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KODIAK BROWN BEAR POPULATION ON KODIAK ISLAND, ALASKA

This report is an attempt to determine the population of
Kodiak brown bear on Kodiak Island Alaska. All biological data on
hand was reviewed and information relative to an estimate to the
numbers of bear was used.

A minimum bear population has previously been estimated at
only three points on the island: Red River Lake, Sulua Creek and
Karluk Lake. These figures are, respectively, 51, 10 and 124, including
cubs. An attempt at an aerial survey of the bear population was made
in 1951 but this proved unsuccessful. Eight major drainages were
observed from the air over a period of about two and one-half weeks.
A total of approximately 16 hours of actual flight time was consumed.
A total of 278 bear were observed and of these, 120 were felt to be
the minimum number of individual bear.

The estimated minimum number of different bears seen from
the air in the three areas where ground counts were made totalled 63.
This figure is only 38 percnet of the minimum estimated from ground
counts. Assuming that this percentage of the bears in other surveyed
drainages were seen, a total of 316 bears (minimum) are estimated to
be in the eight drainages surveyed. As these drainages in question
harbor the bear concentrations on the island, they should contain better
than half the total bear population at the time of salmon spawning.
Thus, probably no more than 700 bears should be on the island if the
past work and the interpretation of it is valid. This figure of 700
is far from accurate as the following information indicates.

An annual bear kill of recorded and conservatively unrecorded animals during the past five years averages approximately 150. An additional 20 animals are probably killed but unrecorded. Thus, the annual kill is estimated at 170 animals. In order to produce this harvest of 170 animals, the absolute minimum total population would have to be 1388 bears. The latter figure is obtained as follows.

From data available at present, it is known that slightly over two-thirds of the bear killed are males. Further, data indicates that males of the following age groups attain the following total lengths: 5th year of life, 7 feet; 6th year, 8 feet; 7th year, 9 feet; 8th year plus, 9 plus feet. The hunting loss in the following table approximates the actual in relative numbers within each group.

TABLE I

Hypothetical Constant Bear Population

Year of life	Total Males Number		Hunting Loss	Natural Loss	:	Females*	Hunting Loss	Natural Loss
9	35	0	2	0	:	35	10	0
8	47	2	6	0	:	45	18	0
7	71	8	16	0	:	63	12	0
6	99	24	48	0	:	75	8	0
5	155	72	34	0	:	83	2	0
4	191	106	14	0	:	85	0	5
3	210	120	0	10	:	90	0	20
2	240	130	0	40	:	110	0	60
1	340	170	0	0	:	170	0	0
Total	1388	632	120	50		756	50	85

*386 breeding females

This table was formulated by deriving the age composition of the bear population from the kill records as obtained during the pre-

vious two years. The total number, the estimate of unrecorded kills, the size of the bear killed in relation to numbers and the percentage of sexes killed was also derived from the kill records. The natural mortality is an estimate formulated from the obtained local knowledge and observations.

The above table I is made under the assumptions that no natural mortality occurs after the first three years, that no male bear lives longer than the ninth year of life, that at birth the male-female ratio is one to one, and that female cubs suffer a higher mortality than males. These assumptions are made to obtain the absolute minimum population necessary to sustain an annual kill of 170 animals. Undoubtably, amny of the assumptions cannot be made on wild populations.

There may be a question as to the validity of the seemingly high infant mortality rate. Charles Madsen, Registered Guide, believes that each female having cubs gives birth to an average of three, or possibly a higher figure. The smallest cub often is abandoned when it cannot travel as fast as the female and the other cubs. Mr. Madsen has seen an instance of this and believes it occurs regularly.

Further, in any wild population, infant mortality is high because of disease, insufficient food for all cubs due to malfunction of the mammary glands or the forcing away from the female of small or "runt" bears by their litter-mates, exposure, suffocation, unintentional injury by the female's movements, loss of the mother because of hunting or natural mortality, and so forth. Female cubs, because of their relatively smaller size, probably suffer a higher mortality in their first year than so the males.

There appears to be a high degree of intraspecies competition and agitation within the population especially between large and small bear and between sexes. Observations indicate that this occurs to a great extent during the spring and summer. It would appear that the breeding attitude of the bear is accountable for part of this mortality as the male during this period attains a more aggressive attitude that its usual retiring nature as found later in the year.

Little mortality would be caused by competition with other species. Environmental factors causing mortality to all age classes are not to be overlooked. Cycles also influence the total population at a given time.

In table I, the hypothetical population, the kill is 28.5 percent of the breeding stock of 598 animals. Any such situation would endanger the species on Kodiak Island for if any of the assumptions are incorrect, the mortality would increase and eventually the population would become extinct.

Any such situation as the above is extremely poor with respect to management practices for there are no surplus animals and should any disease or other unforseen event occur, the population would be wiped out. Table I has but one purpose: to indicate the absolute minimum number of bears needed to sustain the present bear kill.

