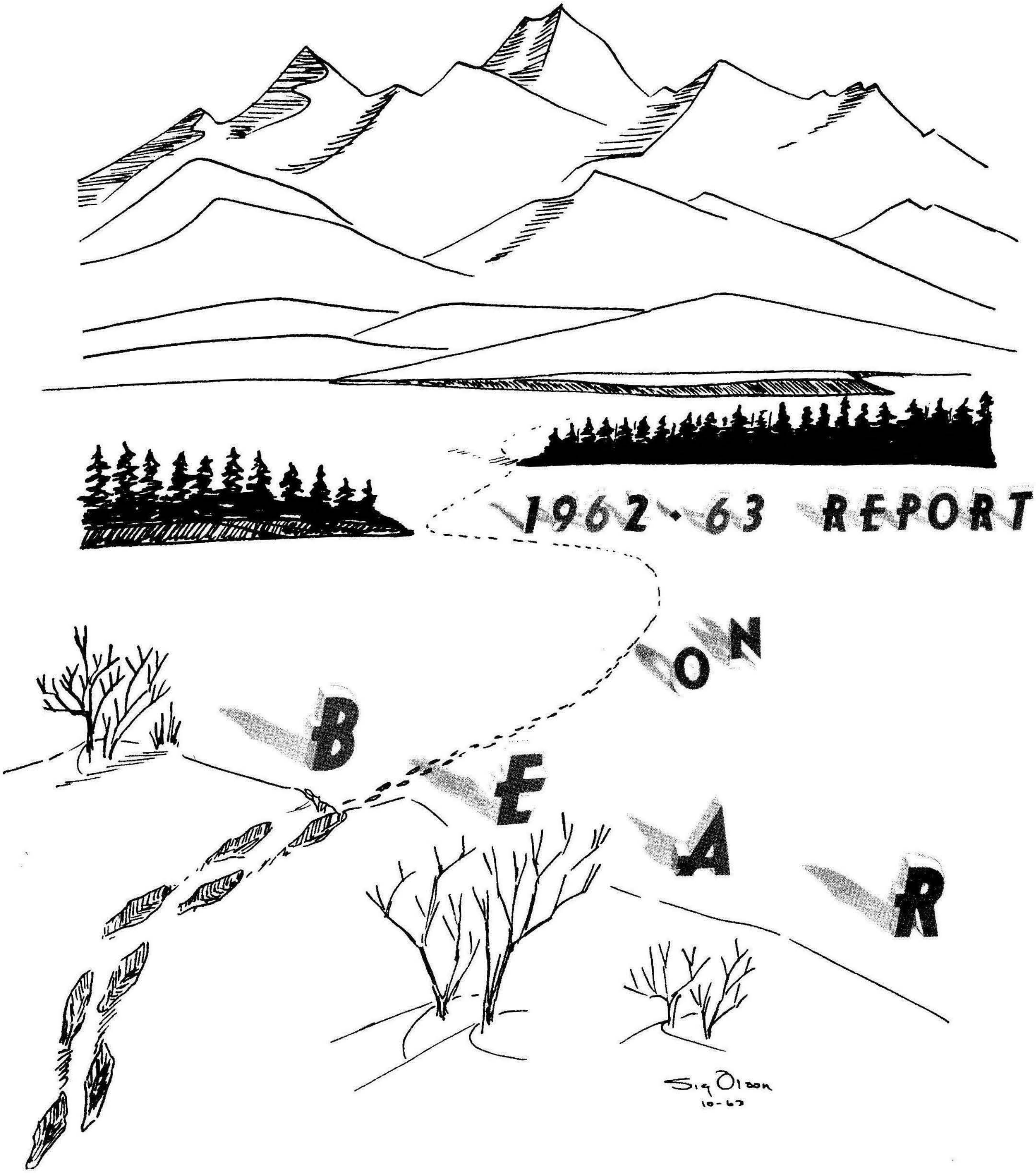

ALASKA DEPARTMENT OF FISH AND GAME

JUNEAU, ALASKA

DIVISION OF GAME

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STATE OF ALASKA
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DEPARTMENT OF FISH AND GAME
Walter Kirkness, Commissioner

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James W. Brooks, Director
Don H. Strode, Federal Aid Coordinator

BEAR REPORT

by

Albert W. Erickson, Leader

Volume IV
Annual Project Segment Report
Federal Aid in Wildlife Restoration
Project W-6-R-4, Work Plan F

The subject matter contained within these reports is often fragmentary in nature and the findings may not be conclusive; consequently, permission to publish the contents is withheld pending permission of the Department of Fish and Game.

(Printed October 1963)

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WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: F TITLE: Bear Investigations

JOB NOS.: 1; 2-a,b; 3; 4

PERIOD COVERED: July 1, 1962 to June 30, 1963

ABSTRACT

Brown Bear Studies - Alaska Peninsula

A statistical evaluation of a number of variables affecting aerial surveys on brown bears was carried out in the Chignik-Black Lakes area of the Alaska Peninsula. The primary design consisted of three replicates of a 3 by 3 Latin square testing for differences between observers, dates, and time of day. Analysis of variance tests showed that real differences (.01 probability level) existed in total bear counts between hourly periods within days. Peak activity occurred during the evening sampling period (5 to 7:30 p.m.) with least activity occurring at midday (11 a.m. to 1:30 p.m.). Differences in total bear counts between observers and between days within squares were not statistically significant at the .05 probability level: differences were found at this level, however, between replicate squares. Increased wind velocity was found to adversely affect the number of bears counted during observation periods. Lowest counts were associated with increased wind velocities.

Chi-square examinations for independence of compositional classification and observer abilities, time of day and dates were considered. Observers did not consistently classify bears in the same categories (.05 probability level). However, classification was independent of the time period or date influence at this probability level. The proportion of cub groups, yearling groups and "other bears" counted was not influenced by wind velocity.

Total counts for the morning surveys were less variable than for other time periods. Therefore, if survey results are

to be used for comparisons between areas or years, this time period would give most uniform comparisons. Also, if classification comparisons are to be meaningful they should be restricted to individual observers whose classification habits are consistent.

Brown Bear Studies - Southeast Alaska

Three replicate aerial beach counts were made on south Admiralty Island on May 19, 20 and 21, 1963. Bears observed numbered 15, 7 and 12, respectively. These counts compared favorably with those obtained during past years.

Two alpine track counts were made on south Admiralty Island on May 6 and May 22, 1963. Sixty-five tracks were counted on the May 6 flight and 35 on the May 22 flight. The results of these flights appear to offer promise as a procedure for determining population trends of Southeast Alaska brown bears.

Characteristics of the Brown-Grizzly Bear Harvest

During 1962, 538 bears were taken by sport hunters in Alaska. This was a 15 per cent increase over the 1961 kill. Kills were divided 263 for the spring season and 275 for the fall season. Heaviest spring kills were for the Alaska Peninsula and Kodiak-Afognak Islands. Fall kills were quite uniformly distributed between regions.

As during 1961, kill chronologies showed spring kills to have been primarily during May. Fall kills were heaviest at the beginning of the season with 37 per cent of the bears taken during the first two weeks of the season.

Fifty-four per cent of the 1962 brown-grizzly harvest was by nonresident hunters who enjoyed a hunter success of 65 per cent. Resident hunter success could not be calculated.

Males constituted 64 per cent of the harvest on the average: 78 per cent in the spring and 50 per cent in the fall. The spring-killed bears were found to be larger than fall kills, on the average: squared hide and skull measurements (mean values) were 7.7 feet and 24.8 inches, respectively, in spring and 6.8 feet and 22.6 inches in the fall.

Twenty-nine per cent of spring hides were rubbed as compared to only 5 per cent of fall hides.

Polar Bear Characteristics of Harvest

Harvest data for the 1963 season are still incomplete. This work will be reported under segment W-6-R-5.

