8479

Dimitri

ALASKA PENINSULA BROWN BEAR RESEARCH AND MANAGEMENT

Harvest statistics which have been collected since 1961 show that the Alaska Peninsula has annually produced more than one-fourth of the brown-grizzly bears taken in Alaska, and that there has been an upward trend in the number of bears taken since that time. This large and increasing harvest has focused attention on Alaska Peninsula bears, and many viewpoints reflecting biological, economic, and esthetic considerations have been expressed regarding their management. This paper gives background information, reviews data, discusses different management approaches, and makes management recommendations.

BACKGROUND

After World War II, trophy hunting of brown bears, particularly by guided hunters, gained rapidly in popularity, especially in Southeastern Alaska and on Kodiak Island. Hunting on the Alaska Peninsula was quite limited, however, until the early 1960's. Persons familiar with the Alaska Peninsula during the 1950's estimate the harvest at that time was from 25 to 100 bears a year. Beginning in the late 1950's, hunting increased as guides went into new areas and new guides became established. In some recent years more than 200 bears have been taken.

Various points of view must be considered regarding brown bear management. The brown bear is a large carnivore found only in a rather limited area.

Many people, some of whom will never see a bear, are concerned about the species' welfare. The Alaska Peninsula is an area of relatively undisturbed havitat which supports good numbers of bears, and it behooves the State to maintain bear numbers and habitat. Brown bears are also a renewable resource, a certain number of which can be harvested on a continuing basis for trophies and recreation. Hunting is important from an economic standpoint,both to guides who charge from $800 to $2000 for a hunt, and to the State since much money that is expended is brought in is by non-residents. It behooves the State to permit hunting in a manner that provides quality trophies and recreation and does not put populations in jeopardy.

REVIEW OF DATA

HARVESTS

Methods

Harvest figures prior to 1961 are estimates made by persons who had knowledge of the area at that time. Beginning in 1961 hunters have been required to present hides of brown bears to a representative of the Department for sealing. This has furnished data on hunter type and the sex, size, date, and location of each bear killed. Beginning July 1, 1967, skulls also had to be presented for sealing. This allowed skull measurements to be taken and, in many cases, a tooth to be obtained for age determination.

Distribution

Bears occur throughout most of Unit 9. Most hunting is done below Becharof Lake, however, because terrain is such that there are more landing sites, and vegetation is less dense than further north allowing bears to be spotted more readily. Prior to 1965, most hunting was

between Ugashik Lakes and Port Moller. Since that time the primary hunting area has been extended nearly to False Pass. (Figure 1). Figure 2 shows locations of camps registered in the spring of 1968. The concentration of camps in the northeast section (Kamishak Bay) is not a true indication of hunting pressure. Although a number of camps were registered, hunting pressure was light compared to the rest of the Peninsula.

Total Numbers

Estimates of the total kill for a few years prior to 1961 range from 25 to 100 per year. Total legal sport harvest figures since 1961 are presented in Table 1 and Figures 3 and 4 The harvest in 1961 was 120. The kill increased to 155 in 1962 and was fairly constant in 1962, 1963, and 1964 averaging 158 per year. The harvest increased substantially in 1965 to 208, increased again in 1966 to 230, and decreased in 1967 to 211. It is believed that changes from 1961 through 1966 are related to hunting pressure since there were no major regulation changes during this period. There is no direct measure of hunting pressure on the Peninsula, but Statewide non-resident brown-grizzly bear tag sales increased from 437 in 1961 to 968 in 1966. More restrictive regulations probably depressed the harvest in the fall of 1967 and spring of 1968.

Sex Composition

Sex ratios of bears taken since 1961 are shown in Table 1 and Figures 5 and 6. The annual kill has been about equally divided between spring and fall seasons, but with one exception more males have been taken each year in the spring. The percent of males taken during each spring season has ranged from 80 to 89, and during each fall season has ranged from 49 to 60. Several factors probably cause the greater male kill in the spring. Hunters are seeking only bears in the spring and are more

selective than in the fall when they can also hunt for other game. Females generally emerge from dens later than males and thus many are protected during the early part of the spring season. In the fall neither sex are in dens when most of the hunting occurs. The regulation protecting females accompanied by cubs also affects sex ratio of the harvest Because of this regulation a large segment of the female population is not subjected to hunting during either season. A larger segment is subjected to hunting in the fall, however, when break-up is occuring for some family groups.

With one exception non-residents have taken a greater percentage of males than have residents. Many residents are unguided and less selective than non-residents most of whom chose to be guided before 1967, and all of whom had to have guides after July 1, 1967.

Hide Size

Brown bears are hunted as trophies, and there is some selectivity for larger and therefore older animals. Selectivity for larger bears could after several years reduce the number of larger bears to the extent that smaller bears on the average were being taken. This should be reflected by a reduction in average hide size. Hide measurements have been obtained for all animals killed since 1961 (Table 1 and Figures 7 and 8). Female hide size data are not presented because there is little variation in size of huntable females, and changes in size and age composition would not be reflected by changes in hide size. Male hide sizes have almost consistently been larger in the spring than in the fall, and non-residents have taken larger bears than residents. This again

probably reflects more selectivity in the spring by all hunters and more selectivity at all times by non-resident guided hunters.

There have been variations in average male hide size from year to year in spring and fall seasons. When all data are combined for each year, however, there has been little variation in average male hide size which has declined from 16.4 feet (length plus width combined) in 1961 to 15.7 feet in 1966. The size then increased one-tenth of a foot in 1967.

Hunter Type

Non-residents take more bears in Unit 9 than residents during both spring and fall seasons and take a greater percentage of the harvest from this unit than they do from any other major brown bear hunting unit (Figures 9 and 10). The resident kill has fluctuated from year to year since 1961, but has not shown an upward or downward trend. The non-resident kill has gone sharply upward since 1961 and has accounted for the increase in harvest since that time. Figures 11 and 12 indicate that the harvest by non-residents and residents has followed about the same trend as non-resident big game tag sales and resident hunting license sales.

Chronology

Approximately one-half of the kill occurs in the spring and one-half in the fall. A few bears are taken before mid-April shortly after they emerge from dens. In years when the season was open through May 31, about 20 percent of the spring kill occured the last half of April, 40 percent the first half of May, and 40 percent the last half of May (Figure 13). In 1967 and 1968, when seasons ended May 10 and May 20, respectively, the peak harvest period extended from the last few days

of April to the end of the season. The opening date for fall hunting in different years has been September 1 and September 15. Harvests have generally been fairly evenly distributed throughout September and October, with a few more bears taken some years the first 2 weeks of October. This is probably because hunting increased for bears when moose season opened October 1. There is little hunting after November 1. Bears are still available then; weather may reduce the hunting effort.

The number and percent of males has been higher in the spring than in the fall. Reasons have been discussed under "Sex Ratios".

Age Composition

A regulation requiring that skulls be presented for examination effective July 1, 1967, provided a means for obtaining teeth for age determinations. Teeth were obtained in the fall of 1967 and spring of 1968. Age determinations have thus far been made for only the fall 1967 bears. Data are presented in Table 2 along with data from several other game management units for comparison.

Hide Condition

The incidence of rubbed hides has been significantly higher in the spring than in the fall. Most years it has been over 25 percent in the spring and less than 5 percent in the fall. Fur condition improves in the fall as the season progresses. As more restrictions are put into effect, trophy quality would be improved if the fall season did not start until October 1.

Non-Sport Harvest

It is difficult to estimate the non-sport harvest. Less than five bears are reported killed each year in defense of life or property. A few more are probably killed and not reported. A few bears may be taken for food by Unit 9 residents and not reported. Some residents of the area and some guides say that fishermen kill many bears each year. Other residents of the area seem to think that the kill by fishermen is not significant. There are very few cases of illegal killing of bears investigated by the Department of Fish and Game during periods between hunting seasons.

AERIAL SURVEY

Aerial observation provides perhaps the only feasible means of brown bear population assessment in an area as large as the Alaska Peninsula. Because bears are sparsely distributed and often in dense cover and because of the large area involved, it is not feasible to census the entire Peninsula so as to obtain a statistically valid population estimate. An alternative is to survey when bears are concentrated in order to obtain minimum numbers, a measure of abundance (bears seen per hour), and composition data. The best time to do this is when bears are concentrated on salmon streams.

The following should be kept in mind when considering brown bear aerial survey data. Items 1 through 5 are as discussed by Erickson and Siniff (1963) in their evaluation of factors affecting brown bear aerial surveys.

