this season on the Peninsula (Figure 23), due possibly to the new regulation limiting use of aircraft.

Unit 10 - The 1963 regulations changed the opening date from October 1 to September 1. There was no increase in harvest.

Units 23 and 26 - The 1962 spring season was altered from May 15 through June 15 to May 1 through June 15 and the 1963 fall season opening date was moved up from September 1 to August 20. There was no appreciable change in harvest (Table 4).

Units 24 and 25 - The 1963 spring season was changed from May 15 through June 15 to May 1 through June 15 and the 1963 fall season opening date was set at August 20 instead of September 1. The change in the harvests were negligible (Table 4).

MANAGEMENT

There is considerable difficulty in evaluating the management, both past and present, of a renewable resource like the Alaskan brown and grizzly bear. Except for those affecting the established refuges, national monuments and parks, policies and objectives for federal wildlife management in the territory were generally undocumented. The relatively short period of state control appears to have provided some improvement. There is definitely a need for long range planning and cooperative state and federal studies to meet a common goal--the perpetuation of the species in the best interest of mankind and the state.

As was mentioned previously, Alaska's bear management objectives appear to be directed toward trophy bear management; the present needs dictate emphasis on a more detailed state-wide harvest information program than was used under federal control. Attainment of this objective required more detailed information. This led to the initiation of the bear sealing program as one way to acquire this information. It is apparent that future management of brown and grizzly bear in Alaska will depend heavily on this program to provide most of the required harvest data.

Use of Sealing Program

In evaluating the use of the sealing program data for present and future management purposes, there are several points that should be kept in mind: (1) the primary emphasis is on harvest analysis; (2) the program data are evaluated to determine the effects of legal harvest on the population structure (i.e. the percentage trends of

sex ratios and average skull and hide sizes); (3) hunting pressure cannot be determined except by relative trends in area harvests; (4) there are bound to be fluctuations in year to year data and the more consecutive data that are available the more accurately trends can be analyzed; (5) the program is relatively new and can probably be further improved; and (6) Alaska is a large state with limited personnel and funds.

There are several important assumptions which need to be recognized before the data are interpreted. The illegal harvest, protection of life and property kills and bears taken for food are assumed to comprise a lower percentage of the total take for most areas than the legal harvest. This would be especially true on Kodiak Island and the Alaska Peninsula. For example, Kodiak Island probably sustains one of the largest kills other than hunter harvests and Troyer (1961) estimated that altogether these kills probably comprise about 30-45 animals. Of these, the defense of life and property kills on the cattle leases probably make up the greatest per cent for most years. On the Alaska Peninsula Erickson and Rausch (1962) estimated that the non-sport human induced mortality most likely did not exceed 20 per cent of the annual sport kill, which at this time was only about 50 animals per year.

In areas such as the Interior-Arctic, where the sealing program showed relatively few animals were taken, the non-sport kills might be larger than the harvests by sport hunters; however, the assumption here is that these kills are not significantly affecting the overall

population. This does not mean that there is no need for evaluating the illegal or non-sport kill. On the contrary, enforcement agents and biologists should make every effort to obtain this information. It would certainly enhance the management of the species, especially if illegal kills and other similar mortalities could be reduced. The most critical effect of an unknown non-sporting harvest would be in an area where the total kill was approaching the sustained yield of an area.

The effectiveness of the sealing program can be strengthened in the Interior-Arctic Units with an increase in personnel and regularly scheduled trips to outlying native villages. Tardy reports and unknown kills from these areas could be influential in biasing harvest data, especially if future kills rise to a point where close management is necessary to maintain a population of grizzly bear. At present, over-harvest does not appear to be a problem but every effort should be made to improve the sealing program before hunting pressure becomes heavy.

Size and Distribution of Harvest

Knowing the distribution and size of harvests is of particular importance to bear management since shifts in hunting pressure can be detected and areas of possible under or over harvests can be located and seasons adjusted accordingly. For example, an examination of Table 1 indicates that hunting pressure has increased on the Alaska Peninsula whereas Kodiak Island harvests have been reduced. The

increased harvest on the Peninsula has not altered the hide sizes (Table 8) which indicates that large animals are still available for harvest. On the other hand, if Figures 21, 22 and 23 are examined, there appears to be several localized harvest areas, due possibly to hunter accessibility. It is possible that these areas may be over harvested locally but should this occur the guides and hunters would probably move their bases of operation in search of larger trophy animals. Thus, the hunting pressure would be self controlling as long as other areas are available. However, in the future it would be adviseable to check this assumption by watching the trend in hide sizes for these heavily hunted areas.