Breeding Biology and Productivity

During this report period the reproductive tracts of 8 black bears, 18 brown-grizzly bears and 39 polar bears were collected. These specimens were preserved for future processing.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: F TITLE: Bear Investigations

JOB NOS.: 1; 2-a,b; 3; 4

PERIOD COVERED: July 1, 1962 to June 30, 1963

OBJECTIVES

To refine and evaluate the aerial survey technique as a means for evaluating the population status of brown bears on the Alaska Peninsula.

To determine the population composition and status of brown bears in logged and unlogged areas of Southeast Alaska and to attempt to evaluate the effect of logging on the welfare of brown bears.

To secure information relative to the harvest of brown-grizzly and polar bears.

To investigate the breeding biology and productivity of black, brown-grizzly and polar bears.

TECHNIQUES

To evaluate the aerial survey technique as a means for measuring the population status of bears, aerial composition surveys were made on representative drainages of the Alaska Peninsula during late July and August when bears were concentrated along salmon streams. The efficiency and representativeness of the counts were evaluated by making replicate surveys according to a statistical design to determine the best time of day and season for making the counts and to determine the degree of survey coverage necessary to properly evaluate status.

To measure the status of southeast Alaska brown bears, aerial surveys were made in May of beach grass flats and of alpine areas. The beach surveys were replicate evening-counts made by the U. S. Forest Service using a Cessna 180 aircraft. The project leader served as a second observer on these flights.

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The area surveyed was that portion of Admiralty Island lying between and including Wilson Cove and Hood Bay.

The alpine track counts were made by Harry Merriam of the Alaska Department of Fish and Game using a Piper Cruiser aircraft. These were midday counts flown at elevations varying between 2,500 and 3,000 feet. Only tracks descending from alpine to lower forested areas were included in the counts. The area surveyed included that portion of the island south of the drainages into Kootznahoo Inlet and Mole Harbor and east of the drainages into Eliza Harbor and the south arm of Hood Bay.

Harvest data for brown-grizzly and polar bears were obtained from affadavits made out by hunters when presenting bear hides for sealing. (Regulations require that bears be sealed within 30 days after being killed.) Hide measurements are the sum of total length (nose to tail tip) and total width (distance between left and right claw tips of front feet). Skull measurements are the sum of maximum skull length and width.

Reproductive tracts of bears were obtained from nuisance mortalities and from bears killed by hunters. These were preserved for future studies of bear productivity and breeding biology.

FINDINGS

Brown Bear Studies - Alaska Peninsula

A report for this project was presented as a technical paper at the 28th North American Wildlife and Natural Resources Conference, Detroit, Michigan, March 3-6, 1963. The text of this report follows.

A STATISTICAL EVALUATION OF FACTORS INFLUENCING AERIAL SURVEY RESULTS ON BROWN BEARS*

INTRODUCTION

Aircraft are becoming increasingly important in assessing the abundance and status of big game species. While past studies have demonstrated many applications of aerial surveys, these studies have given little consideration to animal behavior patterns, observer abilities and other factors which may bias biological interpretations. Riordan (1948), Buechner et al. (1951), Banfield et al. (1955) and others have enumerated a

*Report by Albert Erickson and Donald Siniff.

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number of aerial survey variables and suggested their possible influence on survey results. However, with the exception of limited data presented by Edwards (1954), Buechner *et al*. (op. cit.) and Sumner (1948), only subjective evaluations have been made of such variables. Generally, these workers found aerial counts low compared to ground counts. Bevan (1959), reporting on an experimental design testing the variability of observers in estimating numbers of spawning pink salmon (*Oncorhynchus gorbuscha*) found a variance of 50 per cent between estimates and concluded that even for trend analysis, observations should be limited to one observer.

In parts of coastal Alaska, concentrations of brown bears (*Ursus arctos*) along streams during the spawning migrations of salmon (*Oncorhynchus* sp.) lend themselves to population analysis by aerial observation. However, analysis of data from surveys conducted over the past four years revealed inconsistancies in the number and composition of the bear populations studies (Erickson, 1961). The discrepancies appeared attributable to factors such as: differences in the abilities and experience of observers, the time of day and dates the surveys were flown, weather conditions, fish abundance and other considerations. Similar perplexing inconsistencies have plagued aerial surveys of other big game species in Alaska.

The purpose of this study was to provide a statistical evaluation of a number of measurable survey variables as tested on a brown bear population.

The study was carried out between July 31 and August 16, 1962, in the Chignik-Black Lakes drainage of the Alaska Peninsula (Figure 1). This drainage encompasses approximately 600 square miles and exhibits alpine and sub-alpine areas which typify Alaska Peninsula eco-types (Figure 2). These types are predominately open tundra at the southern tip of the peninsula trending to more dense alders, (*Alnus* sp.) willows, (*Salix* sp.) and cottonwoods (*Populus balsamifera*) at the base of the Peninsula. The drainage exhibited other attributes suiting it particularly to the study objectives. Past surveys had shown the system to consistently contain a sizeable bear population. Relatively accurate salmon catch and escapement data were also available for the system (Alaska Department of Fish and Game Annual Reports). The year to year consistency of the latter was especially advantageous to fulfilling study objectives since an aberrant situation during the study would raise questions as to the applicability of the findings to future and past surveys.

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Figure 1. Map of Black-Chignik Lakes Study Area