1. Not all bears are seen during aerial surveys. Simultaneous air and ground counts indicate that approximately one-half of the bears known to be present in survey areas are seen from the air.
2. Replicate surveys reveal that the most consistent and highest counts are obtained in early morning and evening. Most surveying has been done at these times, but in some cases it has been necessary to fly in mid-day in order to cover planned survey routes.

Table 1. Unit 9 Brown-Grizzly Bear Harvest Data.

Total Kill

YEAR	SPRING					FALL					TOTAL				
	RES.		N-R.		TOTAL	RES.		N-R.		TOTAL	RES.		N-R		TOTAL
	No.	%	No.	%	No.	No.	%	No.	%	No.	No.	%	No.	%	No.
61	27	39	42	61	69	22	43	29	57	51	49	41	71	59	120
62	43	45	52	55	95	15	25	45	75	60	58	37	97	63	155
63	29	39	46	61	75	21	24	68	76	89	50	30	114	70	164
64	19	30	45	70	64	28	31	63	69	91	47	30	108	70	155
65	36	37	62	63	98	35	32	75	68	110	71	34	137	66	208
66	25	25	76	75	101	32	25	97	75	129	57	25	173	75	230
67	33	30	78	70	111	15	15	85	85	100	48	23	163	77	211
68	10	15	58	85	68										

Average Male Hide Size (length plus width in feet)

YEAR	SPRING					FALL					TOTAL				
	RES.		N-R.		AVER.	RES.		N-R.		AVER.	RES.		N-R.		AVER
	Size	No.	Size	No.	SIZE	Size	No.	Size	No.	SIZE	Size	No.	Size	No.	SIZE
61	15.6	20	17.0	32	16.7	15.1	9	15.9	18	15.6	15.6	29	16.9	50	16.4
62	16.2	32	16.6	42	16.4	15.7	5	16.7	24	16.5	16.1	37	16.6	66	16.4
63	16.4	19	17.3	39	17.0	14.6	6	14.9	35	14.9	15.6	25	16.2	74	16.1
64	15.1	15	16.6	37	16.2	15.8	12	16.2	36	16.1	15.4	27	16.4	73	16.1
65	14.9	24	17.4	54	16.6	13.7	17	14.8	39	14.5	14.4	41	16.3	93	15.7
66	15.0	19	16.7	69	16.4	14.3	20	15.1	49	14.8	14.7	39	16.0	118	15.7
67	15.8	21	16.3	67	16.2	15.8	6	15.2	47	15.2	15.8	27	15.9	114	15.8
68	14.5	5	16.4	49	16.2										

Number and Percent of Males in Total Harvest

YEAR	SPRING						FALL						TOTAL					
	RES.		N-R.		TOTAL		RES.		N-R.		TOTAL		RES.		N-R.		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
61	20	80	35	83	55	82	11	55	19	66	30	61	31	69	54	76	85	73
62	33	77	44	85	77	81	5	33	27	60	32	53	38	66	71	73	109	70
63	19	73	39	87	58	83	6	32	36	55	42	49	25	56	75	68	100	65
64	15	83	36	84	51	84	15	54	37	64	52	60	30	65	73	72	108	70
65	25	69	53	85	78	80	18	51	40	56	58	55	43	61	93	70	136	67
66	19	76	68	93	87	89	21	70	49	53	70	57	40	73	117	70	157	71
67	21	64	68	87	89	80	7	47	47	55	54	54	28	58	115	71	143	68
68	5	50	56	86	54	82												

Table 2. Age Composition of Brown Bears Harvested During the 1967 Fall Season Based on Tooth Cementum Layering.

Unit	Sex	No. of Bears by Age Class										Mean Age And Range
		1	2	3	4	5	6	7	8	9-10	11+	
6	♂	-	3	3	-	2	-	-	-	1	-	3.9 (2-10)
	♀	-	1	-	-	-	-	-	-	1	3	10.1 (2-19)
8	♂	-	1	3	4	-	5	-	-	-	1	5.0 (2-13)
	♀	-	2	-	1	1	-	-	-	-	-	3.3 (2-5)
9	♂	-	4	9	3	4	1	3	1	-	5	6.6 (2-25)
	♀	1	3	6	3	1	2	2	3	-	2	5.4 (1-22)
11-12	♂	-	-	2	1	-	-	1	-	3	3	10.3 (3-24)
	♀	-	1	2	1	1	2	1	-	1	3	6.8 (2-14)
13	♂	-	4	2	1	1	-	1	-	4	2	6.5 (2-15)
	♀	-	-	-	-	-	-	-	-	-	-	- -
16	♂	-	1	-	3	-	1	1	-	1	3	8.1 (2-19)
	♀	-	-	3	1	4	1	-	-	-	2	5.7 (3-12)
17-19	♂	-	-	-	-	-	-	-	-	-	5	12.8 (11-15)
	♀	-	1	1	1	1	1	-	-	5	2	7.9 (2-14)
21-26	♂	-	-	-	-	-	1	-	-	1	5	12.7 (6-22)
	♀	-	-	-	-	-	-	-	-	-	-	- -

Figure 1. Map of Alaska Peninsula showing primary hunting area.

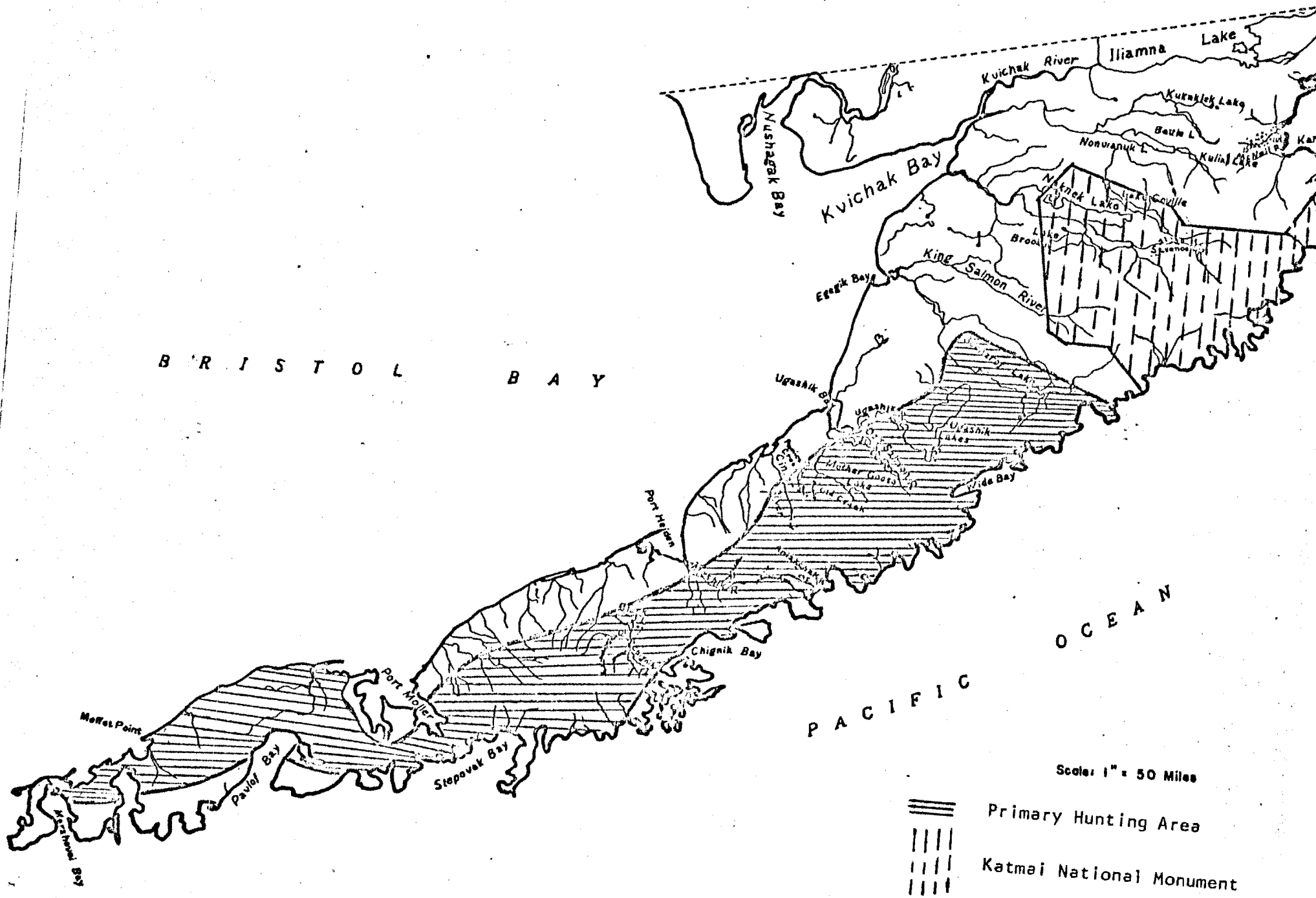


Figure 2. Map of Alaska Peninsula showing locations of brown bear hunting camps registered in the spring of 1968.