In the Interior-Arctic region, the 1961 through 1963 period of kill of grizzly bears was 64, 85 and 119, respectively (Table 1). The increase suggests that the population was either increasing or there was an increase in hunter effort or success. Hunter license sales (Table 3) have remained fairly constant and non-resident grizzly tag sales have only increased from 437 in 1961 to 474 in 1963. Erickson (1964) postulated that the population was on an increase due to the 1959 termination of the predator control program in this area. However, care should be taken in this instance in assuming a population increase. An examination of the data shows that non-resident kills have increased, possibly due to area shifts in hunting pressure. Resident kills have also increased, possibly due to a gradual increase in efficiency in the program for detecting native kills or area shifts may have occurred in resident hunting pressure.

Comparison to Hunter Questionnaire

The possibility of area shifts in hunting pressure or the increased efficiency of the sealing program as an explanation for harvest data changes is further supported by a comparison of the 1961 sealing program data to those obtained by a 1961 state-wide hunter questionnaire survey (Courtright 1964). This study consisted of sampling every seventh resident full fee license application or file in the Juneau office of the Alaska Department of Fish and Game licensing division. A total of 5000 license holders was sampled. An initial questionnaire was mailed and a reminder followed for those who failed to answer. A return of 76 per cent resulted from these two mailings and a total 1961 game harvest was computed.

The estimated total resident brown and grizzly bear harvest from the questionnaire was 363 animals as compared to 215 indicated by the sealing program, an error of 69 per cent. In contrast, the hunter questionnaire was very accurate on sheep harvest estimates with a questionnaire estimate of 637 as compared to 666 sheep indicated killed by the sheep harvest tickets, an error of only 3 per cent. The harvest tickets were believed to be fairly complete because of the fact that all persons wishing to hunt sheep were required to make a report as to whether he was successful or not. On the other hand, the polar bear harvest estimated by the questionnaire method was 30 killed by residents whereas the sealing program indicated that 81 were taken.

There appears to be some doubt as to the accuracy of the questionnaire survey when dealing with smaller harvest figures. This doubt seems reasonable when the survey data are examined further. The questionnaire method showed that 89 per cent of the brown and grizzly bear kill were males and 80 per cent of the polar bear take were males. The sealing program showed about 63 per cent males for brown and grizzly bears and 56 per cent males for polar bear harvested by residents. This suggests that a possible bias is introduced in the survey either because males may be more readily reported than females, or because some females are reported as males.

The greatest harvest discrepancies between the hunter questionnaire and the sealing program occurred in Game Management Units 17, 20, 23 and 25. These areas are fairly inaccessible and only Unit 20 sustains a moderately large harvest. Because both programs were in their first years, their reliability is still open to question and improvement.

Chronology of Kill

Chronology of kill also provides valuable information to consider when adjusting hunting season dates. Data collected by the sealing program (Figure 30) shows that the bulk of the fall kill occurs at the beginning of the fall season, apparently due to the taking of bears incidental to other hunting. Should a reduction in the kill be in order, the initial portion of the fall season should be considered first because of the preponderance of females, the largest

percentage of the kill occurs during the first three weeks (Table 2) and because consideration should be given to hunters primarily hunting bear. However, further examination of the Fish and Game Department brown and grizzly bear tag sales files would be in order to determine what percentage of non-residents purchase multiple tags for early fall hunting. It is one objective of management to maximize the income from non-resident hunters.

Sex and age data should be correlated with the kill chronology information to provide a better basis for evaluating the harvest. For instance, Table 5 shows a preponderance of males in the spring harvest and almost a 50-50 ratio in the fall kill. This supports the conclusion that any necessary reductions in season should first be applied to the fall, to minimize the kill of females.

Hunter Residency

Hunter residency data provides little information useful for bear season adjustments; however, comparitive non-resident success can be determined by relating number of bears killed to tag sales. Because guides were required for all non-residents during the 1961-1963 period, the number of guided successful non-residents was easy to obtain. However, residents as well as non-residents employed guides and the design of the sealing program was not such that all guided hunters could be separated from non-guided ones. It might be adviseable to include a section on the sealing form which would indicate whether a guide was utilized or not. This information

could prove useful in formulating management recommendations. For example, an area which is utilized heavily by the more successful guides might have to be managed differently than an area where a greater percentage of kills are by residents primarily hunting other game.