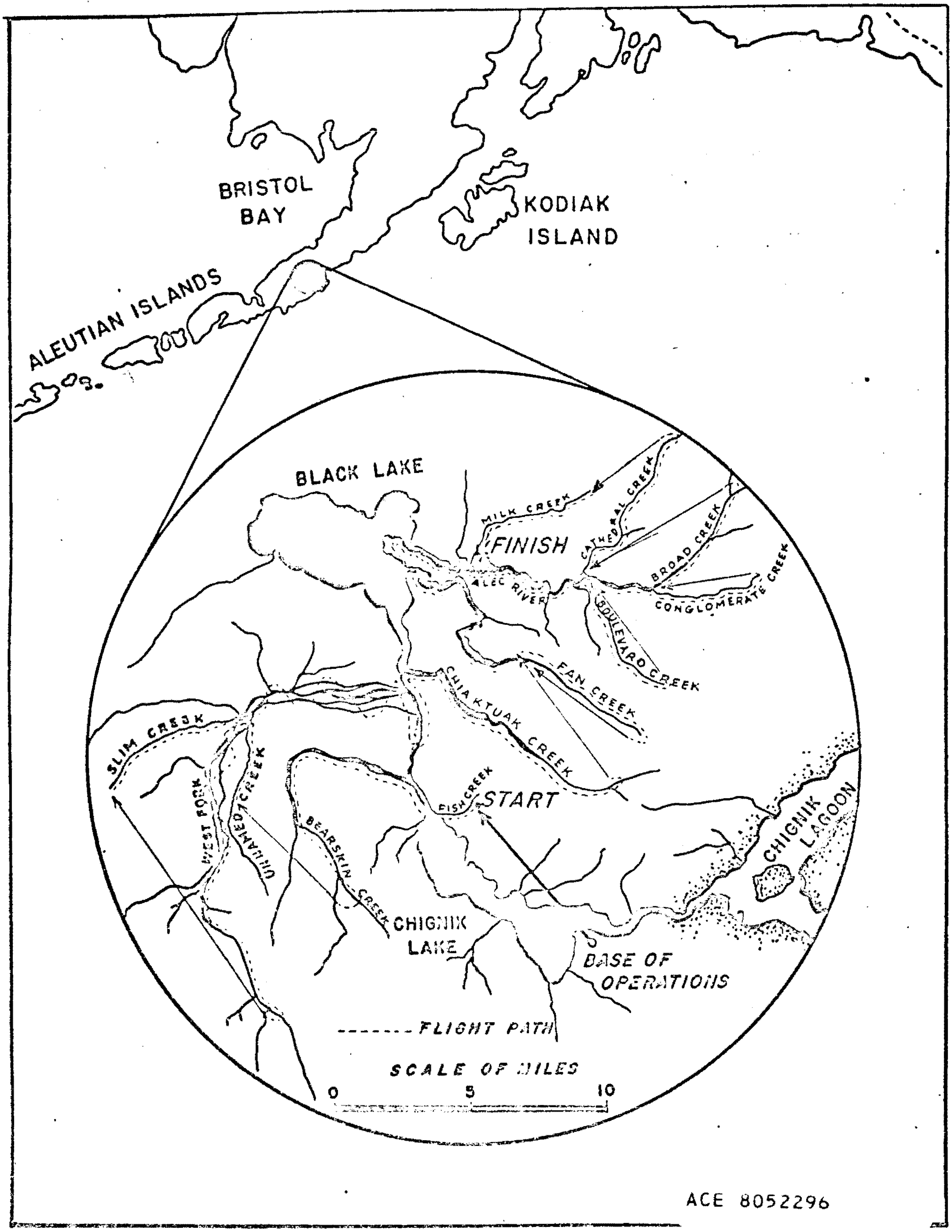

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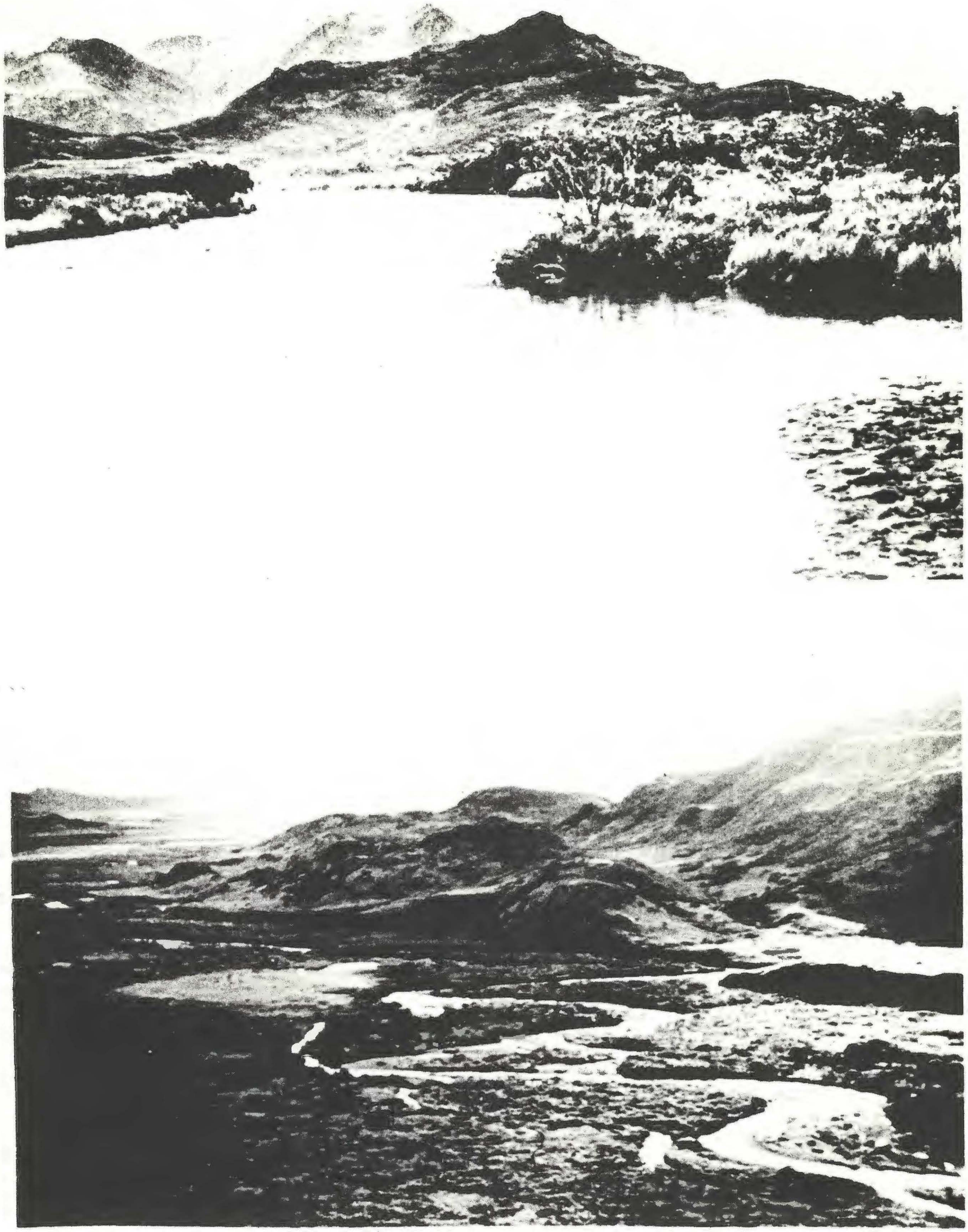
Figure 2. General Physiognomy of the Study Area



METHODS AND PROCEDURES

The primary design of the study consisted of three replicates of 3 by 3 latin square testing for differences between observers, dates and time of day. One pilot and aircraft were used throughout the study with the same flight procedures and flight course for each observation period (Figure 1). The pilot was experienced in flying game and fish surveys with several thousand hours of low level game observations. The aircraft was a Piper "150" supercub Model PA-18. This aircraft has a very low (45 mph) stalling speed and permits tandem seating, a feature we consider superior to side-by-side seating as favored by Riordan (op. cit.) and others. This view is held since (except frontally) both the pilot and observer can view things equally. Consequently, the pilot need only maneuver so he can see, to put the observer into proper position for observing and recording. This is particularly difficult with side-by-side seating since the pilot is trying to position the observer on an area he cannot see himself. A further disadvantage of side-by-side seating is that in making circles or "S" turns only the pilot or observer views portions of the area surveyed.

The observers were Department of Fish and Game employees, including the senior author. The observers varied in their working experience with bears: observer C was without previous experience, observer A had considerable experience observing bears from the ground and observer B had extensive experience observing bears from both the ground and from the air.

Flight periods began precisely at 5 a.m., 11 a.m. and 5 p.m. A.S.T., and each survey continued until completion of the flight course approximately 2-1/2 hours later. For the most part, course legs were flown upstream against prevailing air flows into the drainage basin. This procedure permitted slower ground speeds. Air speeds with flaps extended approximated 60-70 mph. Flight altitude was maintained insofar as possible at 200 feet above the ground.

Bears were tallied on the first passage over the flight course only. That is, bears seen during reflight over portions of the flight course were not counted even if known to have escaped notice. Flight procedures consisted of flying each transect leg in a manner thought most productive for observing bears. Whenever possible this consisted of a series of shallow "S" turns pivoting upon the stream being surveyed. This procedure permitted both the observer and pilot to view all portions of

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the transect course. All bears sighted by either the pilot or observer were tallied and close circling passes were made to permit their classification as sows with cubs, sows with yearlings or "other bears". The latter were further classified as small, medium and large. To reduce bias the pilot did not participate in population element classification. The observer also plotted by composition symbol the location of each observation on a map.

The project design specified that all three surveys for a given day had to be completed to qualify that day in a survey square. Weather caused incomplete surveys to be flown on August 1, 2 and August 15. It was not possible to fly surveys on or between August 8 and August 12. Completion of the survey design was as shown in Table 1.

Table 1. Survey Design

	Square 1			Square 2			Square 3		
Hours	July 31	Aug. 3	Aug. 4	Aug. 5	Aug. 6	Aug. 7	Aug. 13	Aug. 14	Aug. 16
0500-0800	A	B	C	B	C	A	C	A	B
1100-1400	B	C	A	C	A	B	A	B	C
1700-2000	C	A	B	A	B	C	B	C	A

A, B and C are observer designations.

In addition to testing for differences between observers, dates and times of day, observations were recorded to investigate certain weather factors and bear movements. Weather data were taken at camp quarters at the outlet of Chignik Lake and an estimate of wind velocity was recorded by the pilot when passing over Black Lake at approximately the mid-period of each survey.