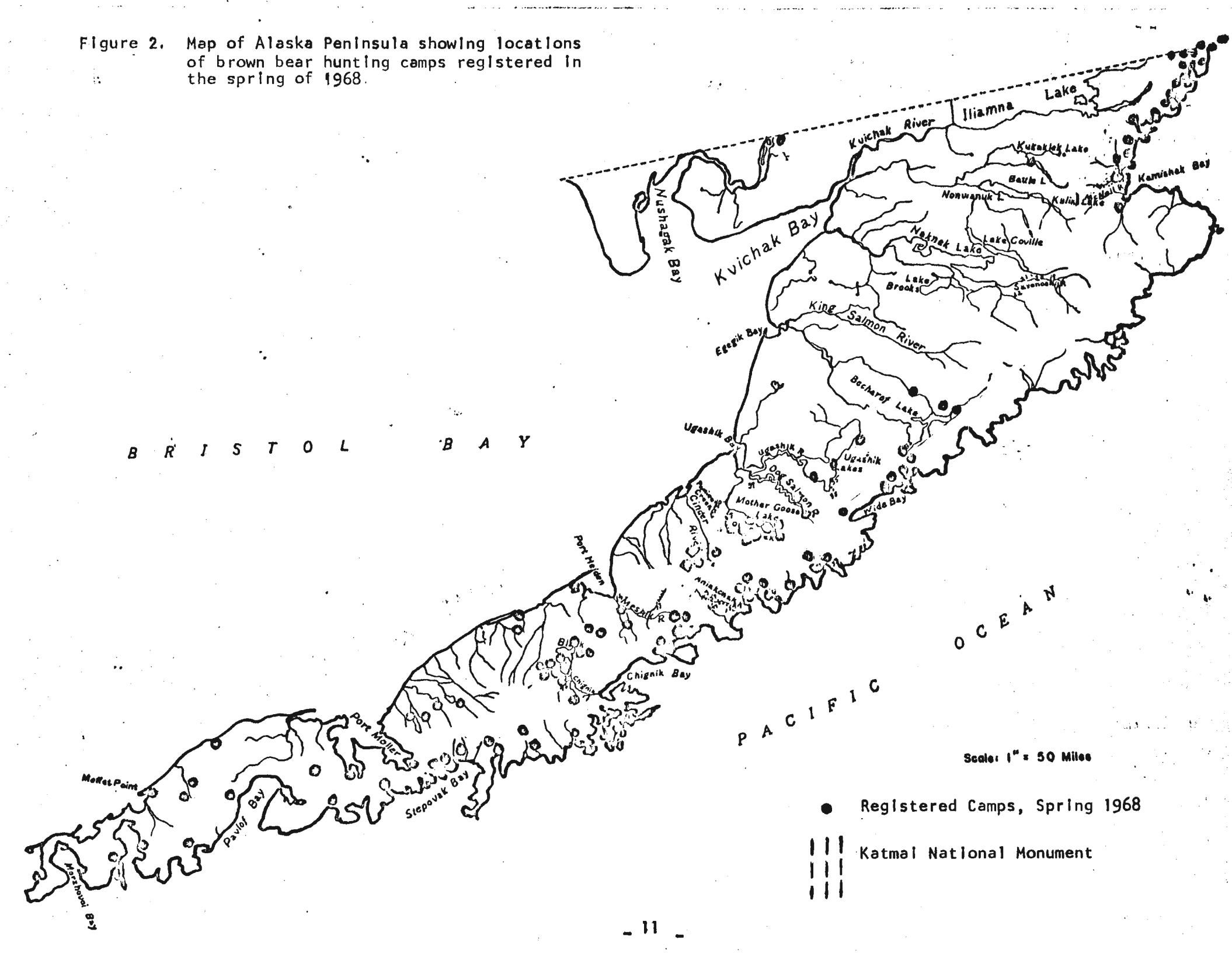
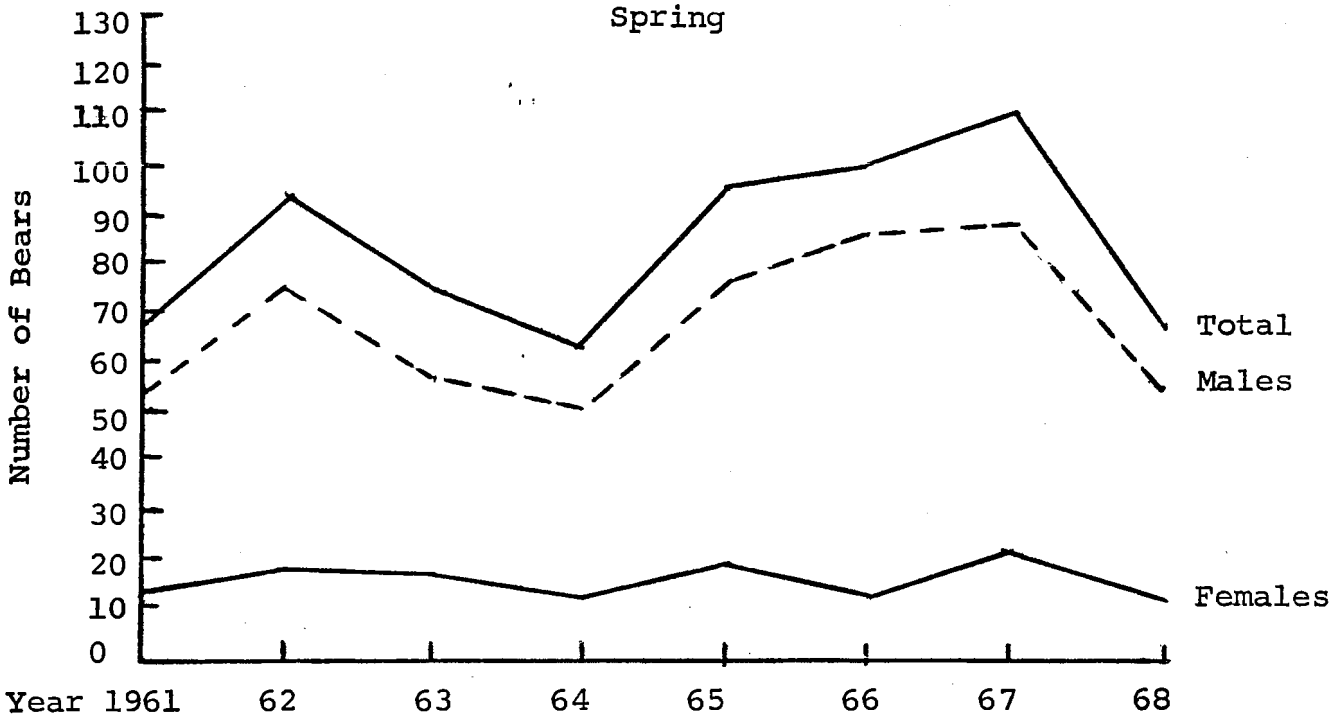


Figure 3 Number of Brown Bears Harvested in Unit 9.