Data on hunter residency and guided hunts also prove valuable when economics is considered. Average bear hunting costs for non-residents and residents can be ascertained and used to estimate an annual economic value for the bear harvested.

Sex and Age Composition

The use of the harvest sex composition data for management purposes was mentioned in some detail earlier, primarily in relation to regulating the harvest toward the male segment of the population should over-harvest occur and also for determining the possible effects of hunting on the population. The main recommendation has been for the continued segregation of the data, wherever possible, by verified and unverified sealing officers, especially for the fall season. This not only gives more accurate sex ratios in heavily harvested regions but it indicates what areas need the most attention from the administration for increasing sealing program efficiency.

The sealing program was not initially designed to provide age data but the assumption was that hide sizes and age for the same sex and area would be directly related. The adoption of a regulation requiring that skulls be presented with the hides for sealing has been suggested; this would greatly improve management. Such a regulation

would be valuable for enforcing the protection of cubs and yearling bears since these classes are readily identified by tooth replacement (Erickson 1964). Of course, great benefit would accrue from the accurate assessment of the size and age structure of bears in the harvest. Rausch (1963) and Mundy (1962) indicate that aging bear from tooth sections is possible, so that much could be gained by requiring skulls to be turned in when hides are sealed. However, it is doubtful that hunters would be willing to sacrifice teeth from the skull of a trophy animal.

There is a possibility that if the mandatory presentation of skulls went into affect a combined three dimensional measurement (length plus width plus depth) might be used as an age index (Erickson 1964). Neiland and Siniff (Cited by Erickson 1964) demonstrated that for the wolf a two dimensional (length plus width) measurement of the skulls was markedly less reliable than the three dimensional system. This procedure is recommended until an even more precise aging technique is developed.

Pelt Quality

Pelt quality is also an important management consideration. Troyer (1961) mentioned that spring Kodiak pelts were often preferred because of the longer fur. HOwever, the sealing program data indicated a heavier degree of rubbing for spring hides than for fall hides. Obviously, from the standpoint of rubbed hides, the fall pelts should be favored. Unfortunately, this recommendation runs counter to that

suggested on the basis of sex ratios where fall seasons would be reduced in the event of over-harvest. Of course, if over-harvest is a possibility, then hide quality should be a secondary consideration to achieving a more desired sex ratio in the population.

Coat color data, discontinued after the first two years of the sealing program, offers very little information relative to the management of the species, although it is interesting to note the preponderance of darker animals along the coastal areas and the variation in pelt colors from the same region. Erickson (1964) mentioned that several color variants may occur in the same litter. An interesting point which does not yet appear to have been investigated is the survival of bear in relation to coat colors.

Assessing Effects of Regulation Changes

As illustrated in the section on results, the sealing program has proved valuable in ascertaining the effects of annual regulation changes on the harvest. This information can also be plotted and accurate records kept as the season progresses. This would provide information necessary for regulation changes within the season if these were to prove necessary.

The use of the sealing program for evaluating season extensions was also demonstrated for Game Management Units 9, 10, 23, 24 and 26. Particular emphasis was placed on Unit 9 where season extensions appeared to have little effect on the harvest. Special consideration will have to be given to the use of seasonal adjustments to regulate

harvest in areas like the Alaska Peninsula and Kodiak-Afognak. Harvests in these areas were probably the least influenced by the taking of bear incidental to other hunting. Because of the high percentage of non-resident kills in these areas (Table 6), the assumption is that at least half of the hunts were guided due to the mandatory non-resident guide requirement. This high percentage of guided hunts may present a problem in management. Should it be decided that harvest restrictions become necessary, there exists the possibility that length of season restrictions may be ineffective in reducing the total kill due to a proportional increase in hunting pressure during the remaining season. It is, therefore, possible that an increased number of guides could maintain a harvest figure despite length-of-season restrictions. However, it should be pointed out that later fall openings on the previous mentioned areas could place the hunting season well into the late fall where inclement weather might affect the hunter success. Because of these factors, the administration may have to consider setting maximum harvest figures prior to the season or to use permits to control the take. The sealing program would prove invaluable for determining within-season harvests.