Ten simultaneous air and ground counts were made within prescribed areas to ascertain the efficiency of air surveys. The procedure for these was to have a ground observer go to a lookout site one hour in advance of the aerial survey crew and with the aid of binoculars locate and plot the movements of bears within test areas. The air crews, similarily,

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plotted the locations of bears observed, and executed a sharp dip and ascent over them to alert the ground observer of the observations.

Prior to the execution of the test surveys the following steps were taken to standardize procedures. For the period July 23-26 the observers were together at McNeil River to observe at close hand the concentrations of bears that gather there and to standardize criterion for classifying identifiable population elements. On July 18, 21, 22, 26 and 28 preliminary evening surveys were flown of the Black-Chignik Lakes drainage to measure fish and bear abundance and distribution and to establish the survey flight course and procedures. A survey was also flown on August 19, three days following completion of the test surveys to measure abundances of bears at that time.

RESULTS

Counts of Bears as Affected by Observer Differences, Days and Hourly Influences

Analysis of the primary design by standard analysis of variance is shown in Table 2. This is an examination of the total bears counted during each observation period and is designed to investigate the relation of the study population to observers, dates and times of day. As shown in Table 2, this analysis indicates that large differences exist (.01 probability level) in the number of bears observable during different times of the day. Peak activity occurred during the evening observation period and fewest bears were available during the midday period. Differences in total bears counted between observers were not significant at the .05 probability level. The bear population diminished slightly toward the close of the study as shown by differences (.05 probability level) in square totals. However, no differences were evidenced between days within individual squares. Also, there was no great difference in the ability of observers to make total bear counts when flown by the same pilot.

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Table 2. Standard Analysis of Variance of Total Counts

	Square 1				Square 2				Square 3			
Hours	1	2	3	Total	1	2	3	Total	1	2	3	Total
0500	94A	81B	62C	237	81B	65C	86A	232	54C	54A	61B	169
1100	67B	16C	40A	123	43C	44A	48B	135	29A	30B	18C	77
1700	118C	34A	91B	243	95A	113B	70C	278	76B	72C	76A	224
Total	279	131	193	603	219	222	204	645	159	156	155	470

Source	d.f.	s.s.	m.s	F
Squares	2	1854	927.0	4.50*
Days within squares	6	3748	624.7	3.03
Hours within squares	6	10279	1713.2	8.32**
Observers	2	1010	505.0	2.45
Error	10	2059	205.9	
Total	26	18950		

* Significant at 5% level.
** Significant at 1% level.

This analysis is subject to the necessary assumptions of analysis of variance testing, i.e., the observations are assumed to be normally distributed and the effects additive. Also, the design does not measure interaction. Hence, it is necessary to assume that no interaction exists between these variables.

Compositional Considerations as Related to Observers

During this survey bears were classified into the following categories: 1) sows with cubs, 2) sows with yearlings, 3) cubs, 4) yearlings or 5) "other bears". The other bear category simply included individuals not included in the other four categories. Although obvious differences in size usually permitted ready classification of family groups as being cub or yearling groups, there existed some gradation from very small cubs to large yearlings. The overlap between large cubs and small yearlings was hypothesized to cause subjective classification and thus

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these individuals may have been classified differently by the observers.

The chi-square test of independence was used to investigate whether classification was consistent from observer to observer. Table 3 indicates, at the .01 probability level, that classification was not independent of observer. The percentages of cubs and sows with cubs recorded by the three observers were directly related to the observers' previous experience in working with bears: the greatest percentages of these components were recorded by the observer most experienced and the lowest percentages by the observer least experienced. Although there was no manner of testing the classification accuracy of individual observers against known population elements, the population composition recorded by observer C seems inconsistent with a natural population structure, i.e., a larger percentage of yearlings than of cubs is not normal considering expected mortality from cubs to yearlings. This perhaps indicates that compositional classification is more accurate when the observers are experienced.

Table 3. Chi-square test of independence between observer classifications.

Observer	Sows with cubs		Sows with yearlings		Cubs		Yearlings		Other Bears		Total
	Obs.	exp.	obs.	exp.	obs.	exp.	obs.	exp.	obs.	exp.	
1	80	76.1	66	64.9	161	164.5	129	120.8	116	125.6	552
2	105	89.4	52	76.2	232	193.1	98	141.8	161	147.5	648
3	52	71.5	84	60.9	119	154.4	149	113.4	114	117.9	518
Total	237		202		512		376		391		1718

Total Chi-square - 68.1 significant at 1% level.

Percentage occurring in each class

Observer 1	14.5	12.0	29.1	23.4	21.0
Observer 2	16.2	8.1	35.8	15.1	24.8
Observer 3	10.0	16.2	23.0	28.8	22.0

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The relation of time period to classification was also investigated using chi-square tests of independence. The hypothesis being tested is whether classification is independent of time and day. The hypothesis of independence was not rejected (.05 probability level) indicating that the time period a survey was flown had no influence on classification.

The consistency of classification from square to square, for each observer, was checked by chi-square analysis to determine if classification was independent of square influence. This analysis showed that for observers B and C the hypothesis of independence was not rejected at the .05 probability level, indicating, for these two observers, classification was fairly constant throughout the entire survey. Classification was not independent of square influence (.05 probability level) for observer A. As the survey progressed, this individual's data were found to show an increased percentage of cubs and a corresponding decreased percentage of yearlings. The authors feel that the consistency of observers B and C indicates that the population remained fairly constant and that the differences found for observer A are a reflection of his increasing experience and a changing of his classification habits.

In the following section on wind considerations, it will be shown that wind velocity has complicated the interpretation of differences in classification due to observer ability.

The Effect of Wind and other Climatological Factors on Bear Observations

As stated previously, the velocity of wind over Black Lake was estimated by the pilot during each observation period. At this location the wind condition was somewhat typical of the flight path as a whole; however, great differences in the wind velocity were often encountered on the survey route due to differences in terrain. These differences in wind velocity over the flight path, and the estimated nature of the measured wind over Black Lake have no doubt caused some additional variation to be included in these data. However, the overall affect of wind on bear classification and total counts appears quite evident.

As has been shown, differences in bear numbers did occur between time periods. Evidently this was caused by the animals'

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activity patterns. It was observed also that wind velocity seemed to adversely affect the number of bears seen during an observation period. To investigate this possibility the number of bears counted during each observation period was plotted against wind velocity (Figure 3). These data were grouped by time periods because of the known differences in bear numbers between time periods (Table 2).

Correlation coefficients were computed between wind velocity and bear numbers for each time period to measure the degree of association (Figure 3). Although a negative correlation between the number of bears observed and wind velocity was shown for all time periods, in only the morning period was the correlation (.05 probability level) significant. Even so, however, the correspondence in direction for all periods and considering the variable nature of small-sample correlation coefficients, it appears that the data give evidence that bear counts were adversely affected by increasing wind velocities.

The relation of wind velocity to bear numbers was assumed to be linear and a linear regression equation was computed for each time period (Figure 3). Again, only the morning observation period showed a significant regression at the .05 probability level. The total unadjusted sum of squares for the Y variable (total bear counts) can be partitioned into variance due to regression and residual variance. The variance due to regression is a measure of the variation which is contributed because of the relation of wind velocity to total bear counts. The residual variance is a measure of the deviation of actual bear counts from the regression line. The deviation from the regression mean square is of particular interest as this value is somewhat indicative of the relative stability of the various observation periods. That is, this variance demonstrates the uniformity of early morning bear counts and the relatively low winds at this time as contrasted to the erratic wind velocities and less consistent bear counts obtained for the midday and evening periods.