Observations this summer by Clark indicate 1.5 bear per square mile during the peak of the concentration of bear around the lake. Computing, this gives a population of 124 bear within the Karluk Lake area. Using this same method and figure per square mile, total number of bear were determined for all other concentration areas on the island. From this the total number of bear were determined for each district as shown in Figure 1. Table II lists
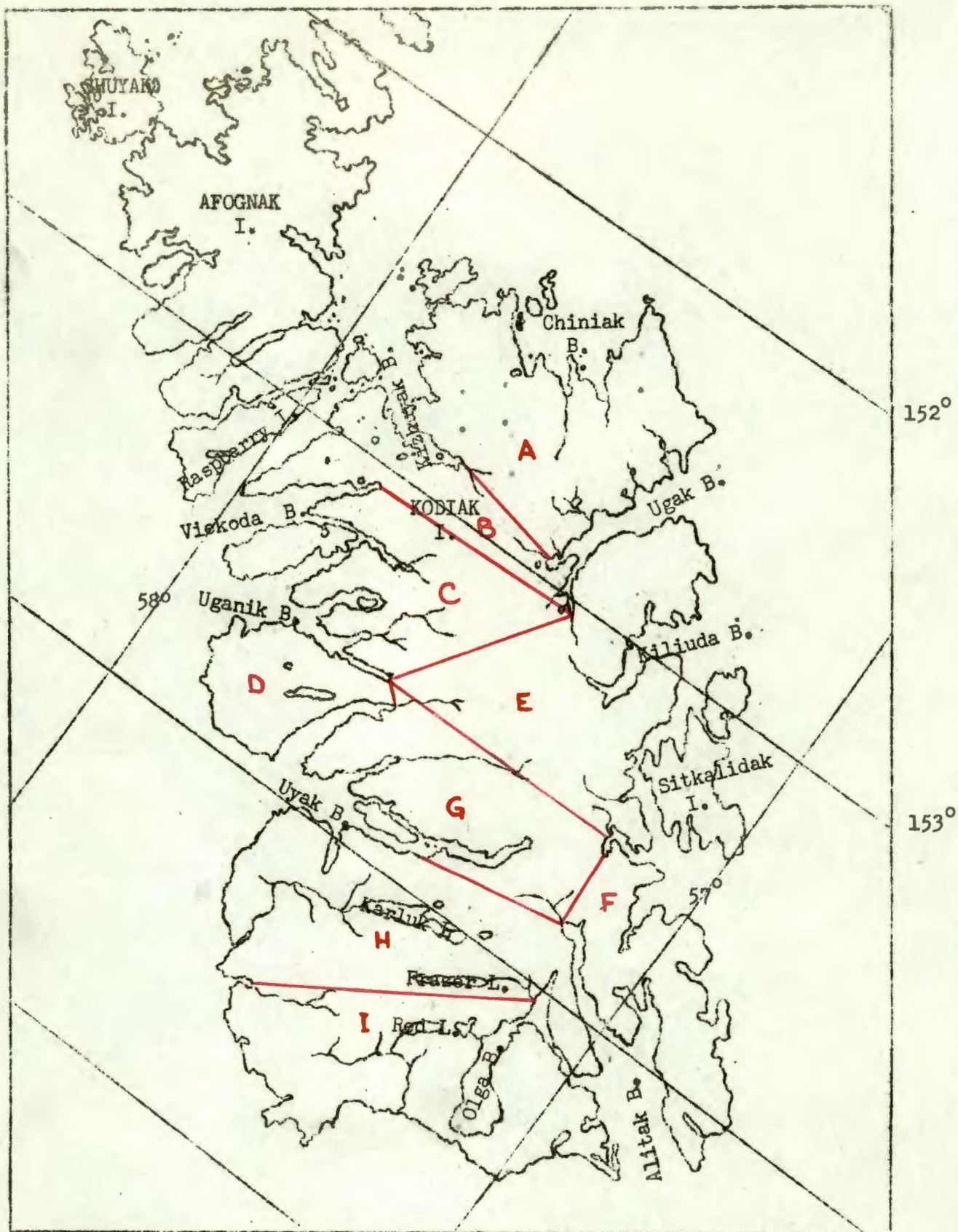
Figure 1. Bear management areas

the districts, the relative number of bear in each, and the percentage of bear to the total number. A correction factor of 20% of the total was added to the number to derive the total population. This correction factor is used to account for the animals in areas other than the concentration areas and for those not counted within the concentration areas.

	TABLE II.				TABLE III.	
District 6	Number of bear	Percent of bear	:	District	Number of bear killed	Percent of bear
A	34	2.6%	:	A	18	8.8%
B	117	8.7%	:	B	15	7.4%
C	230	17.2%	:	C	34	16.7%
D	81	6.	:	D	3	1.5%
E	57	4.2%	:	E	10	4.9%
F	18	1.5%	:	F	7	3.4%
G	470	35.2%	:	G	71	34.8%
H	241	18.1%	:	H	38	18.6%
I	87	6.5%	:	I	8	3.9%
Totals	1335	100.%			204	100.%

The total number of Kodiak Brown Bear on Kodiak Island has been estimated to be 1669. The island has an area of 3,588 square miles; consequently there is 1 bear per 2.15 square miles.