Other Considerations

The sealing program serves another function not previously mentioned which is pertinent to the management of brown and grizzly bears in Alaska. Good public relations can be established between the Fish and Game Department and the guides and hunters provided that due con-

sideration is given to the public. This continual contact between the Fish and Game Department personnel and guides and hunters provides the opportunity to answer questions pertaining to the program and the [illegible] species. In addition, good public relations can enhance the effectiveness of the program by providing a contact for the biologist where other biological information can be obtained. In the past, for example, specimen material such as reproductive tracts, claws, and skulls have been obtained from the hunting public.

Sustained Yield

Before any management plan can be formulated, there must be some decisions made relating to the objectives of the management. In the case of bear, a management policy should be established concerning whether bear are to be managed for large trophies intended for a lucky few or on a greater yield and population turnover rate with more bear for more hunters. The latter appears to be reasonable for several reasons: (1) in the future, any brown or grizzly bear will be a trophy regardless of size, which can be expected to decrease with the reduction in older age classes, so there will be little loss in trophy prestige; (2) the greatest economic value will probably be realized only when the maximum potential harvest is maintained; and (3) Erickson (1964) mentioned that a population dominated by older age classes may serve as a population depressant through physical strife and decreased productivity.

It would be practically impossible with the information available

to determine what a maximum sustained yield harvest might be for any one area and, of course, the population densities vary from region to region. However, studies on Kodiak Island (Troyer 1961 and 1962) have provided the most information to-date on a population structure (Karluk Lake drainage). The Kodiak harvest probably is the closest to a sustained yield in the state. Troyer found in the Karluk Lake study area that the average yearly hunting mortality was about 12 per cent of the population with little significant alterations in the population structure. Erickson (1965) suggested that black bear may be exploited at approximately a 20 per cent level on a sustained basis.

Unfortunately, much information is still needed on movement, breeding, annual increment, population density, age structure and effects of hunting on the population before a definite annual harvest can be predicted and controlled. Until this information is available, the management of the species is mainly dependent on the analysis of harvest data, which is the mandatory sealing program. For all practical purposes, the species does not lend itself to population assessments along the lines of ungulate populations. The assessments in the past have been generally limited to aerial surveys of drainages and areas of seasonal concentrations (e.g. along salmon streams). This technique is not only expensive but has proven to be a very unreliable index because of the many variables concerned. On the other hand the sealing program provides an excellent procedure for obtaining harvest information because the number of animals taken each year is relatively small, so administering the program is practicable.

The sealing program, if properly administered, possesses the potential for accurate assessment of the harvest and for providing data necessary for subsequent recommendations for season adjustments and regulation changes. For example, the trends in harvest data can be assessed relative to the sex and size composition of bears taken to determine whether the exploitation rates are altering the population structure. Initially, increased exploitation rates can be expected to depress average skull and hide sizes. The question then arises as to the degree the older aged portion of the population can be harvested without seriously over-harvesting the resource.

Assuming that a policy was established to maintain a maximum harvest and high population turnover rate, there appear to be two management approaches to this objective. This, of course, is in lieu of research information adequate for making sustained yield management a reality. Until adequate information on aging and population dynamics is available, the sealing program should be utilized and improved to provide the best possible substitute data. With what information is available it seems that the management of brown and grizzly bears must continue on the basis of experimental and conservative management. As Erickson (1964) mentioned, the bear should not be considered a fragile animal in need of complete protection. On the other hand, if there is a reasonable doubt expressed by the administration as to whether or not a particular population is being over-harvested, it seems sensible to exercise some caution in extending seasons and increasing harvests which might prove to be detrimental to the bear population as a whole.

Troyer (1962) proposed the manipulation of harvests to determine the affects of humting on the Kodiak population. This type of experimental management is strongly advocated here, especially for areas like Kodiak Island which can be closely managed. Season adjustments like those mentioned in the "Regulation Changes" section can be made and the resulting average hide size and sex ratio changes analyzed to determine the affects of the adjustments on the population. It should be emphasized that decreased average hide and skull sizes would not necessarily dicate a need for restrictions on take. A population that was managed on a sustained yield basis with a maximum population turnover rate would produce a smaller average hide size in the harvest than is now being taken on the large trophy male basis. However, trends towards continually smaller average sizes and a greater percentage of females in the harvest might be an indication of overharvest.