A further consideration of wind effect is its relation to bear classification. That is, did increased wind cause increases or decreases in certain classification categories? To investigate this possibility, the relation of wind velocity and arcsin $\sqrt{\text{per cent}}$ for each bear category was investigated by computing correlation coefficients and linear regression equations. A comparison of these statistics is shown in Table 4: only the relation of wind and arcsin $\sqrt{\text{per cent sows with cubs}}$

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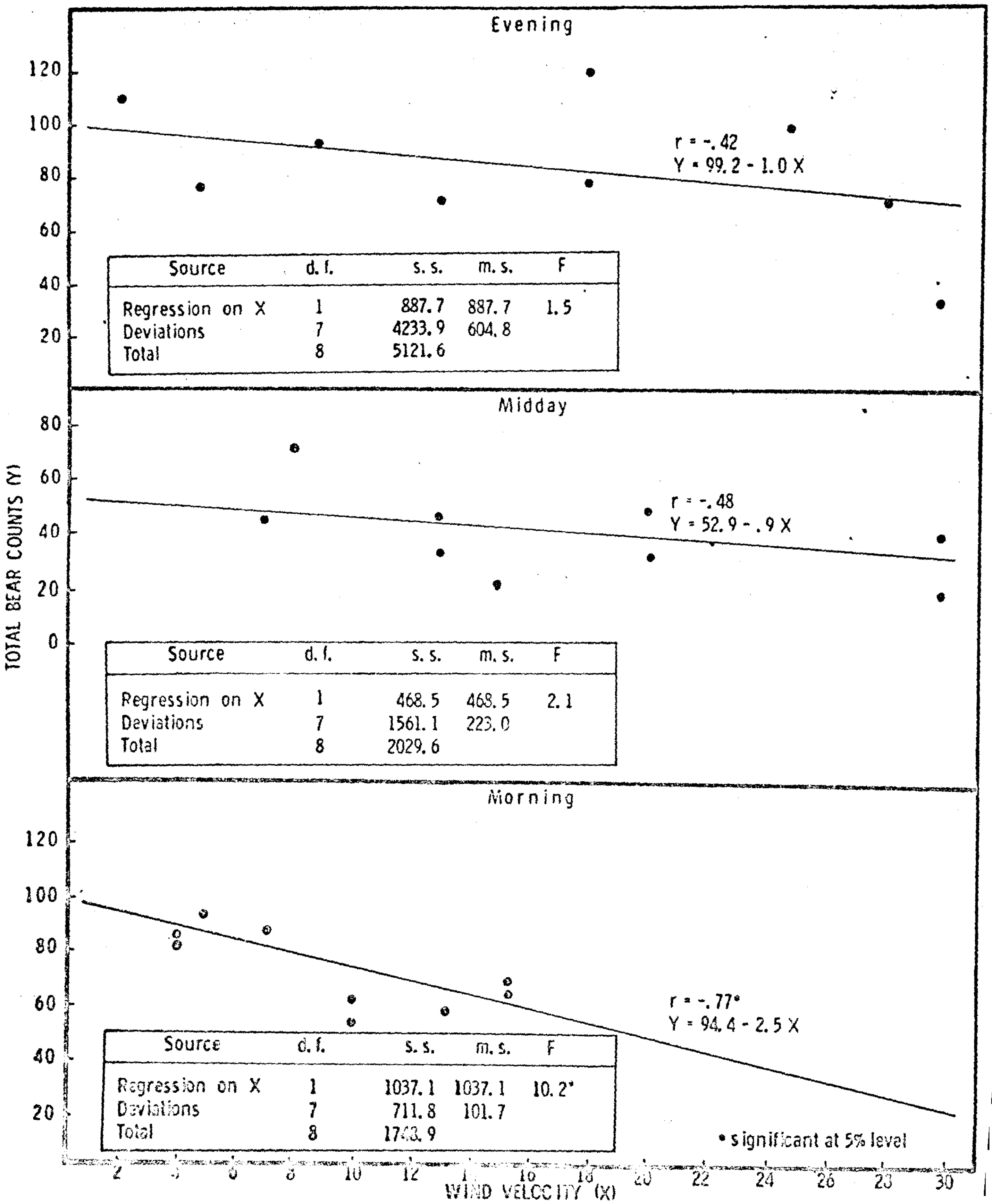
Figure 3. Relationship of Total Bear Counts and Wind Velocity For Each Time Period



Evening

Source	d. f.	s. s.	m. s.	F
Regression on X	1	887.7	887.7	1.5
Deviations	7	4233.9	604.8	
Total	8	5121.6		

Midday

Source	d. f.	s. s.	m. s.	F
Regression on X	1	468.5	468.5	2.1
Deviations	7	1561.1	223.0	
Total	8	2029.6		

Morning

Source	d. f.	s. s.	m. s.	F
Regression on X	1	1037.1	1037.1	10.2*
Deviations	7	711.8	101.7	
Total	8	1743.9		

* significant at 5% level

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constitutes a significant correlation and regression at the .05 probability level. However, to fully assess this relationship it is necessary to consider possible effects of observer and/or time period variations.

Table 4. Correlation and regression coefficients examining wind and classification relationships.

	Correlation Coefficient	Regression Coefficient	F Ratio
Wind & arcsin $\sqrt{\text{\% yearlings}}$	.24	.17	1.50
Wind & arcsin $\sqrt{\text{\% sows/yearlings}}$	.25	.13	1.64
Wind & arcsin $\sqrt{\text{\% cubs}}$	-.34	-.28	3.36
Wind & arcsin $\sqrt{\text{\% sows/cubs}}$	-.40*	-.19	4.61*
Wind & arcsin $\sqrt{\text{\% other bears}}$	.32	.23	2.81

* Significant at 5% level

As discussed in the analysis of compositional factors, chi-square examination indicated that time periods and classification of bears were independent. Since time period had no effect on classification it follows that the effect of wind, as related to time periods, was also independent of classification.

Separation of the effect of wind and observer differences, as related to bear classification, is more difficult. As shown in the analysis of composition, classification was not independent of observer, i.e., differences existed in the manner in which observers classified bears. Therefore, the wind and arcsin $\sqrt{\text{per cent sows with cubs}}$ relationship was separated by observer to determine if wind velocity influenced all observers equally. Examination of Figure 4 shows that when data are so separated, none of the relationships constitute a significant (.05 probability level) correlation or regression, and both negative and positive correlations exist. Therefore, any effect of wind velocity on classification is doubtful. It seems probable that the significant negative correlation between wind velocity and arcsin $\sqrt{\text{per cent sows with cubs}}$ for all of the data

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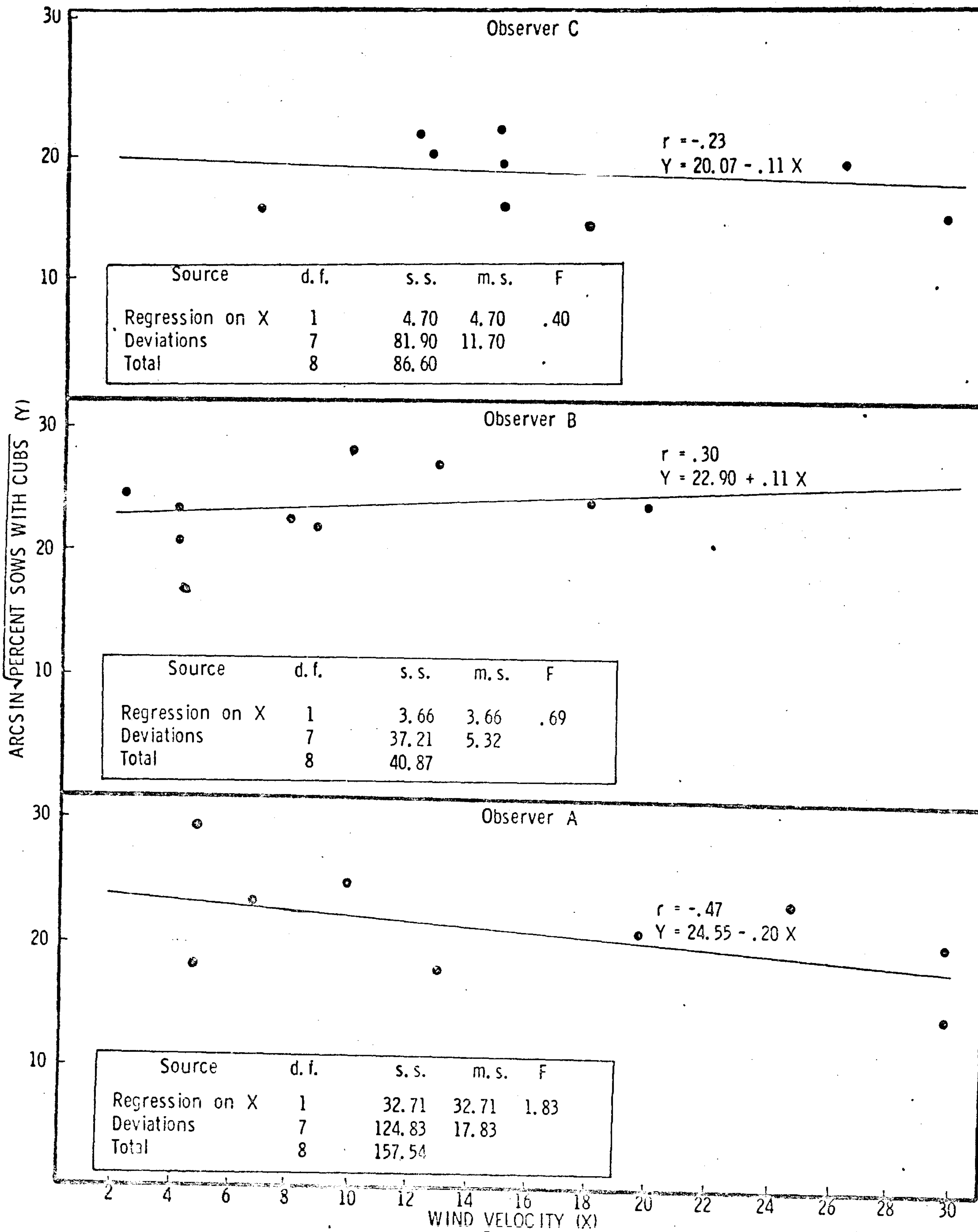
Figure 4. Relationship of Arcsin $\sqrt{\text{Percent Sows With Cubs}}$ and Wind Velocity For Each Observer



