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ALASKA BROWN BEAR STUDIES

Work Plan J Job No. 1 & 2

December 31, 1958

ALASKA GAME COMMISSION

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Volume 13 Number 1

JOB COMPLETION REPORTS

Project W-3-R-13 Alaska December 31, 1958

Wildlife Investigations

Work Plan J

BROWN BEAR STUDIES

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Not for Publication

(The results described in these reports are preliminary and often fragmentary in nature. Conclusions are subject to change with further investigation and interpretation.)

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SUMMARY

Job No. 1: Southeast Alaska Brown Bear Studies

Brown bear composition counts on Admiralty, Baranof and Chichagof Islands showed mean litter size values of 2.2 for cubs of the year and 1.9 for yearling cubs. These ratios compare favorably with litter sizes on Kodiak Island. The track count method of bear census was tested on Admiralty and Baranof Islands and proved effective as an indicator of abundance in local areas but lost its accuracy when applied to large areas. Variable environmental factors, which are difficult to evaluate, control the accuracy of the track counts. The total harvest of brown bears in Southeast Alaska seldom exceeds 75 animals. The average kill by trophy hunters was 56 during 1949-56. Admiralty, Baranof and Chichagof Islands support 89 percent of the total harvest and Admiralty Island alone yields 60 percent of the kill. Annual harvest has been approximately 3-4 percent of the total population. No significant change in sex ratios or trophy size is apparent in the total harvest since 1945. Annual harvest is considered light and not detrimental to the welfare of the total population or the trophy value. Each brown bear killed by a nonresident in Southeast Alaska brings well over $1,500.00 into the local economy. The average annual value of the brown bear resource to the economy of Southeast Alaska was approximately $84,000.00 for each of the years, 1949-1956.

Job No. 2: Alaska Peninsula Brown Bear Studies

Annual composition surveys were conducted July 24 to August 18, 1952 to determine relative numbers and population trends of brown bears on the Alaska Peninsula.

The Peninsula cub crop equals 20 percent of the total population and appears to be somewhat higher than productivity on Kodiak Island.

Survival of cubs to the yearling class based on aerial surveys was 20 percent. At McNeil River ground surveys indicated only 17 percent mortality. Because litter sizes remain essentially constant mortality factors must affect entire litters.

Bear density indices on the three study areas on the Peninsula were 38.9, 7.3 and 17.1 bear seen per hour of flying. The variation between the areas thought to be caused by functions of sampling technique, the environment of both; however, these indices will serve as a basis for future comparisons.

Ground observations showed that no sows with cubs were observed on the coastal areas until June. Male bears comprise 70 percent of the spring kill on Kodiak. This information could constitute an effective management tool by restricting hunting to a spring season if necessary to protect female bears.

The number of bears seen on the Mikfik and McNeil Rivers

increased with the abundance of salmon and then decreased as the berry crop in the hills matured in late July and early August. To obtain maximum results from aerial counts they should coincide with the peak of salmon abundance in the streams.

The legal harvest of bears on the Peninsula is 25 to 50 per year. Execpt for local situations, it is doubtful that the combined illegal and defense of property kill has significant effect on brown bear populations.

Job No. 1

Brown Bear Studies - Southeast
Alaska Brown Bear Studies

PERIOD COVERED: May 1 - September 30, 1958

ABSTRACT

Brown bear composition counts on Admiralty, Baranof and Chichagof Islands showed mean litter size values of 2.2 for cubs of the year and 1.9 for yearling cubs. These ratios compare favorably with litter sizes on Kodiak Island. The track count method of bear census was tested on Admiralty and Baranof Islands and proved effective as an indicator of abundance in local areas but lost its accuracy when applied to large areas. Variable environmental factors, which are difficult to evaluate, control the accuracy of the track counts. The total harvest of brown bears in Southeast Alaska seldom exceeds 75 animals. The average kill by trophy hunters was 56 during 1949-56. Admiralty, Baranof and Chichagof Islands support 89 percent of the total harvest and Admiralty Island alone yields 60 percent of the kill. Annual harvest has been approximately 3-4 percent of the total population. No significant change in sex ratios or trophy size is apparent in the total harvest since 1945. Annual harvest is considered light and not detrimental to the welfare of the total population or the trophy value. Each brown bear killed by a nonresident in Southeast Alaska brings well over $1,500.00 into the local economy. The average annual value of the brown bear resource to the economy of Southeast Alaska was approximately $84,000.00 for each of the years, 1949-1956.

OBJECTIVES

To determine relative numbers and population trends of brown bears on Admiralty, Baranof and Chichagof Islands as a basis for evaluation of the effects of logging on brown bear populations and for comparison with results of bear surveys made in the 1930's. Initial emphasis of the studies was directed in those areas adjacent to Sitka, where logging for the Sitka pulp mill is planned within the next five years, and on southern Admiralty Island, where relative abundance of bears is high, hunting pressure is heavy and where logging by small operators is already underway. Results are needed to aid in formulating forest management practices which will insure the welfare of the brown bear populations in association with large scale logging.

TECHNIQUES USED

Brown bear studies were initiated in the spring of 1958 by the Fish and Wildlife Service, and the Forest Service entered in the studies on July 1, contributing personnel, equipment and financial aid. Field work in the Sitka area was done by Game Management Agent Neil T. Argy with assistance from local Forest Service personnel, Ray Karr and Dave Molinaro. On Admiralty Island field studies were conducted by Wildlife Management Biologist David R. Klein, with

cooperation from other Fish and Wildlife Service and Forest Service personnel. On Admiralty Island persons directly assisting the studies included Charles Graham, William Sholes, Lyman Reynoldson, Joe Johnson and Pete Varnes for the Fish and Wildlife Service and Roman "Slim" Schwartz, John Hall, Don Murray, Richard Hauff, Monrad Kjorlein and Jack Mills for the Forest Service.

Composition Counts: During May, bear sex and age segregation counts were made on southern Admiralty Island and in the Sitka area. At this time bears are readily observed in the evening hours feeding on sedges in the tidal flats at the heads of bays and on beaches. Ground counts were made with 20-30 power spotting scopes from observation points overlooking the sedge flats at the heads of bays. Aerial composition counts were flown in several types of seasonal habitats occupied by bears to determine the effectiveness of aerial counting. In May, evening counts of bears on the sedge flats were flown on southern Admiralty Island. Aerial alpine counts were made in July and August and aerial counts of bears on the salmon streams were attempted in August and September.

In addition, bear sex and age information was solicited from other available sources. Bear sight record forms were prepared and distributed to guides, hunters, stream guards, woods crews and other persons with the opportunity to make bear observations. This information was collected at the end of the summer season and the summarization of observations is presented in the findings.

Census Methods: Application of the results of the spring and summer aerial composition counts as a population index method has been undertaken in those areas where sample counts were obtained. During the course of the aerial counting, all bears observed were recorded by area and flight time and corresponding values of bears per mile of beach or per hour of flying were available for trend comparisons with similar counts in the future.

A method of differentiating and counting bear tracks adjacent to salmon streams was tried and proved of limited value as a population index method.

In 1932, F. Dufresne and J.P. Williams first used a track-count method to census brown bears on Admiralty Island. This method was tested and modified during the 1958 season on Admiralty and Baranof Islands. The actual procedure for measuring and differentiating bear tracks was nearly identical to that used in 1932 as stated by Dufresne and Williams, "In estimating the bears along the creeks, we were guided by several factors. First and foremost was the highly individual tracks of the animals. They were different in size, different in shape, with other more or less noticeable characteristics which would enable us to recognize them from any other tracks. . . we came to an agreement that the most reliable measurement we could take was the width of the bear tracks across the toes. . .Taking into consideration the medium in which the tracks were made,

measuring the same track over and over again where the animals had walked over gravel bars, sand flats and mud holes, we found that we could secure reliable measurements within a quarter of an inch, and further that we could recognize the same track if encountered at other places. Additional strength was given this method by also taking the length of the track from heel pad to middle toe, exclusive of the nail, whenever possible, but by itself this was not a reliable measurement owing to slippage, nature of soil, etc., and must be secondary to the measurement across the toes. We were further aided in this by the fact that some bears had long, narrow soles; others were broad and rounding as though the animal had suffered fallen arches, while others were ham-shaped." In the 1958 studies less individual track variation was found than indicated by Dufresne and Williams and the width of the forepad was considered more accurate than the width across the toes, which varies more widely with the ground conditions.

Testing of the track count method was done on the south end of Admiralty Island from Gambier Bay to Hood Bay and in the Sitka area from Starrigavin Bay to Neva Point, including Katlian Bay and Nakwasina Passage. Five two-man crews, made up of both Fish and Wildlife Service and Forest Service personnel, did the work on southern Admiralty Island during August 5 - 19 and in the Sitka area a similar crew worked during August 27 - September 16. The crews were shuttled to the salmon streams by helicopter and measured and tallied tracks as they returned to salt water.

In addition to the actual measurements of bear tracks adjacent to the streams walked, other pertinent observations were recorded. As an aid in determining variation to expect in each track measurement, the type of ground surface (soft sand, hard mud, etc.) and whether the track was distinct or indistinct were also recorded. Variable environmental factors which affect the concentration of bears on the streams, such as numbers and extent of salmon in the streams, location of salmon obstructions and availabilty of salmon as determined by stream water levels and turbidity were also recorded. Ideally the track counts should be coordinated with the peak of the salmon runs when bears are concentrated on the streams. However, chronological variation in salmon escapements into the streams within any given area necessitated planning field work to coincide with suitable conditions on the greatest portion of streams.

Collection of track count data on some streams required a special approach to minimize counting of duplicate tracks when heavy concentrations of bears were encountered. Generally, there was no problem on streams with less than six or seven bears present. However, on the larger streams where there were frequently as many as ten bears per mile of stream, the differentiation of individual bears from the abundance of tracks measured became more difficult. In these instances, dividing the stream into small workable segments simplified counting, however, the determination of the extent of track duplication remained an inherent problem in the areas of heavy concentration. Cub tracks posed an additional problem as individual

track variation within a litter was usually not great enough to allow determination of the number of cubs present. To compensate for this all groups of new and yearling cub tracks encountered were adjusted according to mean litter size values determined from bear sight records.

During the study period, the majority of the bear population was concentrated around the salmon streams, however, it was necessary to derive an estimate of bears not present in the areas adjacent to salmon streams. Random transects were walked from alpine areas to sea level in Hood Bay and Pybus Bay and all recent evidence of bear activity was recorded. With this information and sight records of bears seen in areas away from salmon streams, it was possible to arrive at an estimate of the percent of bears which were not concentrated around salmon streams.