Land-Use and Economics

The most significant influences on bear management in Alaska have been and most likely will continue to be land-use conflicts. Rapidly expanding human populations and the resulting economic growth have altered the priority use of much land formerly considered bear habitat. Areas like the Kenai Peninsula, Matanuska Valley, the Tanana Valley and areas surrounding towns and cities have already established higher priorities for human populations than bears. In addition, logging industries have expanded in Southeast Alaska; the cattle industry has become permanently established on Kodiak Island; and oil and mineral

resources are now beginning to be utilized.

Brown and grizzly bear also deserve due consideration with regard to land-use priorities, for scientific and esthetic reasons as well as the economic value of the hunting resource. When considering guiding fees ranging from $750 to $1500 per bear (Klein, et.al. 1958), additional transportation costs, game tags ($75), equipment, taxidermy expenses ($250 to $1500 per bear) and miscellaneous spending by hunters, the present total value to Alaska of each successful guided hunt is approximately $1500 to $2000. Since 1960 about 275 non-resident guided hunts have been successful annually; if this is combined with both guided and non-guided successful resident hunters (about 250 total annually) and unsuccessful non-resident and resident hunters, the total economic value alone would be well over half a million dollars annually.

Unfortunately, the esthetic and economic value of bear habitat has not always been considered when land-use conflicts have arisen. Hopefully, past experiences will be considered when dealing with similar problems in the future, especially when two resources are relatively incompatible. The Alaska Peninsula, for example, has recently attracted the attention of stockmen and lease applications have already been filed with the Bureau of Land Management. Although there have been no leases given as yet, the establishment of cattle and/or sheep on the Peninsula seems imminent, providing attempts are not made to establish a higher priority use for this area (e.g. for wildlife). Raising livestock on the Alaska Peninsula would undoubtedly

prove to be as detrimental to the brown bear as it has on Kodiak Island.

Since the establishment of livestock on Kodiak Island, the federal and state agencies have maintained an active predator control program on the cattle leases. The intensity of the control appears to be directly proportional to the political pressures applied to the controlling agency and the number of stock lost each year. The main question has been, "What should be done about the conflict between bear and cattle?" The federal and state agencies apparently developed a "laissez faire" attitude in hopes that the problem would rectify itself. However, the claimed depredations continued and the cattle industry became influential politically as well as economically. As a result, it appears that the cattle industry is on Kodiak Island to stay even though it may be questionable as to whether or not raising cattle is the most economical use of the land. It is possible that the leased land would be more valuable economically to the state as a whole if it were managed strictly for the production of harvestable brown bear.

There is little doubt that the cattle industry on Kodiak Island has been responsible for a decrease in the numbers of bear on the leased land (Klein, et.al. 1958). This is illustrated by the fact that 11 times as many bear have been taken (1961-1963) on non-leased land which represents only about six times as much land area (Table 19). An examination of Figures 12 through 17 shows that some of the bears taken on the leased land are probably bears that overflow from the refuge and may not have been actually produced on the cattle leases.

TABLE 19

SPORT KILL OF BEAR ON KODIAK ISLAND LEASED AND NON-LEASED LAND DURING THE YEARS 1961-1963.

	Number of Kills	
	Non-leased Land ($2,670$ mi^2)	Leased Land (534 mi^2)
1961 Spring	69	6
Fall	32	2
1962 Spring	81	6
Fall	32	1
1963 Spring	60	6
Fall	19	5
Total	293	26

The major point here is that before the cattle industry is allowed to spread to the Alaska Peninsula, some investigation should be made to determine whether or not cattle ranching is the most economical use of the land. Because of the existing conflicts on Kodiak Island, it seems reasonable to suggest that this area be critically examined first.

Fortunately, all economic developments in the state are not entirely incompatible with bear management. Without attempting to predict all the possible economic uses and industries which might become established, the following example will illustrate one case of apparent

compatability. The case in point concerns the heavily timbered Southeast Alaska Islands of Chichagof, Baranof and Admiralty plus the similarly forested nearby mainland. The timber resources of these areas could presently be listed as one of the highest resource values to the state and it is only reasonable that every effort should be made to utilize it. Undoubtedly, if this area were classified by land-use priorities, the brown bear would be listed as a secondary resource. This is reasonable in that this population is exploited only lightly at present and it is doubtful that even a fully exploited population on a sustained yield basis would begin to compete economically with the forestry industry. The questions here, which are in need of further research, are concerned with the possible effects that logging will have on bear populations and what effects the bears will have on the timber industry.