Observer C

Source	d. f.	s. s.	m. s.	F
Regression on X	1	4.70	4.70	.40
Deviations	7	81.90	11.70	
Total	8	86.60		

Observer B

Source	d. f.	s. s.	m. s.	F
Regression on X	1	3.66	3.66	.69
Deviations	7	37.21	5.32	
Total	8	40.87		

Observer A

Source	d. f.	s. s.	m. s.	F
Regression on X	1	32.71	32.71	1.83
Deviations	7	124.83	17.83	
Total	8	157.54		

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is simply a manifestation of observer differences. That is, examination of Table 4 shows substantial differences between observer classifications in the average per cent sows with cub category. When these differences are pooled they evidently cause the significant negative correlation previously observed.

Comparisons were also made between the number and classifications of bears observed under varying cloud, temperature and light conditions. These measurements were recorded at field headquarters. Cloud comparisons were based on the percentage of cloud cover. All measurements were taken at approximately the mid point of the flight periods. None of these factors indicated consistent effects which would have bearing on either the number or the compositional makeup of bears observed.

<u>Comparison Between Air and Ground Counts</u>

On ten occasions observers were stationed at vantage points on areas overlooking a portion of the regular flight path. The areas to be simultaneously counted from the air and ground were specifically defined prior to the flights. The results of these flights are summarized in Table 5. The "total known bears" consists of bears which were distinguished, and are not necessarily the actual number of bears present in the simultaneous count areas. Obviously great differences exist between the number of bears sighted from the air and from the ground. The area of Upper West Fork is the only location where air counts exceeded ground counts. Considering the averages for all counts, observers counted about 47 per cent of the known bears in the sample areas. However, it should be noted that the air counts varied from 0 to 88 per cent of the known bears.

The number of bears observed on individual flights was highly variable and, as would be expected, the mean number of bears observed by air crews was in direct relation to cover density (Table 5). Surprisingly though, greatest variations in these limited counts were for areas with sparse cover.

In addition to the preceeding evidence, additional data were obtained further demonstrating the incompleteness of these aerial counts. The variations between individual counts are themselves suggestive of this. Perhaps more revealing, however, is the infrequency with which bears of individual character were observed. Three of these will serve to illustrate: a sow with four cubs, a sow with four yearlings and a lone three-legged bear. During the 27 survey flights the cubs were

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Table 5. Comparisons Between Simultaneous Air and Ground Counts

Time	Date	Area	Cover Density	Ground count	Air count	Unobserved from ground	Unobserved from air	Total known bears
1713	August 9	Broad-Conglomerate	Moderate	26	11	1	15	27
1700	August 10	Broad-Conglomerate	Moderate	20	7	1	13	21
1915	August 16	Boulevard	Heavy	20	6	0	14	20
1935	August 16	Broad-Conglomerate	Moderate	4	3	3	4	7
0630	August 17	Boulevard	Heavy	6	5	3	4	9
0650	August 17	Broad-Conglomerate	Moderate	13	11	0	2	13
1835	August 17	West Fork	Light	9	14	7	2	16
1842	August 17	West Fork	Light	14	5	1	9	15
0640	August 18	West Fork	Light	5	7	5	3	10
0649	August 18	West Fork	Light	9	0	0	9	9
Totals				126	69	21	75	147

Cover class	Air count	Total known	Percent observed
Light	26	50	52%
Moderate	32	68	47%
Moderate-Heavy	11	29	38%

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sighted 7 times, the yearlings once, and the lone bear twice. Furthermore, all were sighted in the same general location each time. While it is possible that the crippled bear may not always have been identified, and that the yearling observation may have been a misclassification of the cub litter, it is likewise possible that there may have been more than one four-cub litter in which case each group would have been observed less than the seven times indicated. While neither premise can be verified, it seems reasonable to assume that these records indicate that only a small proportion of the bears within the stream system were recorded on individual flights.

Observations of Bear Movements Within the Study Area

Table 6 shows the total number of bears that were observed on each system each day. The purpose of this examination was merely to investigate what intermixing, if any, occurred between streams during the study period. Presumably some of the fluctuations in counts of bears during the study may have been caused by wanderings of bears between streams. Table 6 indicates that this factor is probably a minor consideration and that unilateral population exchange was slight. With a few exceptions, the fluctuations of the bear numbers on each stream would seem to be caused by factors other than population movement between streams. The first observations on Fan and West Fork creeks are certainly large as compared to other observations on these creeks. However, there is little indication that these animals shifted directly to any of the other survey streams, so they perhaps moved to areas not on the flight path. The observations for the rest of the streams generally fluctuate together, although certain streams do suggest peak activity.

DISCUSSION

.This study serves to demonstrate some of the influences which must be considered when using aerial observations for population analysis of brown bears. The findings do not negate the use of aerial surveys but show that with attention to standardization of controllable variables and with awareness of the limitations in the use of aircraft, aerial observations provide perhaps the only feasible means for extensive population assessments. Also, the findings of this study suggest that similar influences may have bearing on the results of aerial surveys of other game species.

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Table 6. Daily bear counts for individual streams.

	July	August								
	31	3	4	5	6	7	13	14	16	Total
Fish Creek	7	4	12	10	1	1	2	1	4	42
Chiaktuak Creek	32	25	31	37	38	18	28	39	35	283
Fan Creek	53	5	7	6	10	6	7	10	9	113
Boulevard Creek	35	18	36	30	33	32	25	16	21	246
Alec River	5	2	12	9	6	19	2	14	13	82
Conglomerate Cr.	11	19	17	9	13	15	11	9	5	109
Broad Creek	18	11	10	18	23	28	20	16	5	149
Slim Creek	11	11	12	30	34	35	16	4	2	155
West Fork	88	26	41	52	46	35	39	36	49	412
Cathedral Creek	0	1	0	0	0	0	0	0	0	1
Milk Creek	1	7	7	6	9	10	3	3	0	46
Bear Skin Creek	18	2	8	12	9	5	6	8	2	70
Unnamed Creek	0	0	0	0	0	0	0	0	10	10
Total	279	131	193	219	222	204	159	156	155	1,718

It has been shown that the number of bears available during morning, midday and evening periods varied greatly. While the average number of bears counted during any one time period is obviously not an enumeration of all bears present, the question does arise as to when and how many flights should be made to make the data comparable on a yearly and area basis. Using the estimated variance of the mean for each time period, it is possible to compute the approximate number of replicate flights needed to estimate the true time period means within 10 per cent, with only a 5 per cent chance of being wrong. These computations indicate that it would take 15 morning, 65 midday and 33 evening flights to meet these requirements. While such large samples are not encouraging, this analysis does indicate when flights should be made, and what sample sizes are necessary to detect changes in levels of abundance between areas and years.