Harvest Statistics: Brown bear harvest data was obtained directly from hunters in the field and from bear kill record forms which were supplied to all guides in Southeast Alaska. Guides recorded body and hide measurements from bears killed by their hunters on the kill record forms in addition to date and location of kill and other pertinent data.

Hunter-kill data from previous years was obtained by reviewing guide reports in the Fish and Wildlife Service files in Juneau. These annual guide reports include specific details of the bear hunts and animals killed from 1945 through 1956 when the registered guide system was discontinued. Guide reports submitted prior to 1954 include body, hide and skull measurements of brown bears killed, in addition to details of the locations and dates of the kills. From 1954 through 1956 reports were not as detailed as the earlier ones, however, the sex of bears killed was recorded.

FINDINGS

Composition Counts: Results of the spring composition counts and a summarization of all bear observations made by bear study personnel and other field observers are included in Table 1. The most significant aspect of these composition counts is the accumulation of litter size observations. Mean litter size values for all observations on Admiralty, Baranof and Chichagif Islands were; cubs of the year - 2.2 and yearling cubs - 1.9. New cub litter sizes compare favorably with brown bear populations on Kodiak Island and the Alaska Peninsula as shown in Table 2. Yearling litter sizes show only a slight decrease from the cubs of the year value and reflect good cub survival to the yearling age. Heaviest mortality undoubtedly occurs during the first two years of life with probable peaks between parturition and emergence from hibernation and during the adjustment period after the yearling cubs are abandoned by the female. Our figures do no reflect survival through the second critical period in the bears' life, however, comparable survival would be expected during this latter period with the exception, perhaps, of congested conditions associated with extremely high bear densities.

TABLE 1

OBSERVATIONS OF SOUTHEAST ALASKA BROWN BEAR
AGE COMPOSITION, 1958

	Pybus and Gambier Bays May 4-16	Aerial Counts Seymour Canal May 12 and 14	So. end Admiralty Is. July 16-Aug. 20	Admiralty Is. sight records. May-Sept.	Total Admiralty Island	Baranof Is. sight records. May-Sept.	Chichagof Is. sight records. May-Sept.	Total for A.B. & C. Islands
CUBS OF THE YEAR	3		2	16	21	21	19	54
Sows with-	1		1	8	10	11	8	25
Av. Litter Size	3		2	2	2.1	1.9	2.4	2.2
YEARLING CUBS	2	7	16	14	39	4	23	66
Sows with-	2	4	7	7	20	3	12	35
Av. Litter Size	1	1.8	2.3	2	2.0	1.3	1.9	1.9
Other Bears Seen	35	23	30	140	228	81	77	375
No. Bears on Streams			47	44	91	30	41	152
No. Bears not on Streams	43	34	10	141	228	90	98	404
Total Bears Observed	43	34	57	185	318	120	139	555

TABLE 2 MEAN BROWN BEAR LITTER SIZES FROM THREE ALASKA AREAS, 1958

Area	Cubs of the Year		Yearling Cubs	
	Average Litter Size	Sample Size	Average Litter Size	Sample Size
Kodiak Island	2.3	52	2.3	41
Alaska Peninsula	2.2	167	2.1	115
Southeast Alaska	2.2	79	1.9	101

TABLE 3 CUB RATIOS IN BROWN BEAR POPULATIONS FROM THREE ALASKA AREAS 1958

Area	Percent Cubs of the Year	Percent Yearling Cubs	Sample Size
Kodiak Island	13.4	10.5	390
Alaska Peninsula	21.4	14.9	779
Southeast Alaska	9.7	11.9	555
Admiralty Island	6.6	12.3	318

Individual litter size values for each brown bear island show remarkably little variation from the total for the three islands in view of the small sample sizes represented.

Cub ratios are shown in Table 3 for Southeast Alaska, including Admiralty Island, in comparison with similar ratios from Kodiak Island and the Alaska Peninsula. From examination of the table it is apparent that sight records of cubs of the year are significantly lower in Southeast Alaska than elsewhere. This is not an indication of reduced productivity, as is apparent from examination of the mean litter size values for new cubs. This variation can be explained through the knowledge of the seasonal habits of these bears. Sows with new cubs come out of hibernation later than other bears and are more seclusive in their habits, avoiding association with other bears. Consequently, they are less readily seen in the usual bear concentration areas, such as the beaches and tidal flats in spring and the salmon streams in summer. Also, in Southeast Alaska the dense rain forests limit observations of bears to the beach edges and salmon streams where the sows with new cubs are less likely to be seen. In view of this, a valid comparison of new cub ratios with other Alaska areas is not possible. Ratios of yearling cubs in the total counts shown in Table 3 may be comparable on an areawise basis, however, local habitat variations may result in differential visibility of this age group also.

Census Methods: Bears observed during the spring and summer aerial composition counts were recorded by mean flight time required for each bear observed. The spring counts of bears on the beaches and tide flats were the only ones adaptable to this method of recording. The May 12 counts recorded 23 bears in 75 minutes of flying, or a mean value of 1 bear for every 3.3 minutes. On May 14 a total of 11 bears was seen in 70 minutes of flying with a mean value of 1 bear every 6.4 minutes. The spring ground composition counts yielded a total of 43 bears observed with a mean value of 3 bears seen per observer-evening. These counts recorded in units of time in conjunction with the composition counts yield standardized observation rates which will be comparable for determination of population trends if done on an annual basis.

Results of the track counts indicate that they are subject to variation due to changing and difficult to evaluate environmental factors. The 1932 Admiralty Island counts, for instance, yielded a figure of 362 bears on the same salmon streams that the 1958 counts indicated a figure of 187 bears. While specific population levels are not known for these two periods, it is felt that the wide variation in the counts is explained by the varying environmental conditions that existed, and not necessarily differing population levels. During the summer of 1932 there was a good salmon escapement, however, the berry crop was poor. The 1958 counts were made during a season of poor salmon escapement but excellent berry production. Apparently more bears were attracted to the salmon streams in 1932 by the abundance of salmon, while in 1958 the scarcity of salmon and the good berry crop had the opposite effect. To compensate for bears

not in the areas adjacent to salmon streams, Dufresne and Williams increased their 1932 counts by ten percent. In 1958 it was estimated that approximately forty percent of the total bears in the study area were on a vegetation diet in areas away from the salmon streams. This estimate was based on bear sign and bears seen by walking random transects from alpine areas to sea level. Total population estimates on the study area are more nearly comparable for the 1932 and 1958 counts when the estimates of bears away from salmon streams are added to the salmon stream track counts (1932 - 398 and 1958 - 312).

In reviewing the 1932 stream, track tally sheets, it was felt that the estimate of bears on the streams was exceedingly high in view of the number and variation of tracks measured. Conversely, the ten percent estimate of bears not on the salmon streams appeared too conservative.

A further check of the track count method to determine the variation which occurs due to changing environmental conditions was made. On August 18, ten days after the last track count had been completed in Gambier Bay, a complete replication of the counts was made on all streams in the bay. The second count showed a 48 percent decrease in the number of bears in the bay and the number of live salmon in the streams showed a corresponding average decrease of 51 percent. While the decrease in bears counted appears proportional to the decrease in the number of salmon present, this may be coincidental as other factors undoubtedly contribute to the movement and concentration of bears. However, the significance of the wide variation between the two counts is in emphasizing the unreliability of the track count method except as an indicator of seasonal use or abundance.

Variable environmental factors definitely affect the accuracy of the track count method, however, the margin of error from these sources can be reduced if allowance is made for their known influence on the results. Variations in the counts can result from any or several of the following factors:

1.) Poor tracking conditions, due to heavy rains, high water or cobble stream beds in which tracks are poorly recorded.

2.) Washing out of old tracks by heavy rains and conversely, excessive accumulation of tracks during dry spells.

3.) Dispersal of bears when fish become unavailable or unpalatable due to high water, removal of existing fish with no new migrants entering and aging and deterioration of fish in the streams.

4.) Poor salmon escapements which fail to attract bears to the streams.

5.) Auspiciousness of the berry crop which may attract or hold the bears away from the salmon streams if fish in the streams are of limited number or availability.

TABLE 4 BROWN BEAR TRACK COUNT CENSUS, ADMIRALTY IS.
August, 1958

STREAM	FWS Stream No.	Date	Limit of Salmon (mi.)	Number of Salmon	Density Salmon/mi.	No. Bear Killed Salmon	Tracking Conditions(1,2,3)	Bear Seen	No. Track Variations	Corrected No. Bears
Gambier	E18	6	1	550	550	11	1	3	5	5
Church's Bt.		6	¾	310	413	30	3	1	1	2
F. Pt. Pybus		7	¾	25	33	1	2	0	4	5
L. Arm Gambier	S17	7	⅛	85	680	0	2	0	3	3
L. Arm Gambier	17	7	½	175	350	1	2	0	9	12
Gambier	18A	7	3	1900	633	10	1	4	10	15
Snug Cove	19	8	3	700	233	10	1	2	10	15
Gambier	18	8	5¾	9400	1635	64	2	4	12	17
Pybus Bay	22	9	¾	225	300	8	2	0	6	8
Cannery Cove	24	9		250	0	0	3	0	4	6
Pybus Bay	21	9	3¾	950	253	10	2	0	7	8
Pybus Bay	23	9	2	6850	3420	400	3	0	5	7
Pybus Bay	20	9	3	850	283	5	3	0	5	6
Pybus Bay	22A	10	0	0	0	0	2	3	4	5
Pybus Bay	S22A	10	⅛	170	1360	12	2	0	2	2
Pybus Bay	E20	11	⅛	1	8	1	3	0	3	3
Eliza Hbr.	28	11	0	0	0	0	3	0	2	2
Little Pybus	25	11	½	250	500	1	3	0	6	6
Woewodski Hbr.	25A	11	0	0	0	0	3	0	2	2
Eliza Hbr.	26	11	1½	1200	800	1	3	0	5	6
Murder Cove	29	12	2½	300	120	150	3	4	6	7
Eliza Hbr.	27	12	1	3	3	0	2	0	1	1
Herring Cove	28C	13	0	0	0	0	3	0	4	5
Wilson Cove	60	13	4	450	112	5	3	0	4	5
Whitewater	58	13	3½	5000	1430	1000	2	1	6	9
Wilson Cove	S60	13	2½	60	24	30	3	0	1	2
Murder Cove	30	13	1½	450	300	100	3	0	3	3
Chaik Bay	57	14	2½	4500	1800	100	3	1	4	4
Hood Bay	54	14	2½	50	20	2	2	1	5	8
Hood Bay	55	14	¾	85	11	6	3	2	2	4
Hood Bay	53	15	3	300	100	50	3	0	3	3
Hood Bay	56	15	0	0	0	0	3	1	0	1
				35089	480 Av.	63 Av.	2.5 Av.	27		187