Probably the logging practices will benefit the brown bear populations (Erickson 1964; Heintzleman 1934; and Klein et. al. 1958). The mature spruce, hemlock and cedar stands provide very little variety or quantity and quality of food for bears which probably explains the restrictions of bears to alpine areas, meadows, creeks and beaches. The early pioneer stages with abundant grasses and berries would appear especially attractive to bears. A rotational cut system would then result in mixed-aged forest stands, some of which would always be important to bears. Of equal importance is the need for safeguards against soil loss, river silting, stream blocking and damage to spawning beds by logging enterprises because of the significance of salmon

as a staple summer food for bears (Clark 1957). It appears that proper forest management will or could eventually increase the bear potentials of these areas.

As Erickson (1964) and Heintzlemen and Terhune (1934) suggested, there will probably be contacts between loggers and bears. This can be kept to a minimum by strictly enforcing regulations concerning garbage disposal and placement of camps away from salmon streams and tidal flats.

SUMMARY

This paper presents an evaluation of brown and grizzly bear management in Alaska with particular emphasis on the role of the mandatory bear hide sealing program initiated in 1961. A brief summary of ecological information is also included. This emphasizes the problems of management and the dire need for additional information, especially on population dynamics on which to base management decision.

Brown and grizzly bears are found throughout most of Alaska in varying abundance. Several census techniques, including aerial counts, track measurements, track counts and ground surveys, have been employed but it appears that each of these methods have either proved too expensive, time consuming or unreliable for workable application in management.

The history of bear management in Alaska is marked by a few major restrictive regulations, such as: prohibiting the sale of hides in 1925; protection of sows with cubs in 1957; and the protection of cubs (including yearlings) in 1958. During the period of federal control in the territory, one of the major contributions to management was the establishment of the Kodiak National Wildlife Refuge in 1941. Under this system a policy of research and controlled hunting was maintained. This has resulted in an average annual harvest of approximately 175 trophy bear per year since 1950. Harvest information for the remainder of the territory was dependent on a fur export permit requirement which provided only cursory data from 1950-1959.

Three major management objectives evolved under the federal con-

trol in Alaska: (1) the establishment of sport hunting over commercial hunting; (2) the equalizing of hunting opportunity by bag limits; and (3) the management toward the larger trophy bears, which was initiated by the protection of sows and cubs.

Following statehood in 1959, Alaska began efforts to more fully determine the statewide bear harvest. In 1961 a regulation went into affect which required that all brown, grizzly and polar bear hides be presented to the Alaska Department of Fish and Game for tagging within 30 days of the date of kill. This mandatory requirement provided more accurate data on brown and grizzly bear harvests than had previously been accumulated. The objective of the hide sealing program was to obtain detailed harvest data for use in adjusting seasons and regulation recommendations. Sex ratios and hide and skull measurements were to be analyzed for possible use as population indices. Other information such as hunter residency, kill dates, locations of kill and pelt condition were also obtained.

The basic assumption for use of sealing data as population indices was that over-harvest would reduce average skull and hide sizes in any designated area. Also, it was assumed that sex ratio trends would have a tendency to eventually favor females in areas of over-harvest. The latter assumption was formulated because of the general selectivity of hunters for large trophy males.

This paper covers the 1961 through 1963 period of the sealing program. During the 1961, 1962 and 1963 seasons, the state-wide harvest

numbered 473, 547 and 567 bears, respectively. The spring season harvests for the three years were 216, 265 and 221, respectively and the fall season kills were 258, 282 and 346. Most of the spring kills took place on Kodiak-Afognak and the Alaska Peninsula, while the fall harvests were more evenly distributed geographically. This is because in the fall many bears are taken incidentally to the hunting of other game.

Plotted kill distributions proved useful for visually examining areas for harvest patterns. For example, the plotted 1963 fall harvest on the Alaska Peninsula showed heavy kills between Port Heiden and Chignik Bay. This was presumably caused by a new regulation restricting use of aircraft for hunting purposes. Further, plotted kills for the entire state showed heavy fall kills in areas where sheep, moose and caribou hunting was also going on, indicating that fall kills were probably often incidental to other hunting.