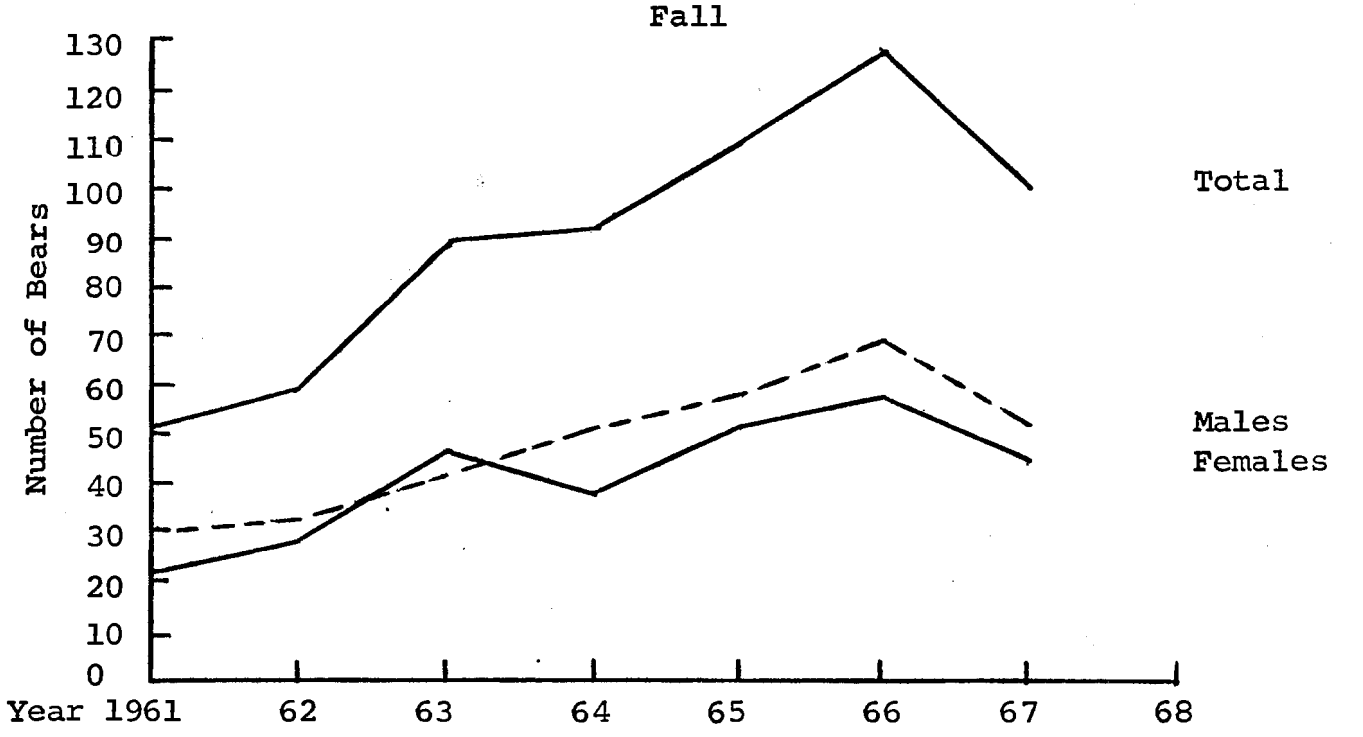


Figure 4. Number of Brown Bears Harvested in Unit 9.

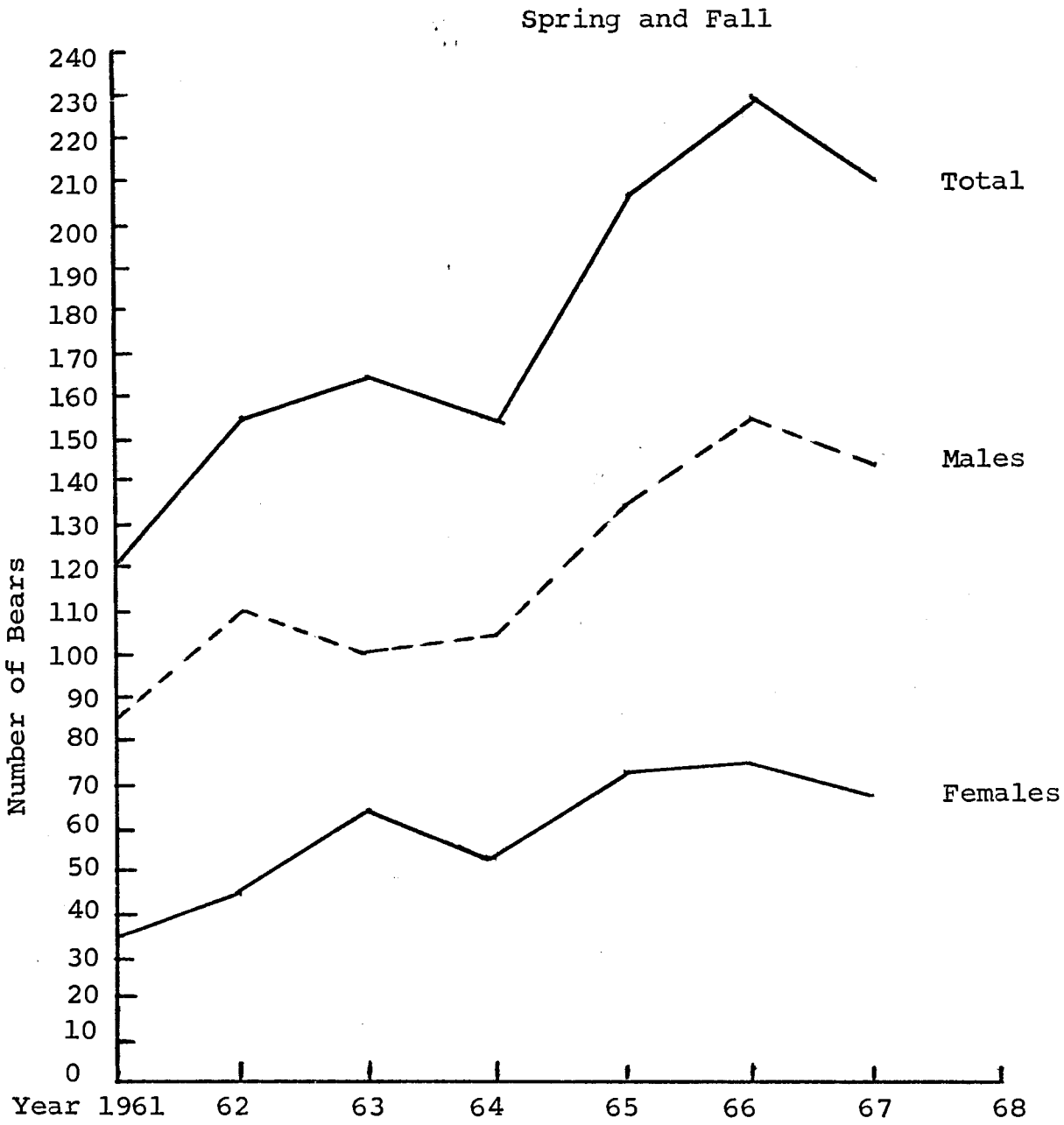
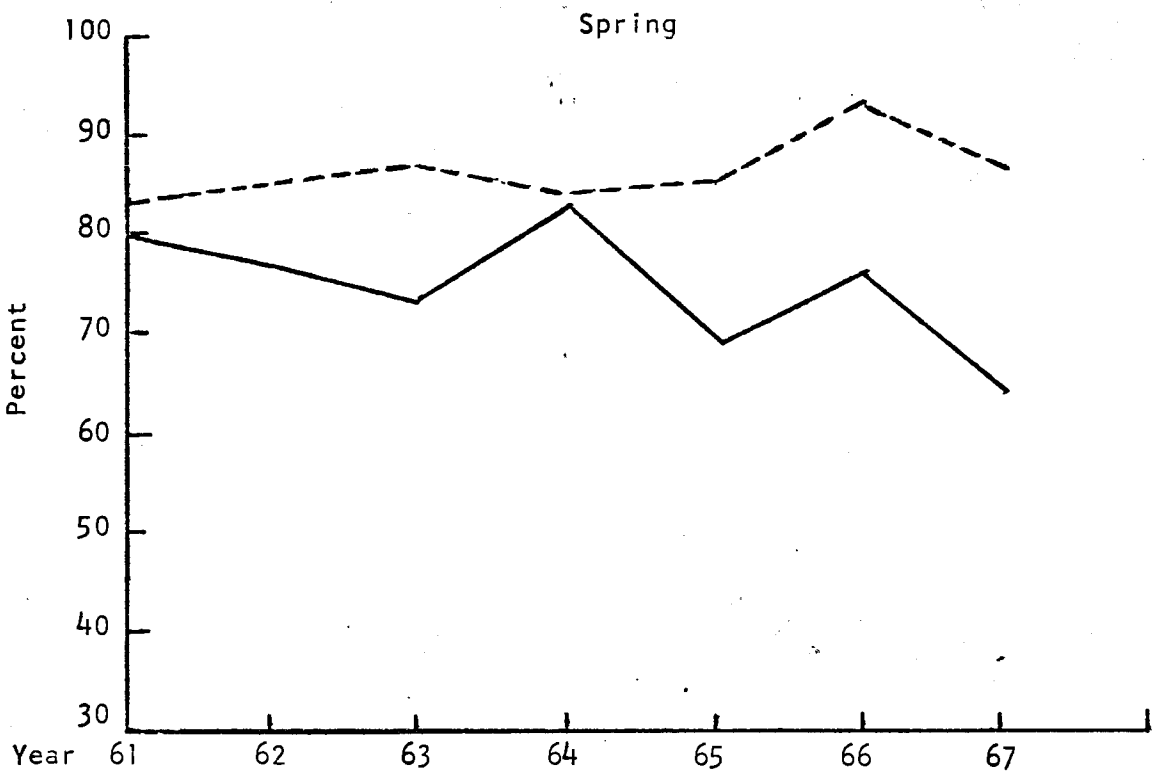


Figure 5. Percent of Males in Unit 9 Brown Bear Harvest.