TABLE 5

REPLICATE TRACK COUNT IN GAMBIER BAY
August 18, 1958

Stream	FWS Stream No.	Limit of Salmon	No. of Salmon	Density Salmon/mi.	No. Bear Killed Salmon	Tracking Conditions (1,2,3)	Bears Seen	No. Track Variations	Corrected No. Bears
L. Arm Gambier	S17	1/8	20	160	1	3	1	3	4
L. Arm Gambier	17	½	100	200	10	3	0	3	4
Gambier	18A	3/4	2130	655	110	3	0	5	9
Gambier	18	6	2100	350	150	1	6	9	12
Snug Cove	19	2	550	275	25	2	0	4	6
Church Bight	---	0	0	0	50	2	0	1	1
Summary of Aug. 18 count			4900	408 av.	58 av.	2.3 av.	7		36
Summary for 1st count Aug. 7 & 8			12500	1042 av.	19 av.	1.8 av.	11		64

TABLE 6

FOREST SERVICE TRACK COUNTS ON ADMIRALTY IS.
August 19-22, 1958

	FWS Stream No.	Date (August)	Limit of Salmon (mi.)	No. of Salmon	Density Salmon/mi.	No. Bear Killed Salmon	Tracking Conditions (1,2,3)	Bears Seen	Estimate Bears On Small Streams	No. Track Variations	Corrected No. Bears
Mole Hbr.	15	20	--	heavy	---	---	3	4	10-15	4	6
Pleasant Bay	16	19	3	9000	3000	200	3	0	---	3	5
Windfall Hbr.	14	20	3	5500	1835	1000	2	2	---	7	12
Pack Cr.	13A	19	1	500	500	---	3	--	---	1	1
Swan Cove	13	19	3	6500	2165	---	3	--	---	2	2
Green Cr.	43	22	--	75	---	300	3	--	12-15	5(inc)	?
Bear Cr.	16	21	2	---	---	some	2	--	2	1	?
Oliver's Inlet	--	20	1	2	---	---	-	0	5-8	2	?

TABLE 7

BROWN BEAR TRACK COUNT CENSUS, BARANOF IS.
August & September, 1958

Stream	ORBS Stream No.	Date	Limit of Salmon (mi.)	No. of Salmon	Density Salmon/mi.	No. Bear Killed Salmon	Tracking Conditions (1,2,3)	Bears Seen	Estimate Bears On Small Streams	No. Track Variations	Corrected No. Bears
Starrigavin	6	9-11	1¾	2180	1245	4	2	0	2	1	2
S.F. Katlian	--	8-28	1½	2525	1685	1	2	0	4	3	3
Main-Katlian	--	8-27	1¼	2700	2160	2	2	0	9	7	9
Main-Nakwasina	--	8-28	3¾	7500	2000	2	1	0	7	4	6
Liza Creek	34	8-29	1	135	135	1	2	0	1	0	1
W. Nakwasina	24	9-9	1½	3500	2335	19	3	1	5	4	5
Halleck Is.	18	9-11	1½	637	425	5	2	0	3	3	3
E. Neva Pt.	17	9-12	¼	50	200	0	2	0	11	6	9
				19227	814 Av.	4.3 Av.	2.0 Av.	1			38

6.) The human element, if different streams are not checked by the same persons.

Additional studies should be correlated with the track counts to determine the extent of bear movements, use of areas other than salmon streams and the importance of fish in the diet.

Determination of the number of bears concentrated adjacent to the salmon streams is possible with reasonable accuracy by use of the track count method. However, the inherent difficulty involved in this method of population census is the problem of determining the number or proportion of bears not present on the salmon streams, which are dispersed throughout the remainder of the island habitat. Consequently, the track count method is most effective as an aid in the determination of bear abundance or usage on small areas or units, such as salmon streams, but its reliability decreases when applied to larger areas.

Harvest Statistics: The annual kill of brown bears by humans in Southeast Alaska probably seldom exceeds 75 animals, including both the legal and illegal harvests. Since the close of World War II trophy hunting for bears in Southeast Alaska has remained relatively constant. From 1949, when the guiding business had fully recovered from wartime restrictions, to 1956 the average annual harvest by guided hunters was 56 brown bears. This constitutes essentially the entire kill for trophy purposes as very little trophy hunting for bears is done by residents. Table 8 shows the yearly kill in Southeast Alaska from 1945 - 1957 with areawise breakdowns. The smaller kill in the last few years, which is apparent in the table, resulted from a decrease in nonresident trophy hunters. This was associated with the "hardening" of the national economy and the shortage of "luxury currency" after the Korean conflict. A breakdown of the annual kill by areas, also in Table 8, shows the importance of Admiralty, Baranof and Chichagof Islands to brown bear hunting in Southeast Alaska. These three Islands supported 89 percent of the total kill and Admiralty Island alone yielded 60 percent of the kill.

Kill figures show that the annual brown bear harvest has been low in view of the indicated total population present. Population levels on Admiralty, Baranof and Chichagof Islands were estimated at 2,285 as determined from the surveys made in the 1930's, and 1,800 as prorated for all the islands from the 1958 Admiralty Island surveys. Total harvest for the ABC Islands has not exceeded 3 percent of the high estimate or 4 percent of the low estimate since the kill was recorded in 1945. On Admiralty Island where hunting pressure has been heaviest, the harvest has not exceeded 8 percent of the low estimate for the island, or 6 percent of the high estimate. On Kodiak Island the annual brown bear harvest during 1950-1957 averaged 187, or 11 percent of the estimated total population of 1,669. No significant changes in sex ratios and trophy sizes, associated with over-harvest, are apparent on Kodiak Island at this level of harvest. By comparison, it is unlikely that over-harvest or harvest

of a level to decrease the trophy size has taken place in Southeast Alaska.

In a game population hunted for trophy purposes, hunting pressure may be heavy enough to remove the larger animals (usually males) without significantly affecting the breeding animals or the general welfare of the population. Under such conditions average trophy size may decrease as hunters are obliged to take younger animals and the sex ratio of the kill will usually change as large females fall within the lowered trophy standards. In Southeast Alaska, no significant changes in sex ratios or body and hide measurements of brown bears taken for trophies have taken place. Table 9 shows the sex ratios of brown bears killed for trophies during 1952 through 1957. The average sex ratio of the kill has been 64 per cent males to 36 per cent females, or a male:female ratio of 174:100. On Kodiak Island the sex ratio of the harvest during the years 1951-1957 has been 63 per cent males to 37 per cent females (170:100). Table 10, which includes mean trophy size and body length of brown bears killed in Southeast Alaska during 1945-1958, shows no significant yearly change in trophy or body measurements. Comparisons of measurements of bears taken on the ABC Islands and the mainland in Southeast Alaska are included in Table 11. The smaller size of the Southeast bears is apparent when compared to Kodiak Island brown bears. Squared hide measurements (arithmetical mean of stretched length and width) average 7 ft. 8 in., or about one foot smaller than the Kodiak average of 8 ft. 9 in. Measurements in Table 11 indicate that the island bears in Southeast Alaska are larger than the mainland bears and, also, differ in body proportions. The ratios of width to length in the skull and hide measurements are greater for the island bears and reflect their more "blocky" proportions. Also, while hind feet, hides and skulls average larger for the island bears, the total length and tail measurements are greater for mainland bears. Very little variation was found to exist between the island bears. Hide and skull measurements were slightly larger for Baranof Island bears, how ever, this small variation will not stand tests of statistical reliability and may be due to sampling error. More significant than the slight variations occurring among bears from different islands is the close similarity that exists between them. On all three bear islands, total length and hide measurements do not show a variation greater than 1.8 inches. This variation is extremely small in measurements of 7 and 8 feet. Measurements of tail, hind foot and skull do not vary greater than 0.6 inches for the three islands. The similarity of size of bears from the three islands points toward a uniformity of species and coincides with recent thinking by taxonomists and particularly Rausch (1953) favoring one, or possibly two, species of brown and grizzly bears in Alaska instead of the multiple specific and subspecific breakdowns of Merriam (1918). On the ABC Islands alone, Merriam recognized seven distinct species, five of them endemic to Admiralty Island and the other two found only on Baranof and Chichagof Islands.

TABLE 8 NUMBERS AND DISTRIBUTION OF BROWN BEARS KILLED IN SOUTHEAST ALASKA, 1945-1957 AS REPORTED BY REGISTERED GUIDES

Year	Av. No. Bears Seen Per Hunt	Total Kill	Admiralty Is.	Baranof Is.	Chichagof Is.	Total for ABC Is.	Cape Spencer To Yakutat	Other Mainland Areas
1945	10	4	3	1	0	4	0	0
1946	19	18	9	1	5	15	0	3
1947	4	6	6	0	0	6	0	0
1948	7	17	6	3	3	12	3	2
1949	38	63	41	9	6	56	5	1
1950	39	68	56	11	1	68	0	0
1951	21	71	36	13	18	67	1	3
1952	26	58	36	5	8	49	2	7
1953	27	57	38	9	5	52	3	2
1954	18	61	31	4	13	48	4	9
1955	25	48	20	3	19	42	6	0
1956	18	25	18	4	2	24	0	1
1957*	20	6	3	1	2	6	0	0
Percent of Total Kill 1945-57			60%	13%	16%	89%	5%	6%

*Includes voluntary reports only - registered guide system discontinued February 27, 1957

TABLE 9 VARIATION IN THE SEX DISTRIBUTION OF BROWN BEARS KILLED ON ADMIRALTY, BARANOF AND CHICHAGOF ISLANDS, 1952-1957 AS REPORTED BY REGISTERED GUIDES

Year	Total Kill Recorded by Sex	Percent Males	Percent Females
1952	17	71	29
1953	45	62	38
1954	47	66	34
1955	42	64	36
1956	25	48	52
1957*	6	83	7
Cumulative Mean Percentages		64	36

*Voluntary reports - registered guide system discontinued February 27, 1957.