Daily bear counts during the study period were shown to be relatively consistent, with preliminary and post surveys indicating that sizeable bear numbers were available from at least July 18 to August 19. The existence of bear concentrations is assumed to be dependent on salmon availability. Because of the great

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differences in the timing of salmon migrations on the Alaska Peninsula, periods of bear concentrations are variable between systems. Therefore, prior knowledge of bear and salmon relationships is necessary before initiating surveys of this nature.

Despite the fact that the observers differed both in their experience with bears and in aerial counting, no differences in their ability to count total bears (with the same pilot) were detected. Although not tested in the study, the authors feel that as long as the pilot has extensive experience in low level game and fish surveys, the degree of his ability to sight bears probably has a minor influence on survey results.

Observers did not classify bears similarly into identifiable population components and it appears that the major discrepancies in classification resulted between cub and yearling litters. Therefore, it appears that beyond simple classification of bears as family groups and "other bears", compositional classifications between observers cannot be considered accurate. This study and work by Bevan (1959) indicates that, wherever judgment considerations are concerned, results of estimates or classifications by several observers cannot be considered reliable. For these reasons, aerial surveys to be used for comparisons of populations between areas or years should, insofar as possible, be made by one observer. Even here, however, compositional findings for an individual observer should be considered of only relative value unless some means can be devised for testing classification accuracy.

Certain climatological considerations also affected survey results. Temperature, light intensity and cloud cover gave no evidence of influencing counts, but wind velocity apparently influenced the number of bears observed, but not compositional status. It is uncertain whether the wind influenced the bears, the aerial survey procedures, or both. There is little question that wind had at least some effect on survey procedures. Increased winds and air turbulence are closely associated. Flight configuration and maneuvers under such conditions were of necessity different than under low wind and nonturbulent conditions. The air speed factor alone may have been of considerable importance. Turbulence did not affect survey coverage but may have affected the survey crews' comfort and state of mind, although none of the observers experienced air sickness.

As has been reported by Sumner (op. cit.), Edwards (op. cit.) and Watson and Scott (1956), air counts were low compared

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to ground counts. Our simultaneous air and ground counts were made under conditions fairly typical for the Alaska Peninsula; approximately half of the bears known to be present in survey areas were observed from the air. These observations and other considerations indicate that bears seen on these surveys were far fewer than the actual number present in the study area.

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Brown Bear Studies - Southeast Alaska

Work on this project was limited to (1) three aerial beach counts made on Southeast Admiralty Island on May 19, 20 and 21, 1963 and (2) two alpine tract counts made on South Admiralty Island on May 6 and 22, 1963.

Aerial Beach Counts

Bears observed on the three beach surveys numbered 15, 7 and 12, respectively. These counts compared favorably with counts obtained during past years.

Alpine Track Counts

Track counts obtained on the alpine surveys were 65 for the May 6 survey and 35 for the May 22 survey. The latter count was depressed due to the disappearance of snow from much of the area surveyed.

Discussion

Field assessment of brown bear populations in Southeast Alaska has posed a problem for a number of years. Aerial beach counts, track counts along salmon streams and summer alpine counts have been attempted. None has been found suitable for assessing status. The preliminary alpine track count surveys made this year appear to hold some promise and should be examined further as a possible procedure suitable for measuring population trends of bears.

Characteristics of the Brown-Grizzly Bear Harvest

Harvest

The sport hunting kill of brown-grizzly bears in Alaska during calendar year 1962 was 538. This take is an increase of 15 per cent over the kill for the previous year. Kills were divided 263 for the spring and 275 for the fall season (Table 1). On a regional basis the 1962 kill was distributed 29 per cent for the Alaska Peninsula, 24 per cent for Kodiak-Afognak Islands, 16 per cent each for Interior and Southeast Alaska and 15 per cent for Southcentral This distribution of kill was similar to that determined for 1961. As during 1961, spring kills were confined largely to the Alaska Peninsula (38 per cent), Kodiak-Afognak Island (37 per cent), and to

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AREA District	Game Mgmt. Unit	SPRING SEASON Number	SPRING SEASON Per Cent	FALL SEASON Number	FALL SEASON Per Cent	BOTH SEASONS Number	BOTH SEASONS Per Cent
Southeast	1	6		5		11	
	2						
	3						
	4	32		14		46	
	5	1		1		2	
	6	9		15		24	
Subtotal		48	18	35	13	83	16
Southcentral	7	no season		1		1	
	11	0		14		14	
	13	no season		34		34	
	14	no season		8		8	
	15	no season		5		5	
	16	3		15		18	
Subtotal		3	1	77	28	80	15
Kodiak-Afognak	8	96	37	34	12	130	24
Alaska Peninsula	9	96		59		155	
	10	3		0		3	
Subtotal		99	38	59	21	158	29
Interior	12	3		17		20	
	17	0		2		2	
	18	0		0		0	
	19	0		11		11	
	20	5		21		26	
	21	1		7		8	
	22	1		0		1	
	23	2		2		4	
	24	3		3		6	
	25	0		4		4	
	26	2		3		5	
Subtotal		17	6	70	26	87	16
TOTALS		263	100	275	100	538	100

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Admiralty, Baranof and Chickagof Islands in Southeastern Alaska (18 per cent). Kills during the fall season were again quite uniformly distributed between regions.

The Chronology of the Kill

As reported on sealing documents, the kill pattern for the 1962 spring and fall seasons developed as shown in Figure 1. Seventy-eight per cent of the spring kill occurred in May. Nine per cent of the kills were made in April and 13 per cent in June. This chronology of kill was almost identical with that of 1961. The earliest spring kill was March 26.

As during 1961, the pattern of kill for the fall season was heavy at the beginning of the season and lessened progressively thereafter. Twenty-three per cent of the fall kill was for the opening week and 37 per cent of the total kill was made during the first two weeks of the season. The latest fall kill was December 23.

Hunter Residence

As seen in Table 2, 54 per cent of the 1962 brown-grizzly bear harvest was by nonresident hunters. Nonresidents accounted for 49 per cent of spring kills as compared to 58 per cent of fall kills. Nonresident hunter success was 65% as judged by comparison of tag sales to bears sealed. This was a slight reduction from the 74 per cent success realized by nonresident hunters during 1961. Resident hunter success could not be determined since species tags are not required of residents.

The 1962 harvest by nonresident hunters was divided among hunters of 41 states and six foreign countries.

The Sex Composition of the Kill

Sex ratio reports for bears killed during the 1962 season are shown in Table 3. Verified reports are those where the sexes of bears were confirmed from hide examinations. As during past years, these examinations revealed a number of female bears to be reported as males.

Verified reports indicated 78 per cent of the spring kills and 50 per cent of the fall kills to be males. Assuming that verified reports accurately reflected sex ratios in the harvest, adjustment of sex ratios for the two seasons indicated 64 per cent of the 1962 total kill to have been males. This is

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Figure 1. Chronology of the 1962 Brown - Grizzly Kill.