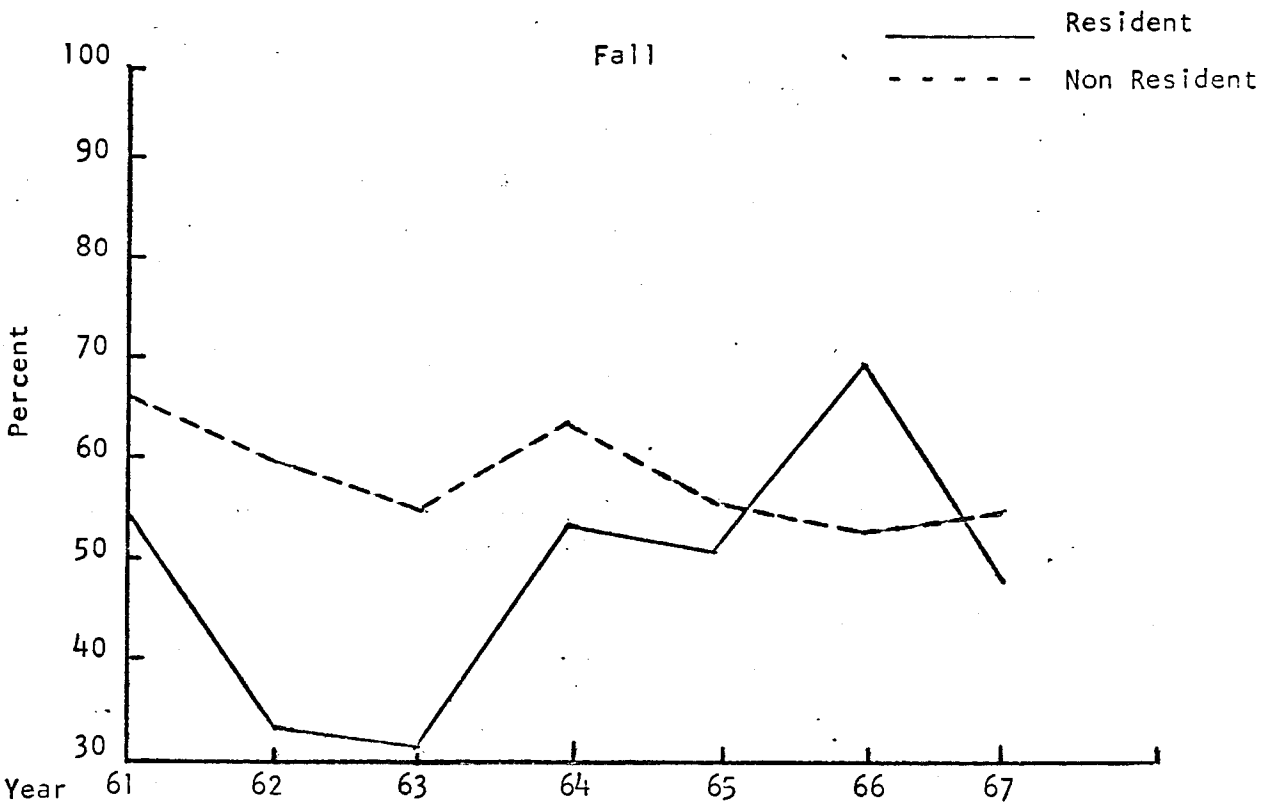


Figure 6. Percent of Males in Unit 9 Brown Bear Harvest.

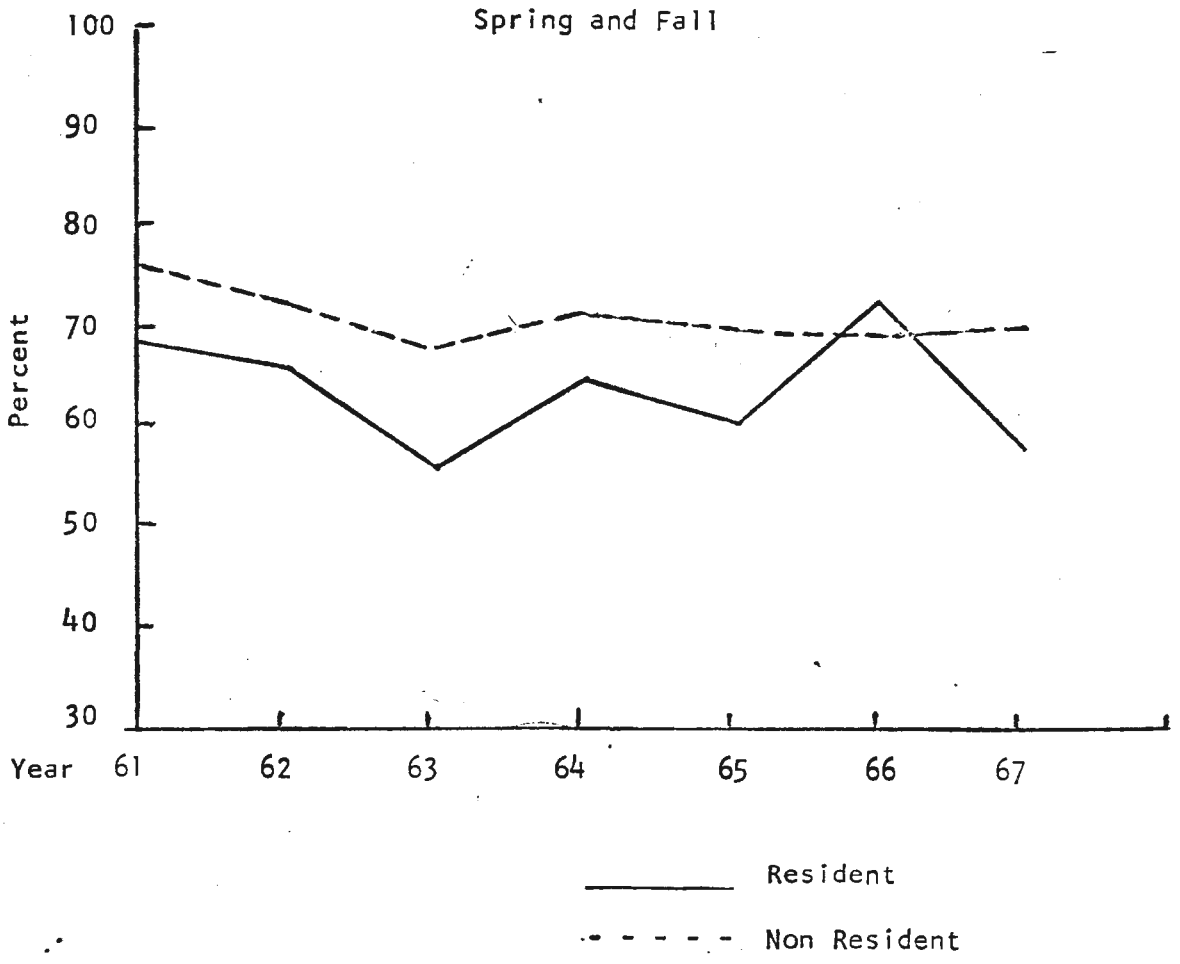
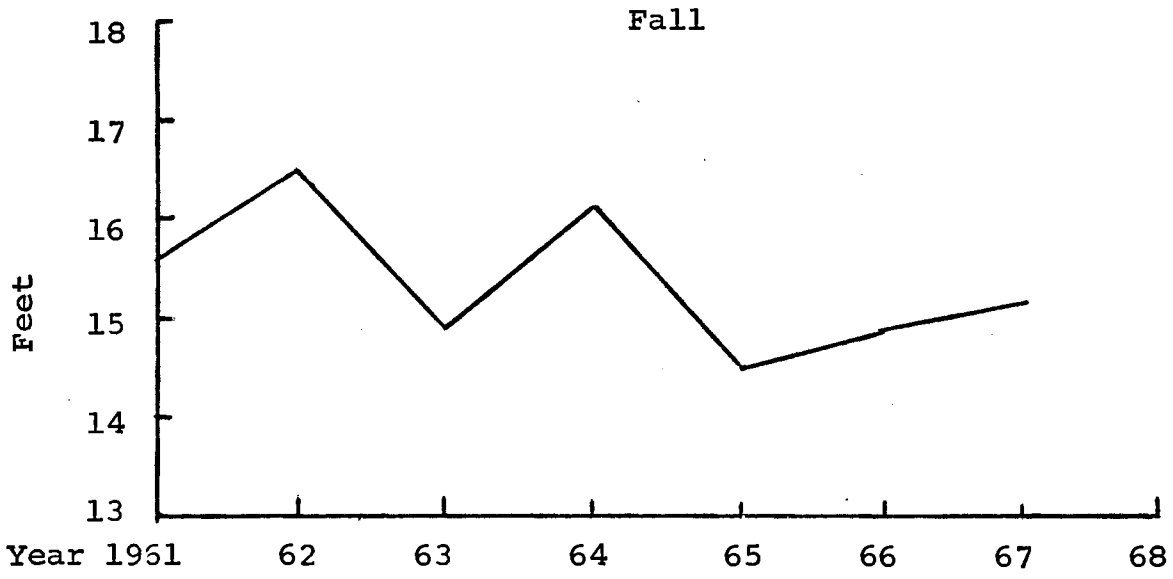


Figure 7. . Unit 9 Brown Bear Male Average Hide Size (Length Plus Width).