TABLE 10 MEAN TROPHY SIZE AND BODY LENGTH OF BROWN BEARS KILLED IN SOUTHEAST ALASKA
1945 - 1958
(Measurements in inches)

	TOTAL LENGTH				HIDE LENGTH				HIDE WIDTH				
Year	Admiralty	Baranof	Chichagof	ABC Totals	Admiralty	Baranof	Chichagof	ABC Totals	Admiralty	Baranof	Chichagof	ABC Totals	No. Samples
1945	96.3	85.0	--	91.0	108.3	92.0	--	100.1	108.3	92.0	--	100.1	2
1946	74.8	80.0	69.5	72.9	88.0	87.0	77.8	83.3	96.2	95.0	92.3	94.3	20
1947	76.3	--	--	76.3	93.6	--	--	93.6	98.1	--	--	98.1	6
1948	68.5	72.4	83.0	73.0	83.8	87.6	107.5	89.6	94.5	101.0	114.0	100.2	10
1949	73.8	70.9	67.1	72.5	87.5	85.0	80.6	86.0	98.0	95.1	87.1	96.2	57
1950	73.8	74.1	72.0	73.6	86.5	88.6	86.5	87.0	95.9	99.2	96.0	96.5	66
1951	73.8	72.7	72.8	73.4	85.0	88.6	82.6	85.0	94.3	92.6	91.5	93.3	64
1952	77.7	77.1	82.0	78.0	88.0	92.5	84.5	89.2	95.5	96.2	97.8	95.7	36
1953	99.0	88.0	81.0	87.2	102.0	98.0	95.5	97.4	110.5	111.0	95.8	101.8	5
1954	--	--	--	--	--	--	114.0	114.0	--	--	108.0	108.0	1
1957	--	--	75.0	75.0	--	--	100.5	100.5	--	--	94.5	94.5	2
1958	--	80.5	72.8	75.3	95.0	93.0	89.8	93.0	100.2	122.0	97.5	103.0	6
Means	74.6	74.5	73.0	74.3	87.2	89.0	87.2	87.5	96.4	96.6	95.6	96.5	
No. Samples	161	40	47	256	165	49	48	262	165	49	48	262	

TABLE 11

MEASUREMENTS FROM HUNTER-KILLED
BROWN BEARS IN SOUTHEAST ALASKA
1945-1958
(Measurements in Inches)

Location	Total Length	Tail	Hind Foot	Hide Length	Hide Width	Skull Length	Skull Width	No. Bears
Admiralty Is.	74.6	3.3	10.4	87.2	96.4	14.8	8.5	165
Baranof Is.	74.5	3.4	10.2	89.0	96.6	15.1	9.1	49
Chichagof Is.	73.0	3.8	9.8	87.2	95.6	15.1	8.7	48
All Islands	74.3	3.4	10.3	87.5	96.5	14.9	8.7	262
Mainland	81.8	4.1	9.3	86.5	90.3	14.9	8.3	21

Economic Importance: Utilization of the brown bear resource has contributed materially to the economy of Southeast Alaska in recent years. There are approximately 10 guide-outfitters and an additional 15 guides in this area that derive at least part of their annual income from guiding brown bear hunters. Each outfitter charges between $65.00 and $125.00 a day for a brown bear hunt and the average trip is 10 days. In addition, non resident hunters spend money in Alaska for travel, outdoor clothing, hunting licenses, and other incidentals. Average expenses incurred in Alaska by nonresident brown bear hunters were obtained from six Southeast Alaska guides. A breakdown of these expenses is shown below:

Outfitters fee, $90/day, average trip 10 days (Includes $30/day guide fee and all field expenses)	$ 900
Nonresident big game lic. & special bear license	60
Intra-Alaska transportation	70
Liquor	50
Special outdoor clothing	150
Ammunition	40
Photographic film	20
Food, lodging, incidentals & souvenirs in travel	100
Average expenditure of each nonresident brown bear hunter	$1390

The average expenditure of $1390 by each nonresident brown bear hunter brings the average value of each bear killed to well above $1500, since increasing numbers of hunts in recent years are for photographic purposes and do not result in the killing of bears. The average annual value of the brown bear resource to the economy of Southeast Alaska was approximately $84,000 for each of the years 1949-1956.

RECOMMENDATIONS

Findings of this study indicate that the brown bear populations of Southeast Alaska are not being depleted under present conditions. However, the present, rapid development and planned future expansion of the forest products industry in Southeast Alaska causes concern for the welfare of the brown bear. In order to be in a position to develop a sound brown bear management-timber use program, current knowledge of the welfare of the brown bear populations is essential. In addition, studies must be initiated to enable evaluation of the many and varied effects of logging on the brown bear and its habitat.

Brown bear studies should be continued and increased in scope as outlined below:

The Bear Population:

1. Annual composition counts should be continued to obtain cub ratios and mean litter size values for comparative purposes. These can be obtained in the spring and summer from both aerial and ground counts and by enlisting the aid of stream guards and woods crews.

2. Annual trend counts should be made on specific portions of the bear range to reflect population fluctuations.

3. The collection of harvest data should be continued to reflect hunting pressure and its effect on the bear populations.

The Effects of Logging:

1. Vegetation studies should be initiated to determine the effects of logging on forest floor vegetation. Both immediate and long range effects should be evaluated.

2. Existing studies of the effects of logging on salmon streams on the Maybeso Forest, Prince of Wales Island and at Young Bay, Admiralty Island, should be correlated with the brown bear studies to utilize this closely associated information.

3. The immediate effect of increased population pressures as bears move from areas being logged onto adjacent areas should be studied. Similarly resulting increased bear predation on salmon in streams adjacent to drainages being logged should be evaluated.

4. Methods of garbage disposal at logging camps, which will reduce attraction of bears, should be developed and tested. Also, repellent chemicals and devices should be tested to determine their effectiveness for keeping bears away from centers of human activities.

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Prepared by: David R. Klein, Wildlife Mgt. Biologist

Approved by: Sigurd T. Olson, Acting Supervisor, Game Restoration

Date: December 31, 1958

JOB NO. 2--Alaska Peninsula Brown Bear Studies

PERIOD COVERED: June 20, 1958 to September 1, 1958.

ABSTRACT

Annual composition surveys were conducted July 24 to August 18, 1952 to determine relative numbers and population trends of brown bears on the Alaska Peninsula.

The Peninsula cub crop equals 20 percent of the total population and appears to be somewhat higher than productivity on Kodiak Island.

Survival of cubs to the yearling class based on aerial surveys was 20 percent. At McNeil River ground surveys indicated only 17 percent mortality. Because litter sizes remain essentially constant mortality factors must affect entire litters.

Bear density indices on the three study areas on the Peninsula were 38.9, 7.3 and 17.1 bear seen per hour of flying. The variation between the areas thought to be caused by functions of sampling technique, the environment or both; however, these indices will serve as a basis for future comparisons.

Ground observations showed that no sows with cubs were observed on the coastal areas until June. Male bears comprise 70 percent of the spring kill on Kodiak. This information could constitute an effective management tool by restricting hunting to a spring season if necessary to protect female bears.

The number of bears seen on the Mikfik and McNeil Rivers increased with the abundance of salmon and then decreased as the berry crop in the hills matured in late July and early August. To obtain maximum results from aerial counts they should coincide with the peak of salmon abundance in the streams.

The legal harvest of bears on the Peninsula is 25 to 50 per year. Except for local situations, it is doubtful that the combined illegal and defense of property kill has a significant effect on brown bear populations.

OBJECTIVES

To determine relative numbers and population trends of brown bears on the Alaska Peninsula as a basis for comparing the relative abundance of the various populations of brown bears inhabiting the Alaska Peninsula.

TECHNIQUES USED

Aerial composition surveys were conducted between July 24 and August 18, 1958, of the brown bear populations inhabiting the Alaska Peninsula. The survey covered all the major rivers draining to the Bering Sea, and some of the rivers draining to the Pacific Ocean. Ground observations

were made on several bear populations by United States Fish and Wildlife Service Bureau of Commercial Fisheries stream guards at locations on both the Bering Sea and Pacific Ocean coastlines of the Alaska Peninsula.

Aerial Surveys

The aerial surveys were made using a 150 Supercub piloted by Game Management Agent Virgil Crosby, a Cessna 180 piloted by Game Management Agent Ray Tremblay assigned to bear-enforcement patrols, and a Bureau of Commercial Fisheries Grumman Goose through the cooperation of Sand Point District Management Agent Henry Chrostowski.

The surveys were hampered greatly by incessant inclement weather, rain, fog, turbulence and strong winds. The weather combined with logistic problems prevented adequate coverage of rivers draining into the Pacific Ocean; particularly that portion of the coastline between Kamishak Bay and Albatross Bay (Figure 1).

Whenever possible the surveys were made from an altitude of 300 to 600 feet above the terrain. The altitude varied within the above limits in response to the density of the vegetation and the prevailing weather conditions. Duplicate counts were made on several rivers in an effort to assess the efficiency of aerial-bear surveys.

A total of 148.1 hours of flying time was expended on this project. The time and its classification was distributed as follows:

Pacer - 14.0 hours, preliminary survey of the Peninsula in June 1957 by Rausch and Crosby
Supercub - 91.2 hours, bear surveys
Cessna 180 - 42.9 hours, bear enforcement patrols
Goose - observations on lower peninsula by Bureau of Commercial Fisheries chartered by Game Management to put out gas caches

Ground Observations

The ground observations were made possible through the cooperation of the Bureau of Commercial Fisheries district management agents who instructed their stream guards to record bear observations.