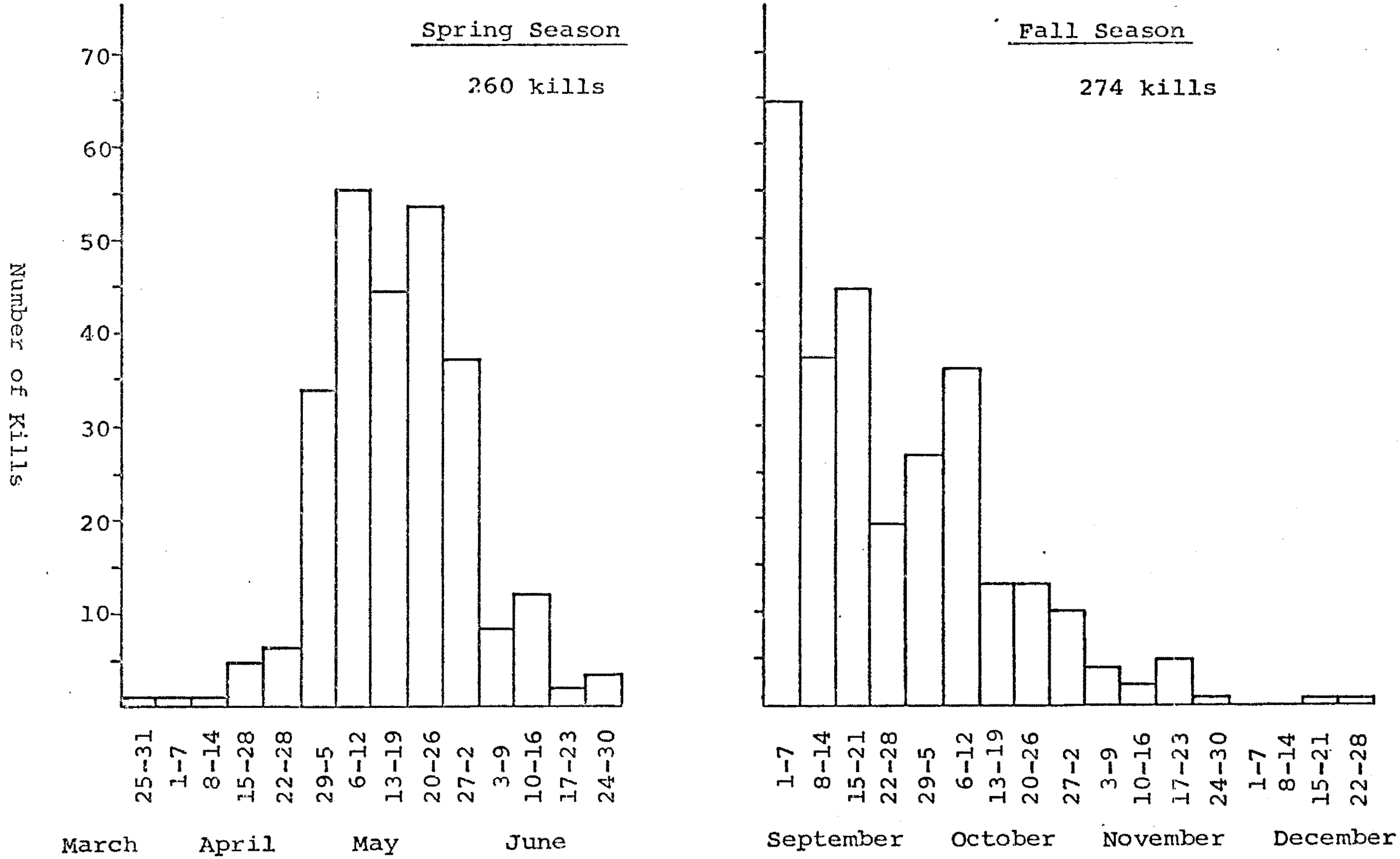

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Table 2. 1962 Brown-Grizzly Kill by Hunter Residence

	Tag Sales	Number of Kills	Per Cent of Kill	Per Cent Success
Spring Season				
Resident Hunters	--	133	51	--
Nonresident Hunters	??	130	49	??
		263	100	
Fall Season				
Resident Hunters	--	116	42	--
Nonresident Hunters	??	159	58	??
		275	100	
Both Seasons				
Resident Hunters	--	249	46	--
Nonresident Hunters	446	289	54	65
		538	100	

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Table 3. Verified and Unverified Sex Ratio Reports for Bears*

	Number of Reports		Per Cent Males	
Spring Season	Verified	Unverified	Verified	Unverified
Resident Hunters	52	78	75	68
Nonresident Hunters	42	88	81	83
	94	166	78	76
Fall Season				
Resident Hunters	46	64	43	67
Nonresident Hunters	93	67	53	58
	139	131	50	63

*Excludes 8 kills unreported as to sex.

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a 6 per cent increase over the proportion of males included in the 1961 harvest.

The Size Composition of the Kill

The mean hide size reported for bears killed during the spring season was 15.4 feet and for the fall season 13.8 feet (Table 4). These measurements are the sum of the total length plus width. By classical reference to the sizes of bears by "squared hide" sizes, these values equal 7.7 and 6.8 feet, respectively, for the spring and fall seasons.

The skull sizes of bears as a measure of size showed mean values for the spring and fall seasons to be 24.8 and 22.6 inches, respectively (Table 5). Skull data were limited to 147 skulls voluntarily presented for measurement when hides were sealed and were likely biased to larger bears.

Hide and skull measurement data obtained for 1961 and 1962 were essentially similar and showed the mean sizes of bears killed in the spring to exceed those of fall kills. This is attributed to closer selection for trophies during the spring season.

The Quality of Bear Hides as Trophies

As shown in Table 6, 29 per cent of the bears killed during the spring season were reported as rubbed, compared to only 5 per cent for bears killed during the fall season. Forty-six per cent of spring kills in Southeastern Alaska were rubbed as compared to 27 and 25 per cent, respectively, for the Kodiak-Afognak Islands and the Alaska Peninsula. Eight per cent of spring kills from Interior Alaska were rubbed. There were not enough spring hides from Southcentral Alaska to provide a meaningful comparison with other areas. Fall hides were uniformly good regardless of area.

Polar Bear - Characteristics of Harvest

Harvest data for the 1963 season are still incomplete. This work will be reported under segment W-6-R-5.

Breeding Biology and Productivity

Work on this project was limited to collections of bear reproductive tracts. Collections for this report period

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Table 4. The Sizes of Sealed Bear Hides*

AREA	SPRING SEASON No. of Hides	SPRING SEASON Ave. Size	FALL SEASON No. of Hides	FALL SEASON Ave. Size
Southeast	42	14.52	32	14.40
Southcentral	4	13.12	76	12.50
Kodiak-Afognak	97	16.18	33	15.73
Alaska Peninsula	96	15.64	58	15.20
Interior	15	11.75	63	12.58
	254	15.40	262	13.76

*Total of width and length; excludes 22 hides lacking measurement data.

Table 5. The Skull Sizes of Sealed Bears*

AREA	SPRING SEASON No. of Skulls	SPRING SEASON Ave. Size	FALL SEASON No. of Skulls	FALL SEASON Ave. Size
Southeast	14	19.62	8	24.54
Southcentral	0	0	5	19.33
Kodiak-Afognak	51	25.19	19	21.85
Alaska Peninsula	28	26.21	11	25.20
Interior	2	23.00	9	21.06
	95	24.83	52	22.60

*Skull length plus width; data from a limited number of skulls accompanying hides.

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Table 6. The Condition of Sealed Bear Hides

Spring Season

Area	No. Rubbed	No. Not Rubbed	Per Cent Rubbed
Southeastern	21	25	46
Southcentral	3	1	--
Kodiak-Afognak	26	71	27
Alaska Peninsula	24	73	25
Interior	1	13	8
	75	183	29

Fall Season

Area	No. Rubbed	No. Not Rubbed	Per Cent Rubbed
Southeastern	0	33	0
Southcentral	2	74	3
Kodiak-Afognak	3	31	9
Alaska Peninsula	5	53	9
Interior	2	62	3
	12	253	5

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included the testes of 6 black bears, 7 brown-grizzly bears and 35 polar bears and the ovaries and uterii of 2 black bears, 11 brown-grizzly bears and 4 polar bears. These specimens have been preserved for future processing.

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