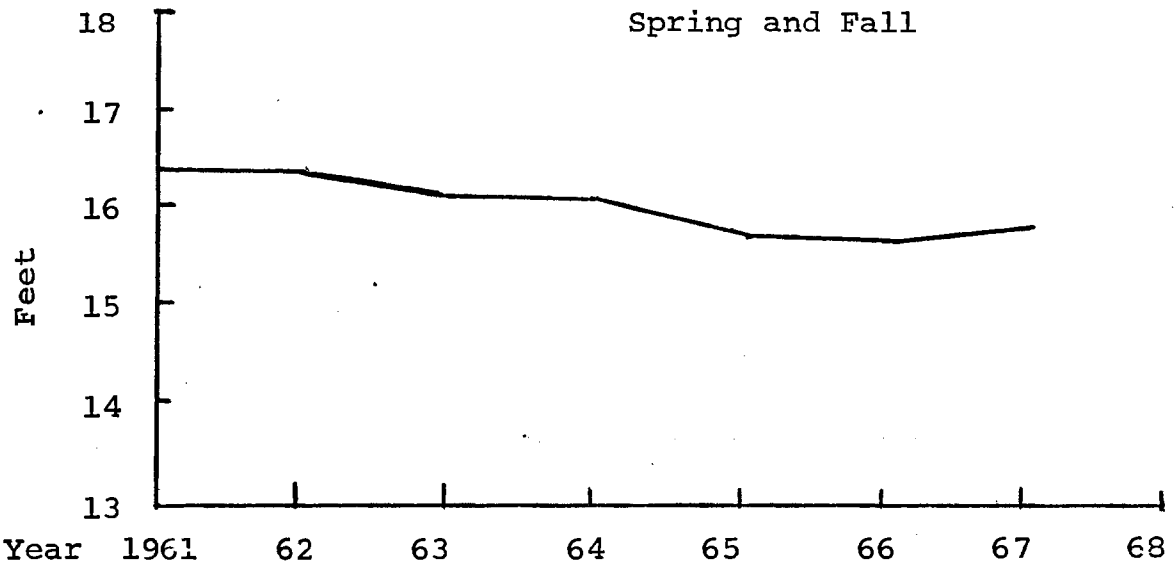
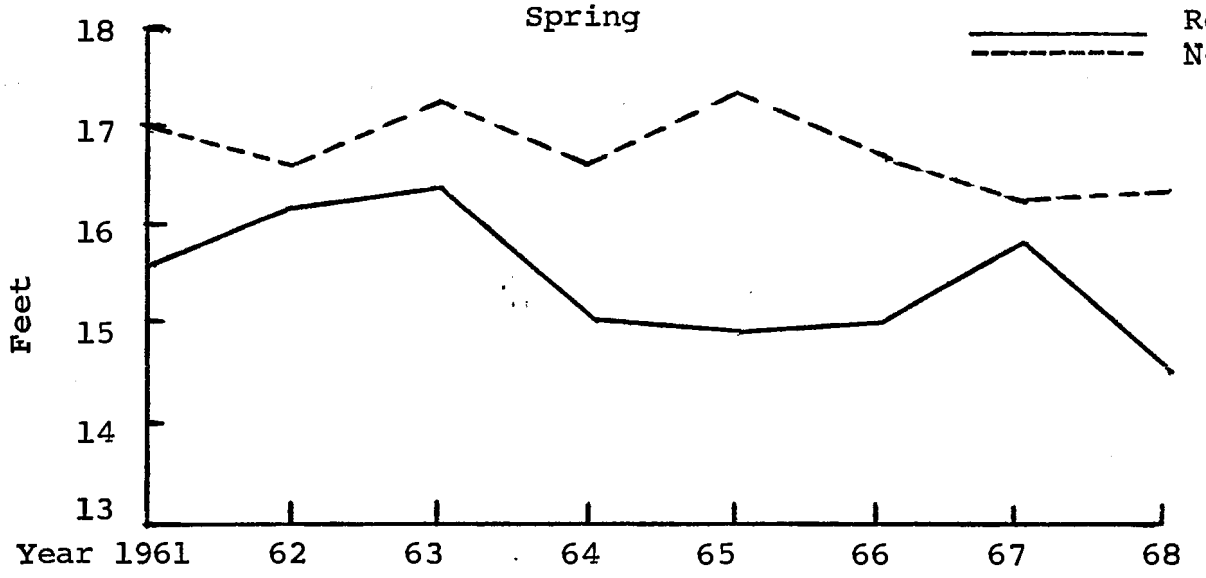
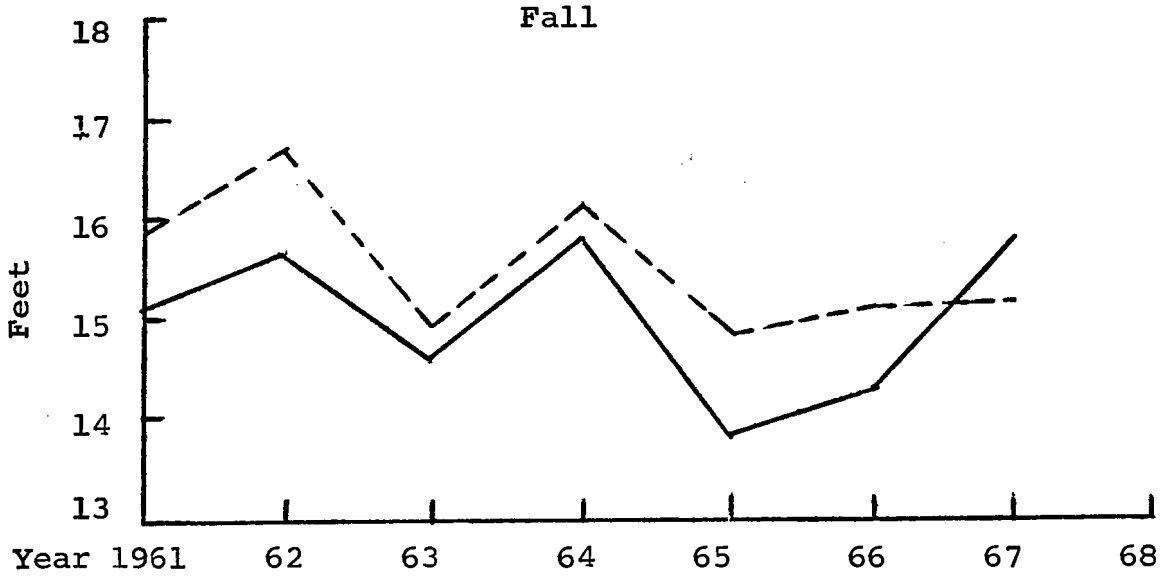


Figure 8. Unit 9 Brown Bear Male Average Hide Size (Length Plus Width) by Hunter Type.