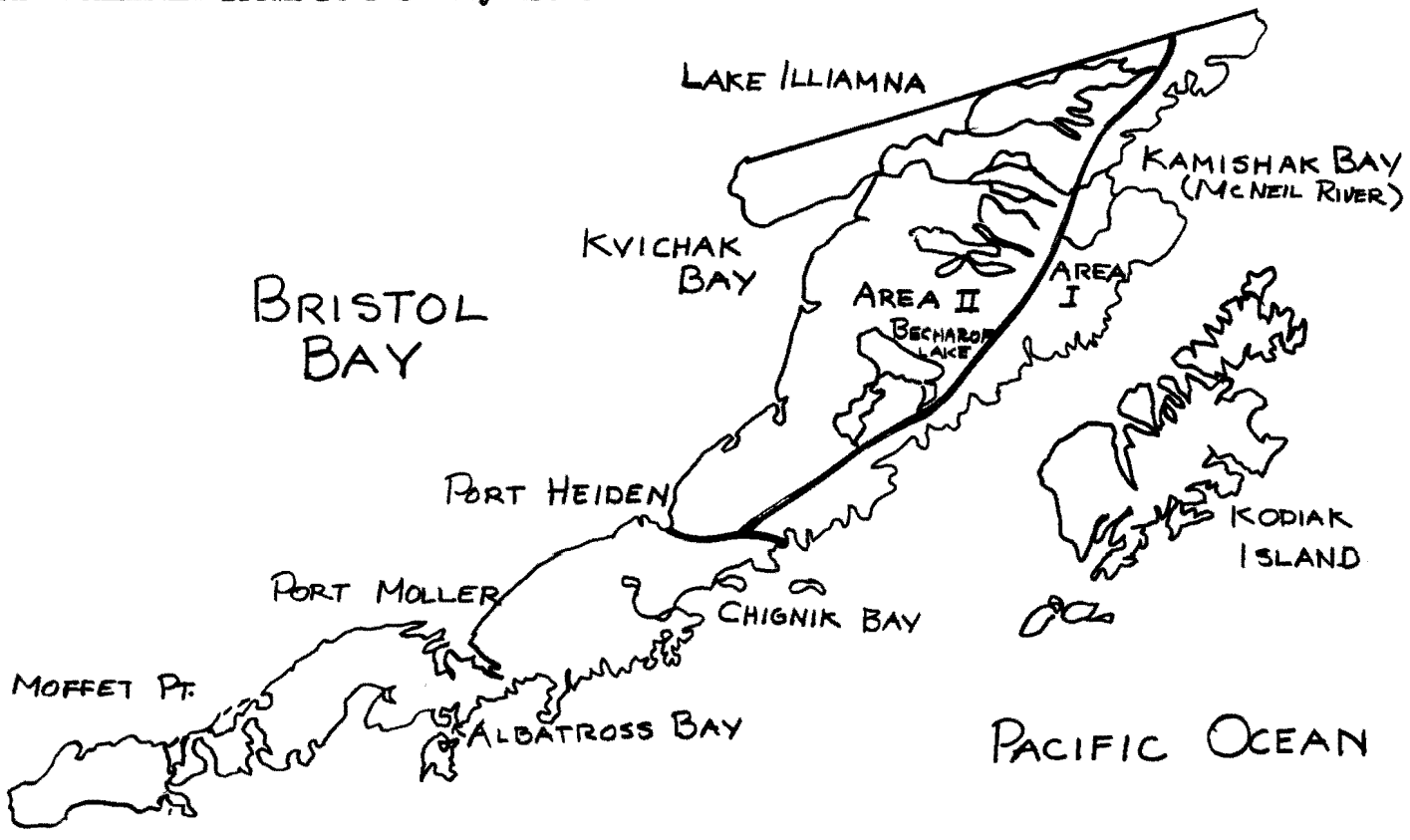
The stream guard observations are largely from the lower Pacific side of the Peninsula. A few observations were made on the Bering Sea side of the Peninsula near Port Moller and Naknek.

Data Recorded

Classification of bears by aerial and ground observations are limited to three major categories:

1. Sows with cubs of the year
2. Sows with yearlings
3. Other bear

Figure 1 Alaska Peninsula Brown Bear Survey Areas



Scale - 1:5000,000

Classification of sub-adults not accompanied by a sow is not considered reliable by this writer, and these bear are included in the "other bear" category.

The time spent flying over each drainage and the approximate ground speed was recorded for comparative bear-density studies.

Methods of Analysis

The data from the aerial surveys and from the ground observations are analyzed for productivity and survival. The indices to productivity and survival are derived from the three general classifications of bear observations.

Productivity— as used here refers to the general well being of the bear population as measured by the following indices:

1. Per cent cubs in the total population
2. Per cent yearlings in the total population
3. Per cent of females two years and older producing and rearing cubs or yearlings to the time of the survey.
4. Frequency of various litter sizes, and average litter sizes.

The female segment of the population is determined by assuming a 100:100 ratio in bears older than yearlings. The total number of females with cubs and yearlings is then added to the total of the "other bear" category and the sum divided by two to derive the calculated total female population segment. The "per cent productive females" is obtained by dividing the "total sows with cubs or yearlings" figure by the "total females" figure.

Survival

Survival as discussed here refers to survival of cubs of the year (5 to 7 months) to yearlings (17 to 19 months) and is measured by the ratio of total yearlings to total cubs. This ratio assumes that total cub production and survival to the time of the count is constant. The assumption is subject to considerable error, but until annual composition surveys are made no other estimate of cub survival is available.

Bear-Density

The total aerial-time spent surveying bear populations was analyzed to determine relative bear density in three major sections of the Peninsula. The bear-per-hour of aerial survey time figure was derived by dividing the total bear observations by the total hours of observation time expended.

Ground Observations

The observations made at McNeil River were analyzed in an effort to determine seasonal distribution of the various sex and age groups and

Table No. 1

Summary of Brown Bear Composition Counts
Made on the Alaska Peninsula and Kodiak Island, Summer 1958

	Sow/1 Cub	Sow/2 Cubs	Sow/3 Cubs	Sow/4 Cubs	Sow/1 Yearl.	Sow/2 Yearl.	Sow/3 Yearl.	Other Bear	Total Bear
Area I	4(21)	10(53)	3(16)	2(10)	1(11)	5(55)	3(34)	53(37)	142
Area II	2(18)	5(46)	4(36)	0(0)	2(13)	9(60)	4(27)	80(49)	162
Area III	6(21)	12(41)	9(31)	2(7)	7(27)	12(46)	7(27)	189(52)	361
Total	18(28)	27(41)	16(25)	4(6)	10(20)	26(52)	14(28)	322(48)	665
Total All Aerial Observations	18(23)	32(42)	23(30)	4(5)	11(20)	31(55)	14(25)	364(47)	779
McNeil River Ground Observations July 13-Aug.1	11(10)	41(38)	53(48)	4(4)	6(6)	37(39)	52(55)	492(41)	1200
Kodiak Refuge 1958 Aerial Surveys	4(15)	13(48)	10(37)	0(0)	3(14)	9(43)	9(43)	265(63)	421

Table 2. Per cent composition of various brown bear population elements on the Alaska Peninsula and Kodiak Island

Area	Cubs in Total Population	Yearlings in Total Population	Yearlings & Cubs in Total Population	Sows/Cubs in Total Population	Sows/Cubs of Estimated Female Segment of Population	Other Bear in Total Population	Average Litter Cubs	Average Litter Yearlings	Total Bear Observations
I	29	14	43	20	69	37	2.16	2.22	142
II	15	20	35	16	49	49	2.18	2.13	162
III	18	14	32	15	45	52	2.24	2.00	361
Total	20	16	36	17	51	48	2.20	2.08	665
Total all Aerial Survey	21	15	36	18	48	46	2.17	2.05	779
McNeil River Observations 7/13 - 8/1	22.3	20	42.3	17	59	41	2.45	2.48	1200
Kodiak Refuge Aerial Observations	14.3	11.4	26	11.4	27	63	2.22	2.28	421

to determine the peak of bear-abundance at McNeil River.

Comparison of Survey Techniques

Air and ground surveys of McNeil River, and duplicate aerial surveys of Sandy and Bear Rivers were made and analyzed to test the efficiency of the various survey techniques.

FINDINGS

Productivity

Productivity data obtained from aerial surveys and ground observations of brown bear populations inhabiting the Alaska Peninsula and Kodiak Island are presented in Tables 1 and 2. In analyzing the productivity data, the data obtained from aerial and ground observations made on the Peninsula, and aerial observations made on Kodiak Island by Refuge Manager, Will Troyer, are compared. It is realized that the Peninsula aerial and ground observations, and the Peninsula and Kodiak aerial observations may not be directly comparable for the following reasons: the areas represented are not the same, the timing of the counts varied, and the ground observations include many duplications.

The Alaska Peninsula survey represents all of the Peninsula's major drainages to the Bering Sea, and some of its drainages to the Pacific Ocean. The Kodiak Island aerial counts involve a different land mass and contrasting vegetation types. The McNeil River ground observations are from one small area near the mouth of McNeil River on the Pacific side of the Peninsula.

The results of aerial or ground survey techniques that do not consider differential activity periods are apt to be biased. Bears are believed to exhibit crepuscular activity patterns, however, some observers contend that during the summer, when bears are fishing for salmon, that the various population elements exhibit different activity patterns. An example of the latter contention is provided by the observations made at McNeil River in late July, 1958 by Ivan Marx. Marx observed 20 adult bears, without cubs or yearlings, feeding on salmon at about three A.M. He believes that large bear, presumably boars, are active only at night.

The Alaska Peninsula aerial surveys were conducted throughout the day, whenever weather permitted. The ground observations at McNeil River were usually made in the morning and again in the evening. The Kodiak aerial counts were made during the early morning. It is my opinion that, under most Alaska Peninsula conditions, aerial surveys conducted throughout the day will provide a reliable cross section of the existing population, because the noise of the plane tends to flush bears not on the streams. Thus, sampling from all sex and age groups even if they have different activity periods.

The sex and age composition data from McNeil River is based on 1,200 bear-observations made between July 13 and August 1, 1958. Undoubtedly duplications were common; however, if one assumes that all sex and

age classes and family groups have an equal opportunity to be observed, and that the population was essentially resident, then the averages of the sex and age composition data represent a reasonable approximation of the existing population.

Analysis of the data obtained from the indices to productivity is difficult because of the previously discussed sampling problems, and because of the limited data vailable for comparison. No conclusions regarding productivity are drawn, rather suggestions or indications of productivity are discussed.