Table III shows the number of bear killed and on record during the past two years and does not list the total number of bear killed on Kodiak Island for this period. The bear kills have been listed as to

districts and the percentages of bear killed in each district to the total number has been computed.

A similar comparison is shown between the percentages listed in Table ii and III. The figures in table III were not used to derive the figures of Table II.

TABLE IV.

Year of life	Total Number	Males	Hunting Loss	Natural Loss	Female	Hunting Loss	Natural Loss
9	6	0	0	0	6	2	0
8	8	0	2	0	8	3	0
7	13	2	2	0	11	2	0
6	17	4	8	0	13	1	0
5	26	12	6	0	14	1	0
4	33	18	3	0	15	0	1
3	37	21	0	2	16	0	3
2	42	23	0	7	19	0	10
1	59	30	0		29	0	0
Total	241	110	21	9	131	7	14

Table IV shows a hypothetical constant of the minimum population of the bear within district H and table V shows the population as it has been computed by this report. The figures from these tables show that a maximum of 35 bear can be taken per year from this district and still maintain the numbers of bear. However, any more than this will reduce the population until it reaches 241, and then more than 28 bear taken per year would ultimately reduce the numbers seriously.

As an example of the management of the Kodiak Brown Bear within an area of Kodiak Island, district H has been chosen. This district was chosen because it lies in the center of the district, biological work was carried on there last season, and the conflicting interests that occur there. Clark found a minimum number of bear at Karluk Lake to be 124. This was obtained from daily observations around the lake. Computing as was done in the preceding tables, 20% of the total number of bear around Karluk Lake is added to the 124 bear estimated and a total of 154 bear are estimated to be within the lake area proper. Therefore, using the percentages as found in table I between the total number of bear and the number killed per year, it is found that 19 bear could be killed at Karluk Lake each year and still maintain the numbers. Last year, 1951, 24 bear were killed within this area and 19 bear were killed there this year.

These figures show that a sufficient kill is being exerted upon this area and that the kill is such that it produces a control factor in the immediate area. The kill in 1952 would have been higher except for two things. First, the late spring forced hunters and guides into other areas prior to May 25 and consequently fewer spring bear were taken. Secondly, two guides with hunters stayed away from the lake part of the fall season because of the activity at the lake coupled with the scarcity of bear in September and the first part of October.

This type of management can be used and improved upon as the proper biological information is learned through a period of years.

TABLE V. Maximum

Year of life	Total Number	Males	Hunting Loss	Natural Loss	Females	Hunting Loss	Natural Loss
9	8	0	1	0	8	1	0
8	10	1	1	0	9	4	0
7	15	2	3	0	13	3	0
6	22	5	10	0	17	1	0
5	33	15	8	0	18	0	0
4	41	23	3	0	18		1
3	45	26	0	2	19		6
2	53	28	0	9	25		11
1 Total	73 300	37 137	0 26	0 11	36 163	9	0 18

A total of 204 bear can be taken from Kodiak Island each year and still maintain the present population. The bear kills on Kodiak Island have increased during the past three years. The estimated unrecorded and illegal kills vary between 20 and 50. Therefore, according to the kill figures, the increase of numbers of bear killed per year is minimum and consequently, proper management is being exerted.

A study to estimate the bear population of Admiralty Island in southeastern Alaska was conducted in 1932. The result of this study shows a population of 900 bear on the 1,664 square miles or 1 bear per 1 3/4 square miles. This compares favorably with the conclusions found in this paper.

Various guesses as to the bear population on Kodiak Island range from 300 to 5,000 animals. Probably the local persons best qualified to hazard an educated guess are the professional guides. Three guides, Bill Poland, Alf Madsen and Charles Madsen estimate the population at 1,500, 1,800, and 2,300 respectively.

Females with cubs avergae approximatly 2.1 cubs per litter after much of the cub mortality has occurred.

It is generally supposed that females have cubs every other year but this may not be true. It is entirely possible that three years elapse between births and if most females do have cubs each second year, others undoubtably vary from this. Many year and one-half old cubs are seen suckling on females. If these latter females are lactating, breeding and fertilization would be unlikely until the following spring or second year. Such a female would then bear cubs three years after the previous litter.

Many females probably never have cubs; this might be due te faulty hormone balance or malformation of the genital system. Also, old females probably have few cubs or none. Data indicate that young females bearing their first litter usually have but one or two cubs.

Consequently, although there may be a large female population, the number of cubs per adult female may be quite low. Little is known concerning the sexual behavior of brown bears. Males may be monogamous or polygamous. If the males mate with but one female, a low male population caused by selective hunting would reduce the number of cubs by limiting

the number of females fertilized. If males are polygamous, a lesser number of males would not injure the population.

Questions such as these must be answered in the continuing biological work even though a total population estimate is available. Justification of increased or decreased bear killing must be assumed until these unknowns are solved.

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