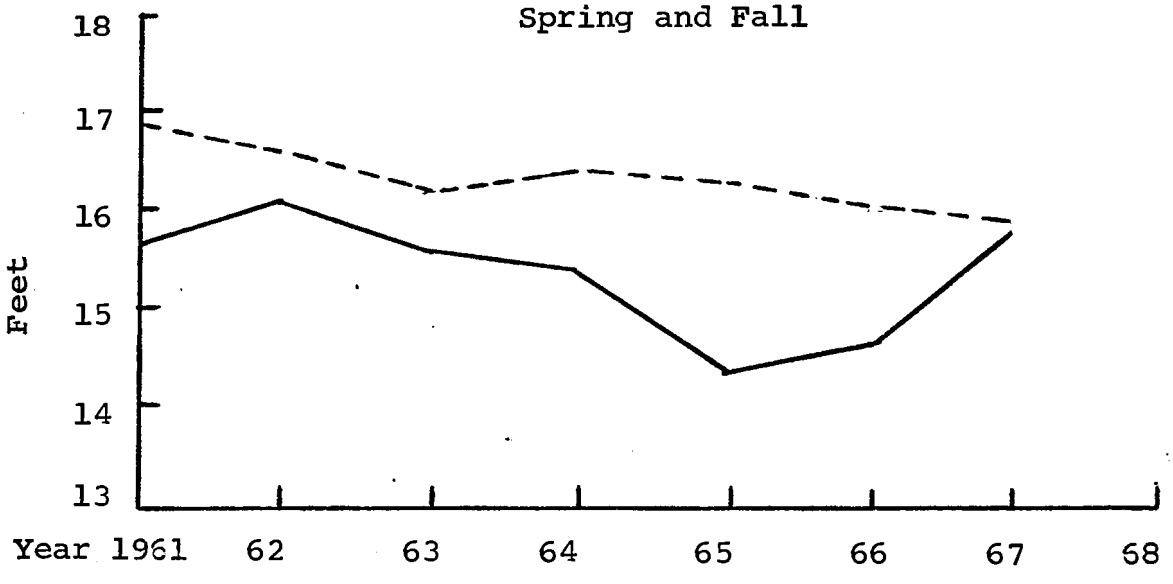


Figure 9. Unit 9 Brown Bear Harvest by Hunter Type

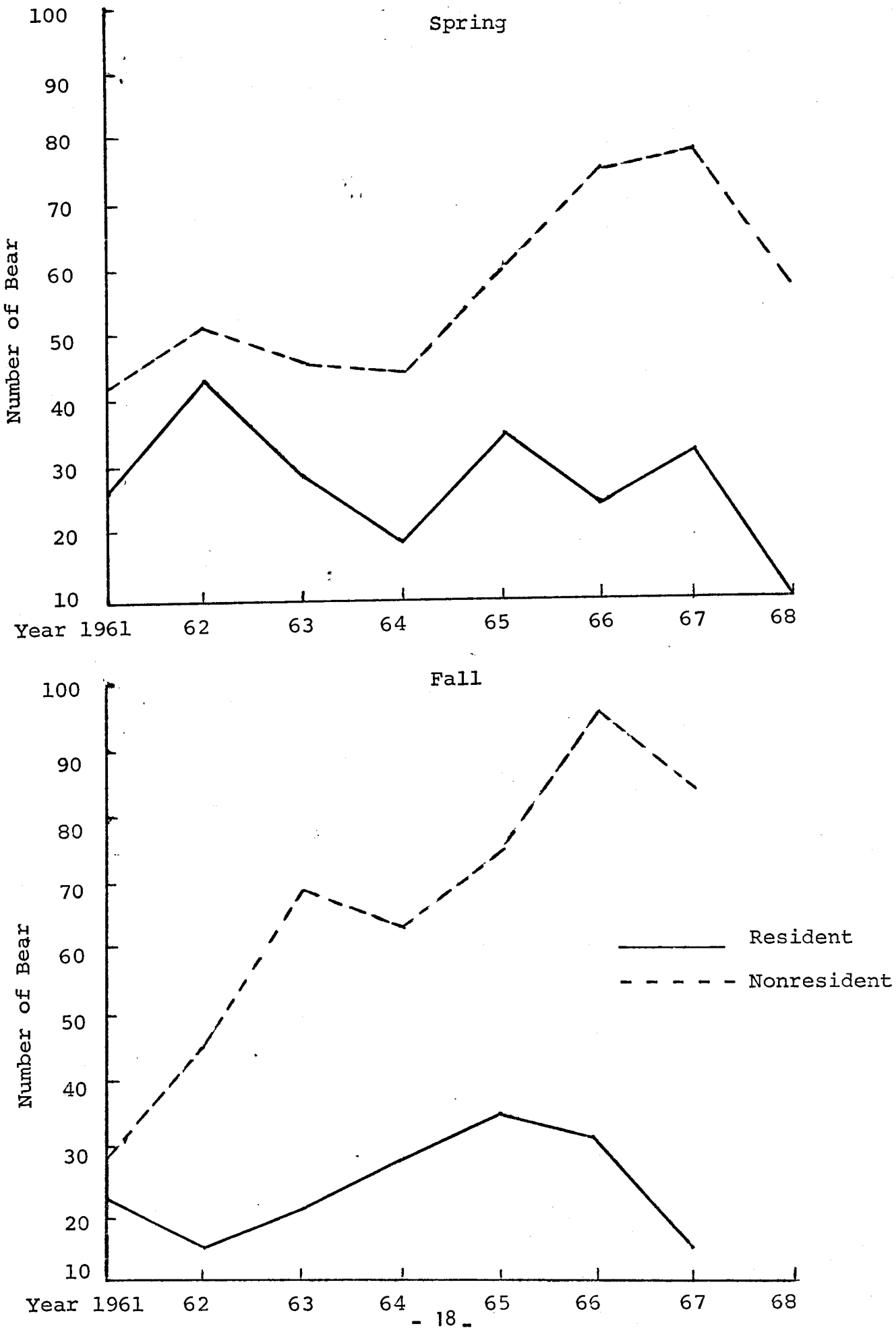
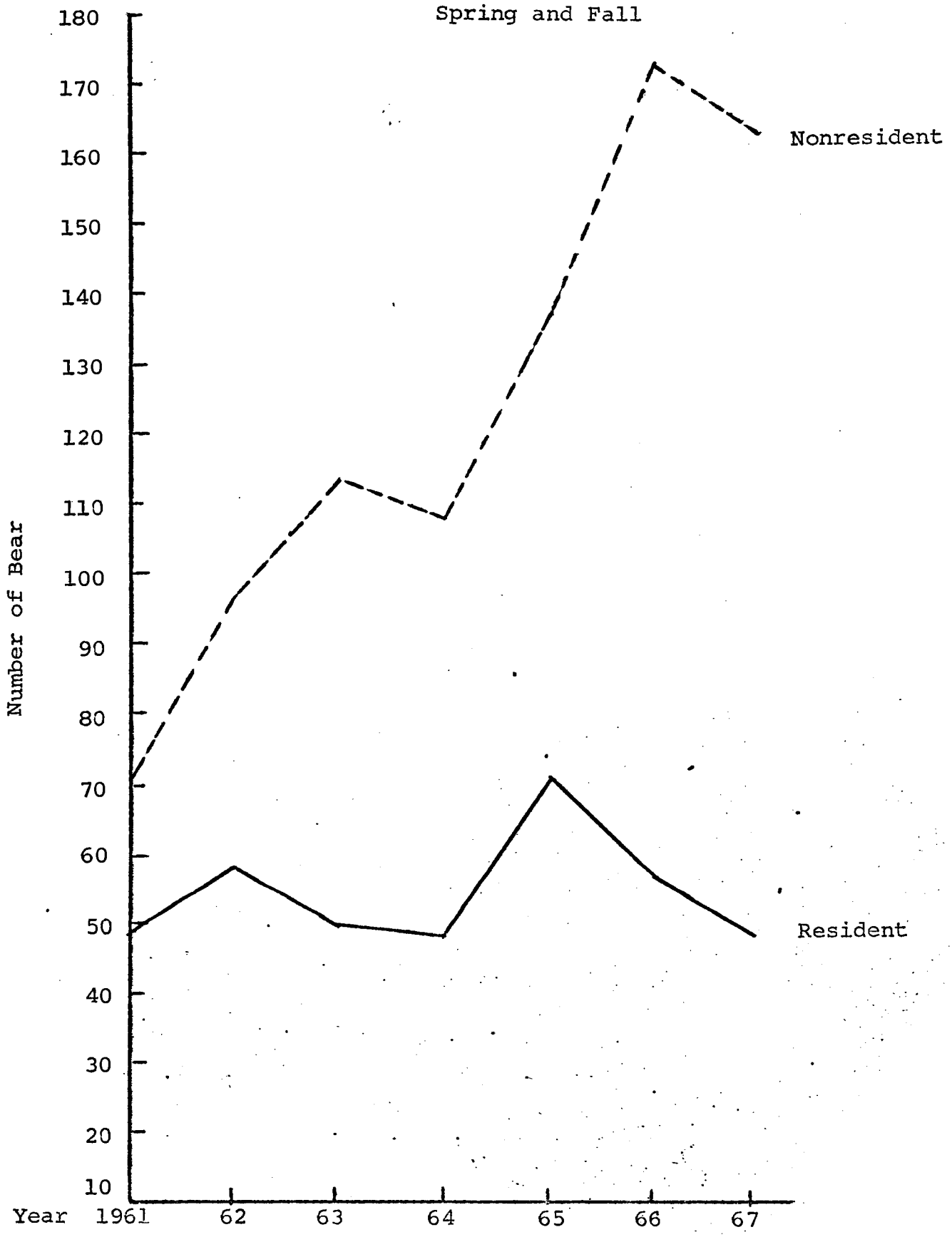


Figure 10. Unit 9 Brown Bear Harvest by Hunter Type.