Kill chronology data showed that 80 per cent of the spring kills occurred in May. Of the fall kill, 24 per cent occurred during the first week and 51 per cent during the initial three weeks. Eighty-one per cent of the first week fall kills were taken in the combined Southcentral and Interior-Arctic regions where incidental kills were most likely to occur.

Non-residents harvested 49 per cent of the spring kills and 57 per cent of the fall kills. Hunter success for non-residents was 50 per cent for 1961, 64 per cent for 1962 and 61 per cent for 1963. For the spring season, non-resident hunter success was 70

per cent and for the fall seasons it was 58 per cent. Hunter success for residents could not be computed.

Sex ratio data were compiled from verified reports of three bear project personnel because unverified reports were biased towards males, especially in the fall when females made up about 50 per cent of the kill. Seventy-six per cent of the spring harvests were males as compared to 49 per cent males for the fall seasons. The shift in sex ratio to favor females in the fall is believed to be due to kills incidental to hunting other game. Also, more females are available to harvesting in the fall due to family breakups and greater selectivity for males in spring hunting.

The mean composite hide size for the spring seasons was 15.5 feet; that for the fall was 13.6 feet. The Kodiak-Afognak area and the Alaska Peninsula showed the largest spring average hide sizes with 16.0 and 16.3 feet, respectively. In the fall, Kodiak-Afognak maintained an average size of 16.2 feet but the Peninsula dropped to 14.7 feet; the drop is attributed to the shift towards a greater percentage of females in the harvest. It was found that skull size averages could not be utilized during the three year period because usually just the larger skulls accompanied the hides.

During the composite three year period it was found that 31 per cent of the spring hides showed rubbed pelts while only 6 per cent of fall hides were rubbed. It was formerly believed that spring pelts were superior in quality to those taken in the fall.

In the past little reason existed for very restrictive brown and

and grizzly bear management policies. Now, with the increasing exploitation occurring, there is a need for long-range planning and cooperative research. Except for the Kodiak National Wildlife Refuge, research on population dynamics has been practically non-existent in the state. Much more is needed. In addition, there is now a need to determine whether bear should be managed for a few large trophy animals or more numerous smaller trophies.

The unique situation occurring in Alaska is that bear have become established as an important economic resource. It was estimated that over one-half million dollars are annually derived from bear hunters, guides and related businesses; however, it is believed that except for Kodiak Island the bear in Alaska are not being harvested near a maximum sustained yield basis. In order that bear management receives due consideration in the event that land-use conflicts arise, it appears that the economic potential can best be realized if a sustained yield is maintained. Unfortunately, much information is needed to even establish maximum harvest figures for any one area. Most important are the required aging and censusing techniques which have not been perfected.

Until adequate research information is available, the administration should establish a policy of experimental and somewhat conservative management. Regulation adjustments should be made and the resulting average hide and skull sizes and sex ratios analyzed to determine the effects of the changes. Should there be a reasonable doubt as to whether or not a population is over-harvested, caution

should be exercised in further changes which might prove detrimental to the population. The mandatory hide sealing program now in affect can provide the data necessary for management both before and after population information is available.

Unfortunately, the three year period covered by this report was not adequate to provide enough consecutive harvest data for determining true trends in average hide and skull sizes nor sex ratios. However, analysis of the data has provided some information for management. It was determined that should reductions in harvest be in order, the fall season opening date should be delayed. This is because the fall sex ratio favors females. In addition, the first three weeks of the fall season accounted for 51 per cent of the fall kills due to the concurrent opening of the regular hunting season. Within season changes can be formulated by analyzing data compiled as seasons progress. Indications of localized over-harvest can be spotted by plotting kill distributions. Each Game Management Unit harvest in the state can be separated and individually analyzed to determine the effects of regulation changes on the harvest.

The sealing program's effectiveness can be improved by increased personnel and funds and more complete coverage of the state, especially the Interior-Arctic regions. Every attempt should be made to increase verified reports in all areas of the state and to more accurately determine the non-sport harvest. In addition, a mandatory skull requirement should be invoked so that aging and size trends can be established.

LITERATURE CITED

Clark, W. K. 1957. Seasonal food habits of the Kodiak bear. Trans. N. Amer. Wildl. Conf. 22:145-149.