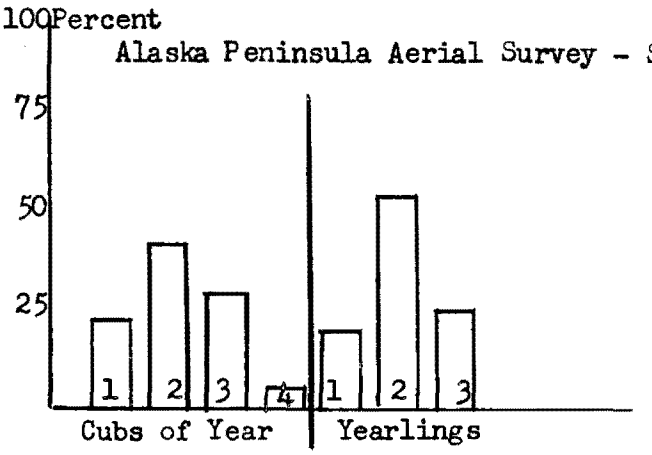
The sex and age composition data obtained from the Alaska Peninsula are compared with similar data from Kodiak Island in Tables 1 and 2. These data reveal that the bear populations are comprised of population elements as follows: Alaska Peninsula, cubs-of-year 21 percent, yearlings 15 percent, sows with cubs 18 percent, and estimated producing sows 48 percent; McNeil River, cubs-of-year 22 percent, yearlings 20 percent, sows with cubs 17 percent, and estimated producing sows, 59 percent; Kodiak Island, cubs-of-year 14 percent, yearlings 11 percent, sows with cubs 11 percent, and estimated producing sows 27 percent.

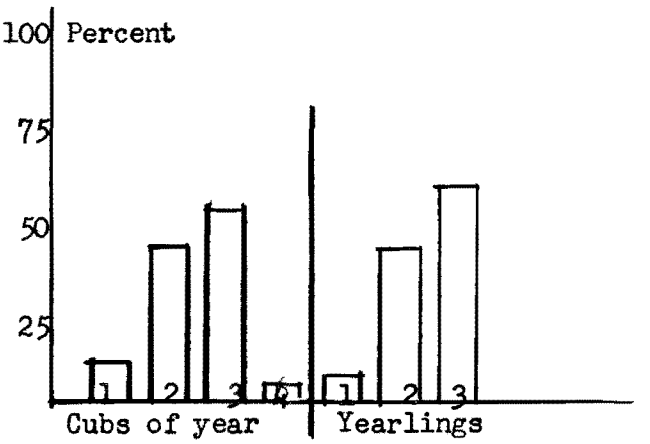
Another indication of comparative productivity is gained from the litter-size-frequency (Figure 2), and from the average litter size (Table 2). The litter-size-frequency data reveals that the Peninsula aerial survey and the Kodiak aerial survey litter sizes are similar, with twins being the most frequent litter size, followed by triplets singletons and quadruplets in that order. The Peninsula and Kodiak average litter sizes for cubs of the year and for yearlings are 2.17 and 2.22, and 2.05 and 2.28, respectively. The McNeil River observations are not used in comparing Peninsula bear populations with those of Kodiak. The McNeil River cubs-and yearlings-per-sow figure are statistically different from the same population elements for the entire Peninsula. The reasons for the different, biological or sampling techniques, are not known at present. Generally the McNeil ground observations indicates a higher reproductive rate than either the Peninsula or Kodiak aerial observations.

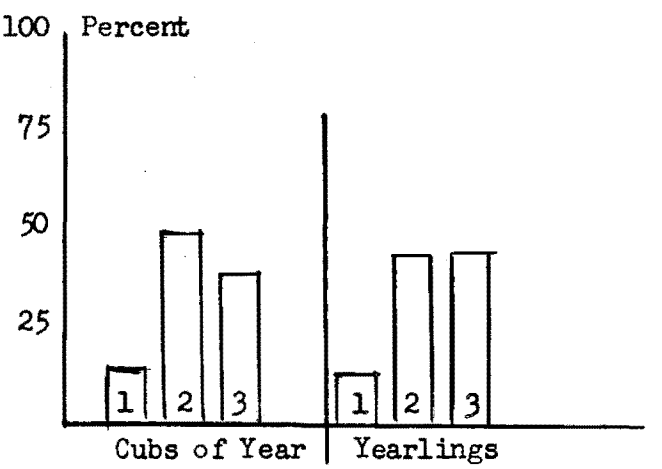
The aerial survey data on the Peninsula indicates an annual cub crop equaling 20 percent of the total population. The significance of this figure to a bear population is not known, but in certain other wildlife populations, such as moose and caribou, a calf crop comprising 20 percent of the total population suggests good productivity. Yearlings comprise 15 percent of the total Peninsula bear population, but if cubs-of-the-year are excluded, they equal 19 percent of the population, similar to the population composition of the Nelchina Caribou herd.

In general the Peninsula bear population indicates a higher productivity than the Kodiak Island population which has withstood relatively intense hunting pressure for a number of years. The comparisons, particularly, of percentage-population-composition may not be valid, however, because the Kodiak counts were made largely in the early morning, whereas as previously discussed, the Peninsula counts were made thoughout the day. Possibly the Kodiak counts sampled disproportionately from the male population segment; conversely, the Peninsula data could be biased toward the "females with cubs"

Figure 2 Percent - Frequency of Brown Bear Litter Sizes
Alaska Peninsula, Aerial and Ground Observations, and
Kodiak Island area observations compared







segment of the population. There are no significant differences between average-litter-sizes of the Peninsula and Kodiak aerial samples.

Perhaps the greatest value of the 1958 Alaska Peninsula brown bear composition counts will be in future comparisons with similar data, and the realization that under certain conditions brown bear apparently exhibit a productivity rate similar to other northern big game species.

Survival

Survival of cubs to the yearling class, as measured by the aerial counts, indicates a mortality of 29 per cent. Ground observations at McNeil indicate a 17 per cent mortality.

Another indication of survival is provided by comparing the average litter-size of cubs versus yearlings. The difference between cub and yearling litter size on the Alaska Peninsula is very slight. Cubs averaged 2.17 per litter and yearlings averaged 2.05 per litter. The aerial observations made on Kodiak and the ground observations at McNeil indicate that the average yearling litter is slightly larger than the average cub litter. In all areas, however, yearlings comprised a smaller percentage of the total population, suggesting that cub production is not constant from year to year. If it is constant, and 15 to 30 per cent mortality occurs to cubs (between 5 to 7 and 17 tO 19 months), the mortality factors must affect entire litters rather than portions of litters since litter sizes remained relatively constant. One possible mortality factor which could affect entire litters is hibneration loss about which little is known.

Several observations of intraspecific strife in areas of bear concentrations were made this past summer. On August 6, 1958, Ivan Marx and the writer found the remains of a cub-of-the-year which had apparently been eaten by a larger bear. Several days later a large bear was observed pursuing a cub of the year. The result of this attack was not learned. Will Troyer, Refuge Manager, Kodiak Bear Refuge, reports making similar observations on Kodiak this past summer. The extent or importance of intraspecific strife is not known. Other factors such as parasites, disease, food shortages and severe winters contribute to natural mortality but are difficult to assess quantitatively.

Bear-Density

Brown bear numbers are reported to have declined in the north central portion of the Alaska Peninsula, particularly during 1955 and 1956. In an attempt to assess the existing relative-bear density, the Peninsula was arbitrarily divided into the general areas (Figure 1.).

Area I, the Pacific coast and associated drainages from Iniskin Bay to Amber Bay (most of the counts were made between Iniskin Bay and Kamishak Bay). This area is characterized by precipitous mountains which frequently rise abruptly from near the shoreline. The rivers are short and swift. A narrow, flat, salt grass plain lies between the mountains and the ocean in some places. The vegetation is lush, and consists principally of grasses, forbs and shrubs.

Area II extends from the crest of the Aleutian Range to the Bering Sea, and is bounded on the west by the Meshik River drainage and to the east by the Kvichak River. This is the area where bears are reported to have decreased in 1955 and 1956. The terrain varies considerably within this area. Steep mountains form its southern border, and a wide rolling plain varying in width from 20 to 30 miles extends from the foothills of the mountains to the Bering Sea. The vegetation includes many types, ranging from a mature spruce-birch forest type around portions of Illiamna Lake to a heath-tundra-sedge type north of Becharof Lake. Generally the flora is not as lush as in Area I. The streams vary in character, flowing swiftly in the mountains and foothills, and generally being meandering through the plains area.

Area III includes both sides of the Peninsula from and including the drainages of the Meshik and Aniakchak Rivers to the tip of the Peninsula. The terrain and rivers include features similar to both Area I and II. The vegetation more nearly resembles that of Area I, although extensive areas of short heath-tundra and sedge vegetation types are present on the Bering Sea side of the area.

The great environmental variation among the three areas preclude direct bear-density comparisons. In order to establish a basis for future comparisons, however, the three areas are compared. The average number of bear sighted per-hour of flying in Areas I, II and III are 38.9, 7.3 and 17.1 respectively. This indicates fewer bear-per-unit of area in Area II, but the lower figure is expected when considering the overall habitat. The present differences in densities are difficult to interpret especially in view of the population composition (Table 1) which indicates that cubs and yearlings in Areas I, II and III comprise 43, 35 and 32 per cent of the total population, respectively. Area II, which has the lowest bear-per-hour of survey time, has a higher measurable productivity than Area III and a lower productivity than Area I.

Further investigation of bear population dynamics is needed at present, however, it appears that the low density population in Area II is a function of the sampling technique, the environment, or both.

Ground Observations

The ground observations of bear made by Bureau of Commercial Fisheries personnel are listed in Tables 3 and 4. The McNeil River Bear Reserve observations which have been used for comparative purposes in other sections of this report are discussed separately.

Bear observations by stream guards were made on both sides of the lower peninsula. The majority of the observations, however, were made along the Pacific Coast. Observations by stream guards are limited to the coastal areas near stream mouths. Consequently, counts are fragmentary, and, perhaps, their greatest value will be for future comparisons.

The observations on the bear population inhabiting the McNeil River Bear Reserve were made between May 6 and August 10, 1958, by Ivan Marx. The data are presented in Table 4. Bear, presumably boars or

Table 3 Bear observations by Bureau of Commercial Fisheries stream guards stationed on the Alaska Peninsula

Area	Sow/1 Cub	Sow/2 Cubs	Sow/3 Cubs	Sow/1 Yearling	Sow/2 Yearlings	Sow/3 Yearlings	Other Bear	Total Bear Obs.	Man Days
Morzhoval Bay Little John Lagoon		4			1		57	82	40
Balboa Bay Area	1	2		1			3	13	29
Volcano Bay						1	3	7	38
Chiginagak Bay		2			1		17	26	29
Hook Bay			2					8	Unknown
Aniakchak Bay							3	3	15
Chignik Weir							1	1	Unknown
Naknek Cannery Dock								1	Unknown
Bear River Weir								2	28
Bear River Stream							4	4	24
Canoe Bay Area	4	4		2			7	31	18
Metra Fania Bay or Ivan Bay					1		5	8	23
Belkofski Bay	1				1		7	12	26
Alagnak River Tower							1	1	Unknown
Totals								199 186	Unknown 242

Table 4. Kamishak Bay Brown Bear Observations made by Ivan Marx--May 6 to August 10, 1958.

Date	Sow/1 Cub	Sow/2 Cubs	Sow/3 Cubs	Sow/4 Cubs	Sow/1 Yrlg.	Sow/2 Yrlgs.	Sow/3 Yrlgs.	Yrlgs. w/o Sows	2-yr Olds	Other Bear	Total Bear
5/11/58										1	1
5/12										1	1
5/14									1	2	3
5/15										2	2
5/16										1	1
5/19										5	5
5/23										2	2
5/25										2	2
5/26										2	2
5/27										3	3
5/29										1	1
5/30										4	4
5/31										1	1
6/1										3	3
6/2						1					3
6/3					1	1				1	6
6/4						1					3
6/5						1				1	4
6/6						1				2	5
6/9						1				1	4
6/10						1				1	4
6/11						1				1	4
6/15					1					3	5
6/16					1	1				4	9
6/17					1					4	6
6/18					1					5	7
6/19										4	4

Table 4. Kamishak Bay Brown Bear Observations made by Ivan Marx--May 6 to August 10, 1958 (Continued).

Date	Sow/1 Cub	Sow/2 Cubs	Sow/3 Cubs	Sow/4 Cubs	Sow/1 Yrlg.	Sow/2 Yrlgs.	Sow/3 Yrlgs.	Yrlgs. w/o sows	2-Yr Olds	Other Bear	Total Bear
6/20					2					5	9
6/21										7	7
6/22										10	10
6/23										6	6
6/24										7	7
6/25										16	16
6/26										8	8
6/27										8	8
7/1										4	4
7/2										6	6
7/5			1		1					4	10
7/6		1								12	15
7/7		1							1	6	10
7/8		1								16	19
7/9		1								6	9
7/10						1				6	9
7/11		1				1				19	25
7/12		1				1				8	14
7/13	1	1				1			14	27	49
7/14		2	3			2			16	13	53
7/15		4	2			3	3		14	24	79
7/16	1	3	2			2	1			17	46
7/17	1	2	1			1	1		2	10	31
7/18	2	3	4			3	5		3	32	93
7/19		1	3			3	3		7	35	78
7/20		2	10			1	6		8	36	117
7/21	1	3	3		1	2	3		5	23	71

Table 4. Kamishak Bay Brown Bear Observations made by Ivan Marx—May 6 to August 10, 1958 (Continued)

Date	Sow/1 Cub	Sow/2 Cubs	Sow/3 Cubs	Sow/4 Cubs	Sow/1 Yrlg.	Sow/2 Yrlgs.	Sow/3 Yrlgs.	Yrlgs. w/o Sows	2-Yr Olds	Other Bear	Total Bear
7/22 Storm		1	1			1	3		10	7	39
7/23 "						1	1			3	10
7/24		3	7		1	5	6		17	33	128
7/27	1	1	5	1		3	4		7	17	79
7/28	1	1	1	1		1	3		6	13	48
7/29	1	2	2	1	1	2	3		5	24	70
7/30	1	4	3	1	1	1	4		8	18	78
7/31	1	4	4		1	3	5	6	6	14	87
8/1 A.M.		3	2		1	4	4	7	9	11	
P.M.		5	3 counted s/cubs only								
Other bear							1		1	4	93
8/3 Storm			1			1	1		2	12	25
8/4 Fog			2					1			9
8/5		2	1				2	7	6	14	45
8/6			2				1	1		13	26
8/7			1	1		1	3	2		4	30
8/8			3			2	2	4	3	14	47
8/9		1	3				3	4	3	15	49
Total	11	51	68	5	14	55	68	32	154	644	1767
7-13- 8-1	11	41	53	4	6	37	52	13	128	351	1200

sows without cubs, were utilizing the salt grass meadows located along the shores of Kamishak Bay by May 6. No sows with cubs or yearlings were seen until June 2 when a sow with yearling cubs was observed. The first sow with cubs-of-the-year was observed on July 5.

The fact that no sows or yearlings were observed on the coastal areas until June could be a practical management tool. If further investigation confirm this year's observations, then hunting of bears along the Pacific Coast of the Alaska Peninsula during the month of May would probably not significantly affect bear reproduction. Data from the sportshunter harvest of bear on Kodiak for the month of May which show that approximately 70 per cent of the harvest are males, adds support to the spring hunting theory. Also, most of the hunting along the Pacific Coast of the Alaska Peninsula is confined to the beaches and grass flats because there are few lakes suitable for float plane operations.

Observations of bear increased slowly but steadily from May 11 to July 12 (Figure 3). A dramatic increase in bear-observations occurred from July 12 through July 17, and approximately 80 bear-observations were made daily from July 18 through July 30. The abundance of bear coincided with the availability of large numbers of salmon at and below the falls on Mikfik and McNeil Rivers. From July 30 until the station was closed on August 10, bear-observations decreased steadily, although salmon, in varying numbers, were available throughout this period. Observations of fresh bear scats revealed that many of the bear were feeding on berries in late July and early August. The maturing berry crop may have influenced the bears feeding habits and prompted their gradual dispersal from the concentration areas on Mikfik and McNeil rivers.

Comparison of Survey Techniques

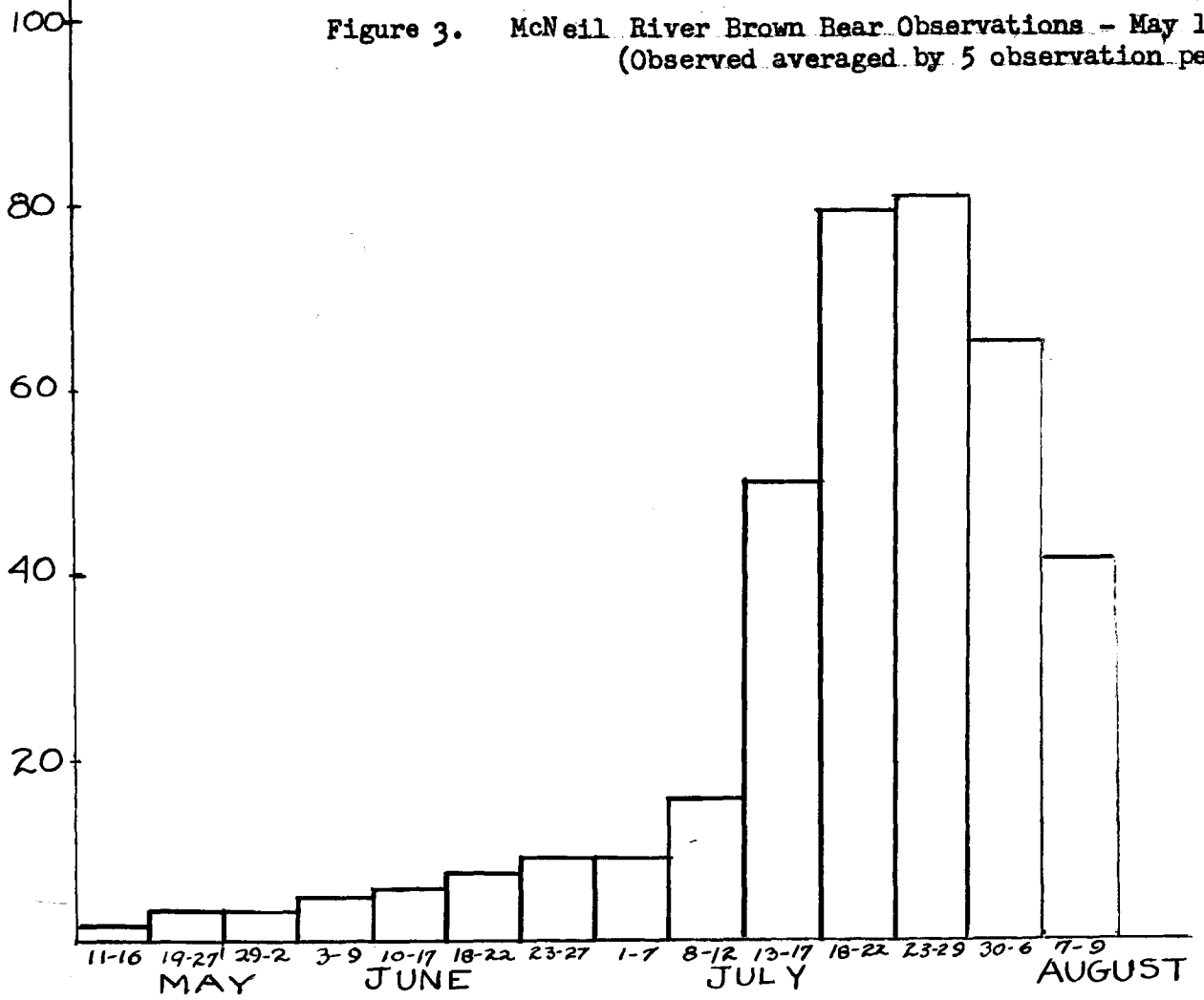
No attempt was made to estimate the total number of brown bear on the Alaska Peninsula, however, comparative studies of the relative efficiency of air versus ground observations were conducted at McNeil River. Fifty-three bear were counted from the air, and on the same day a ground observer counted 87 different bear and estimated that at least 100 bear were in the immediate vicinity of the McNeil River Falls. Thus, under the conditions existing at McNeil River--a rather dense alder type--roughly 50 per cent of the known population were observed.

Duplicate aerial surveys were made on the Sandy and Bear Rivers. The Sandy River surveys which were flown on July 31 and August 1 revealed totals of 28 and 21 bears, respectively. The indentifiable composition was as follows: July 31, sows with 2 cubs--3, cows with 3 cubs--2, other bear-11; August 1, sows with 2 cubs--2, sows with 2 yearlings--2, other bear--11. Thus, a total of 34 different bear were observed on Sandy River, although the greatest single count revealed only 28.

Bear Management Considerations

Assessing the legal and illegal take of bears was another segment of this project.

Figure 3. McNeil River Brown Bear Observations - May 11 - August 19, 1958
(Observed averaged by 5 observation periods)



The present brown or grizzly bear license should provide an accurate estimate of the legal take by licensed hunters. Attempts to assess the past legal harvest have not been wholly successful. Fragmentary data obtained from guides, taxidermists and U.S. Public Health Service, indicate that the legal harvest has not exceeded 25 to 50 bears annually in the past few years.