Courtright, Alan M. 1964. Game harvest report. Fed. Aid in Wildl. Resto. Project No. W-6-R-4. Unpubl. Rpt. Alaska Dept. Fish and Game, Juneau, Alaska. 23pp.

Dean, F. C. 1957. Investigations on grizzly bear in Interior and Arctic Alaska. Unpubl. Alaska Coop. Wildl. Res. Unit, Quart. Rpt. 9(1):13-14.

_____. 1958. Investigations on grizzly bear in Interior and Arctic Alaska. Unpubl. Alaska Coop. Wildl. Res. Unit, Quart. Rpt. 9(4):61-71.

_____. 1962. Investigations on grizzly bear in Interior and Arctic Alaska. Unpubl. Alaska Coop. Wildl. Res. Unit, Quart. Rpt. 14(1):9-16.

Dittrick, L. and H. Kronberger. 1963. Biologisch - anatomische Untersuchungen uber die Fortpflanzungsbiologie der Braunbaren (Ursus arctos L.) und anderer Ursiden in Gefangenschaft. Z. Saugetierkunde 28:129-155.

Dufresne, F. and J. P. Williams. 1932. Admiralty Island bear estimate. Alaska Game Commission and U.S. Forest Service, Juneau, Alaska Unpubl. Rpt. 8pp. mimeo.

Erickson, A. W. 1964. The brown-grizzly bear in Alaska. Fed. Aid in Wildl. Resto. Project No. W-6-R-5. Unpubl. Rpt. Alaska Dept. Fish and Game, Juneau, Alaska. 69pp.

_____. 1965. The black bear in Alaska. Fed. Aid in Wildl. Resto. Project No. W-6-R-5. Alaska Dept. Fish and Game, Juneau, Alaska. 19pp.

_____, and R. A. Rausch. 1962. The population status of brown bears on the Alaska Peninsula, Alaska. Unpubl. Rpt. Alaska Dept. Fish and Game, Juneau, Alaska. 33pp.

_____, and Donald B. Siniff. 1963. Aerial survey results in brown bears. Trans. N. Amer. Wildl. Conf. 28:391-409.

_____, and W. G. Youatt. 1961. Seasonal variations in the hematology and physiology of black bear. J. Mamm. 42:198-203.

Heintzleman, B. F. and H. W. Terhune. 1934. A plan for the management of brown bear in relation to other resources on Admiralty Island, Alaska. U.S.D.A., Misc. Pub. 195, 20pp.

Klein, David R. 1958. Track differentiation for censusing bear populations. U.S. Fish and Wildl. Serv. Unpubl. P. R. Report, Alaska. W-3-R.

_____. 1959. Track differentiation for censusing bear populations. J. Wildl. Mgt. 23:361-363.

_____, W. A. Troyer and R. A. Rausch. 1958. The status of the brown bear in Alaska. Proc. 9th Alaska Sci. Conf. pp. 21-24.

Merriam, C. H. 1896. Preliminary synopsis of the American bears. Proc. Biol. Soc. Wash. 10:65-83.

_____. 1900. Papers from the Harriman Alaska Expedition. Description of twenty-six new mammals from Alaska and British Columbia. Proc. Wash. Acad. Sci. 2:13-30.

_____. 1914. Descriptions of thirty apparently new grizzly and brown bears from North America. Proc. Biol. Soc. Wash. 27:173-196.

_____. 1918. Review of the grizzly and big brown bears of North America. N. Amer. Fauna, No. 41. U.S. Government Printing Office, Washington.

Mundy, K. R. D. 1962. Age determination in the grizzly bear (Ursus arctos) from sectioned molar teeth. Unpubl. Rpt. Dept. Zool., Univ. Alberta, Edmonton 16pp.

Rausch, R. L. 1963. Geographic variation in size in North American brown bears, Ursus arctos L., as indicated by condylobasal length. Canadian J. Zool. 41:33-45.

Troyer, Willard A. 1961. The brown bear harvest in relation to management on the Kodiak Islands. Trans. N. Amer. Wildl. Conf. 26:460-468.

_____. 1962. Size, distribution, structure and harvest of a Kodiak bear population. Master of Science thesis in Wildl. Tech., Montana State Univ., Unpubl. 48 pp.