Illegal killing of brown bears by commercial fishery interests and local residents is believed by many to be a limiting factor to the bear populations on the Peninsula. Accordingly, enforcement patrols were assigned the mission of determining the magnitude of the illegal kill, and if possible, detering it. The enforcement patrol was supplemented by stream guards and by the bear-survey party. No violations were observed during the period of intensive investigations which extended from July 25 through August 7.

Illegal killing of bears falls into two major categories; wanton killing along the beaches and streams and killing in defense of life and property in and around areas of human habitation. The bears killed along beaches and rivers are difficult to detect. Two dead bear were observed from the air during last summer's studies. One was definitely an illegal kill, whereas the cause of death of the second animal could not be determined. Three additional illegal kills were reported by Jay Hammond of Naknek. The defense-of-life and property kills are somewhat easer to locate since people frequently report them. A total of eight defense-of-property kills were located this past summer. In all probability bears will be killed whenever they come into contact with areas of human habitation.

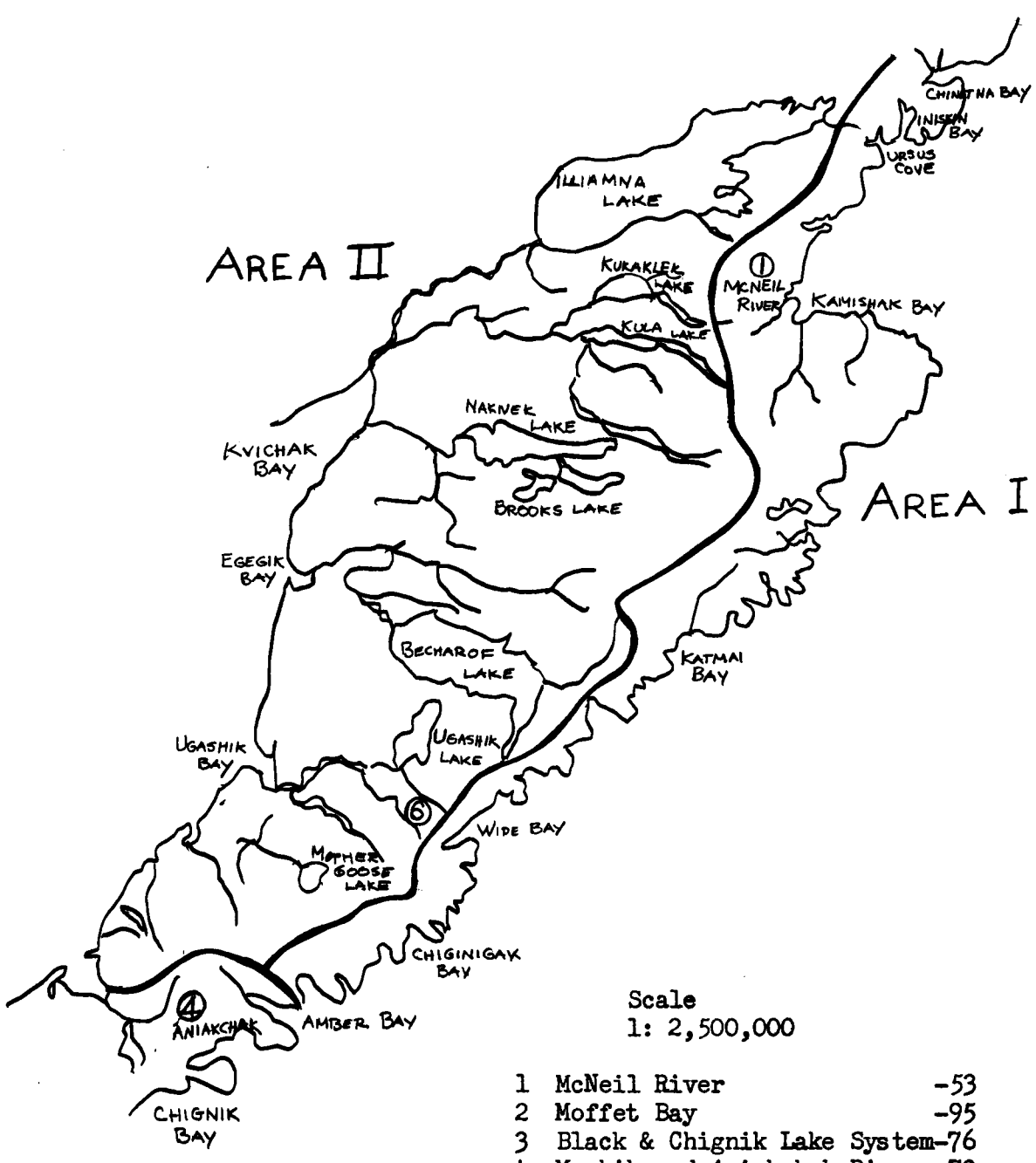
At present, it is extremely doubtful that the combined illegal and defense-of-property kill has any significant effect upon the brown bear populations. In certain local areas, however, the illegal and defense-of-property kill may be sufficient to depress bear populations. However, more quantitative kill data is needed before conclusions can be drawn.

The need for public conservation education throughout the Peninsula is critical. Law enforcement, particularly arrests which lead to fines and imprisonment, leaves little impression upon most of the indigenous personnel. Wanton destruction of bear by commercial fishing interests will continue in this area until the true bear-salmon relationships are known. Killing of bears in and around areas of human habitation could be minimized by adequately enforced garbage disposal around canneries, military bases, defense communication system sites, and villages.

Bear Concentration Areas.

The major concentration areas surveyed are shown in Figures 4 and 5. The concentration areas and total numbers of bears observed are as follows: McNeil River--53, Moffet Bay--95, Black and Chignik lake system--76, Meshik and Aniakchak drainages--70, Sandy Lake and River--34, Ugashik Lakes--32. These areas may serve as key or index areas for future counts.

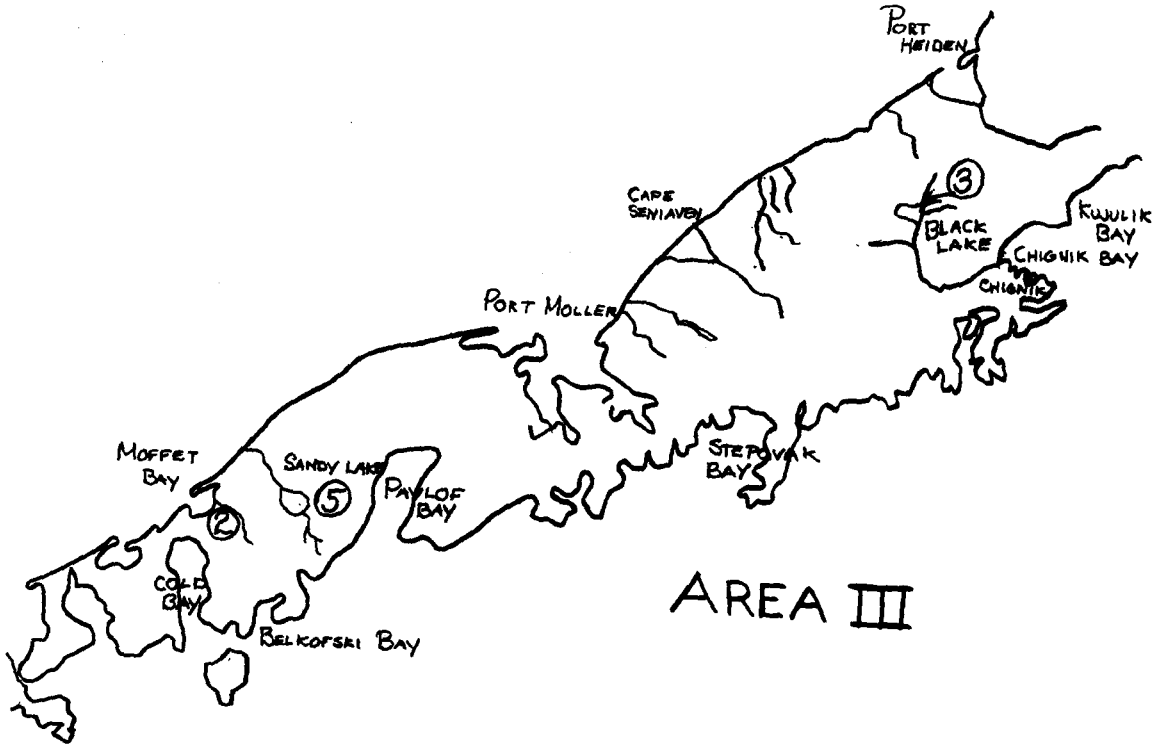
Figure 4



Scale
1: 2,500,000

1 McNeil River -53
2 Moffet Bay -95
3 Black & Chignik Lake System-76
4 Meshik and Aniakchak Rivers-70
5 Sandylake and River -34
6 Ugeshik Lakes -32

Figure 5


PORT HEIDEN
CAPE SEMIAVEN
3
BLACK LAKE
KUJULIK BAY
CHIGNIK BAY
CHIGNIK
PORT MOLLER
MOFFET BAY
SANDY LAKE
5
PAVLOF BAY
STEPOVAK BAY
2
COLE BAY
BELKOFSKI BAY
AREA III

RECOMMENDATION

Recommendations for future studies of the Peninsula brown bear populations fall into two categories, one a number of general suggestions pertaining to Peninsula study operations, and the other, outlining specific proposals for future work.

It is recommended that the agency charged with planning of future bear studies on the Peninsula employ a pilot well acquainted with Peninsula flying conditions—such as Virgil Crosby. If the studies are to include the entire Peninsula, then ample caches of gasoline should be placed at predetermined camping locations on both Pacific and Bering Sea sides of the Peninsula. At least 30 to 45 days should be allowed for a coverage similar to this past summers. In my opinion a Supercub 150 equipped with balloon tires would be preferable to a float equipped plane. A wheel plane would enable better coverage of the Pacific coast through utilization of the beaches and gravel bars as landing strip, thus, allowing more extensive ground observations of bear concentration areas.

Among the specific proposals are the following:

1. Annual aerial sex and age composition surveys should be conducted.
2. Experimentation with duplicate surveys to determine the reliability of aerial surveys should be conducted.
3. The surveys should be timed to coincide with spawning salmon migrations.
4. Movements of bear should be studied.
5. Ground observations, particularly at McNeil River should be continued.
6. The hunter harvest of bears should be recorded in detail.
7. Conservation education should be implemented.

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