RESIDENT HUNTING LICENSE SALES
(EXCLUDING SUBSISTENCE LICENSES)

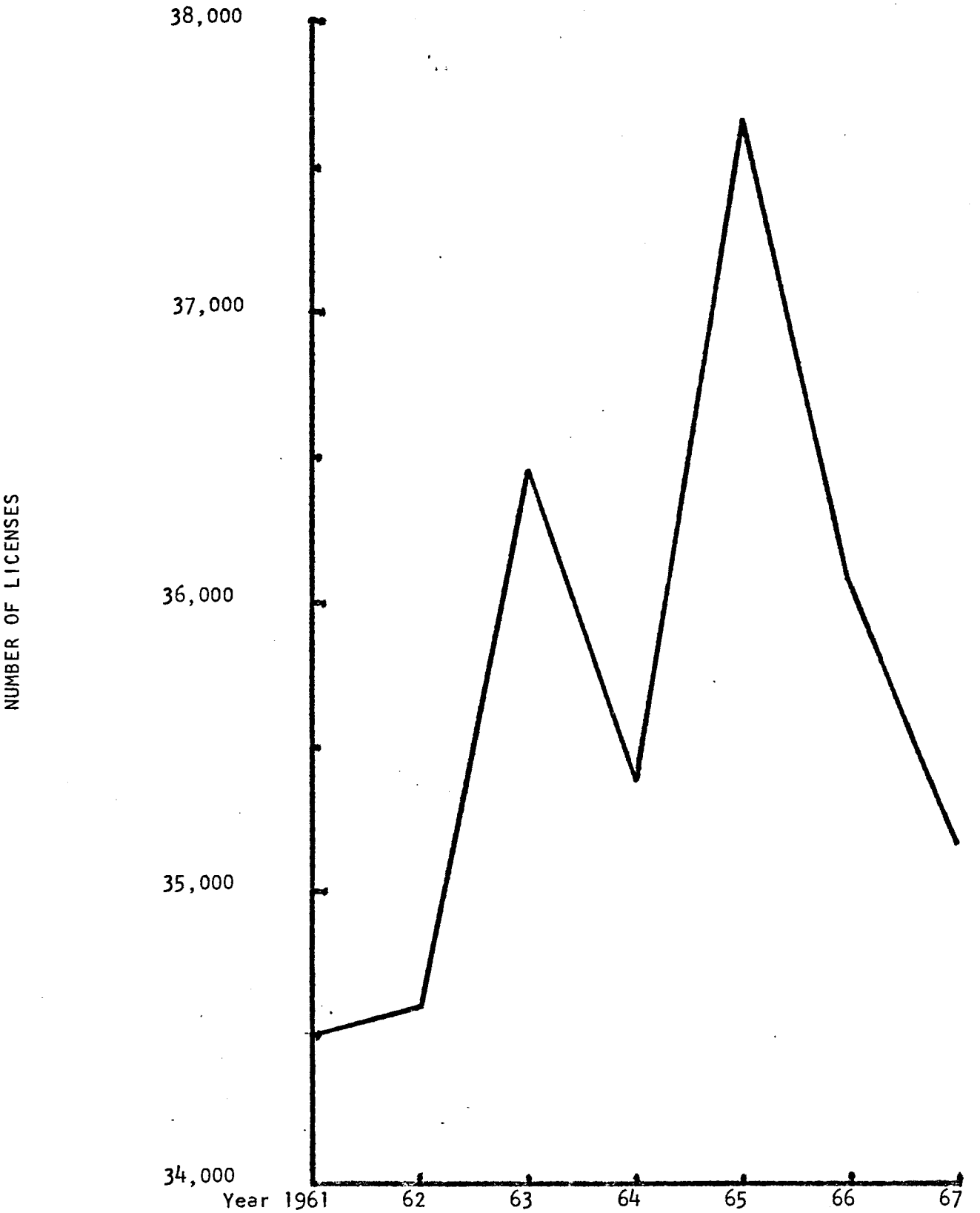


FIGURE 12. NON-RESIDENT BROWN-GRIZZLY BEAR TAG SALES

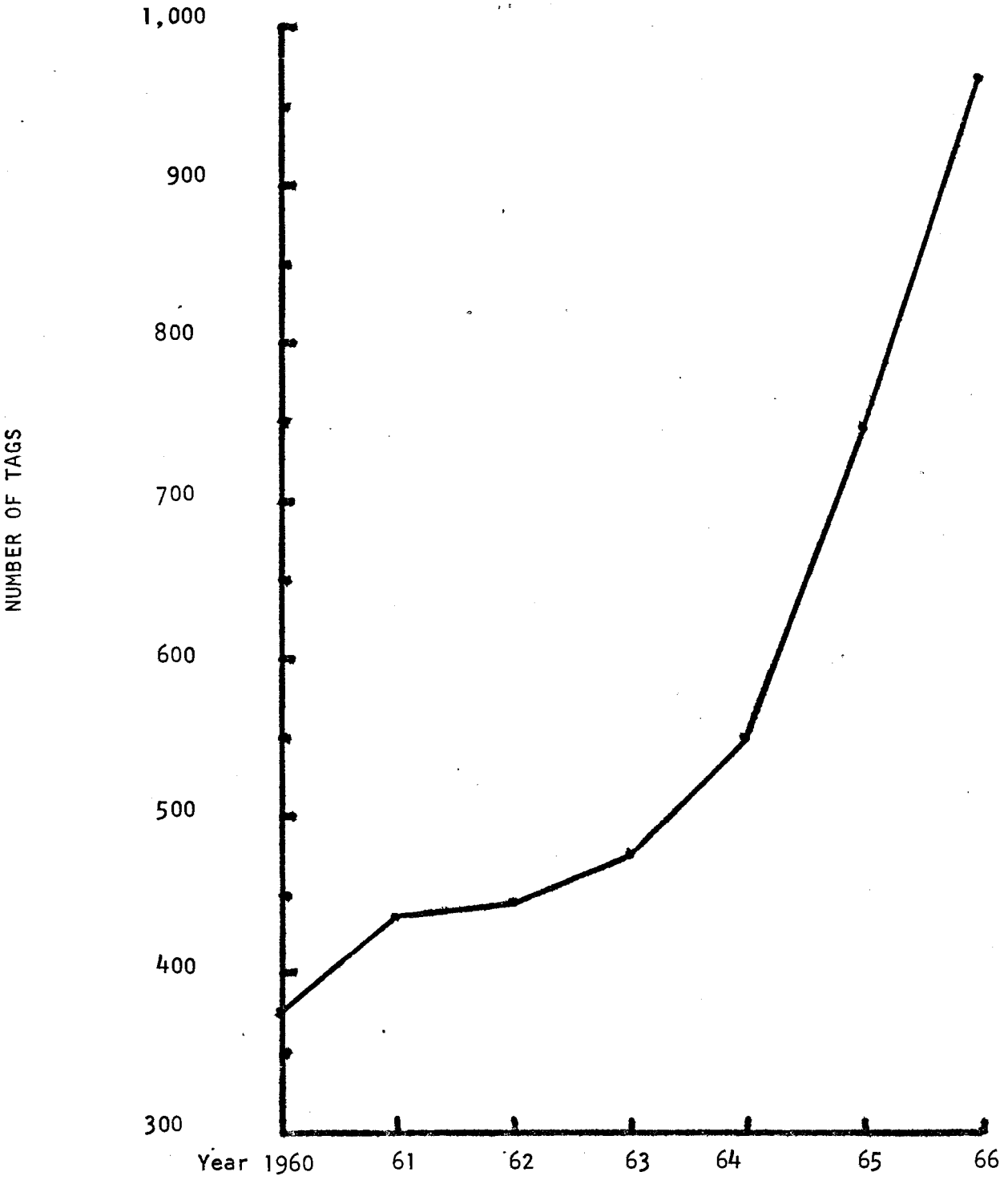
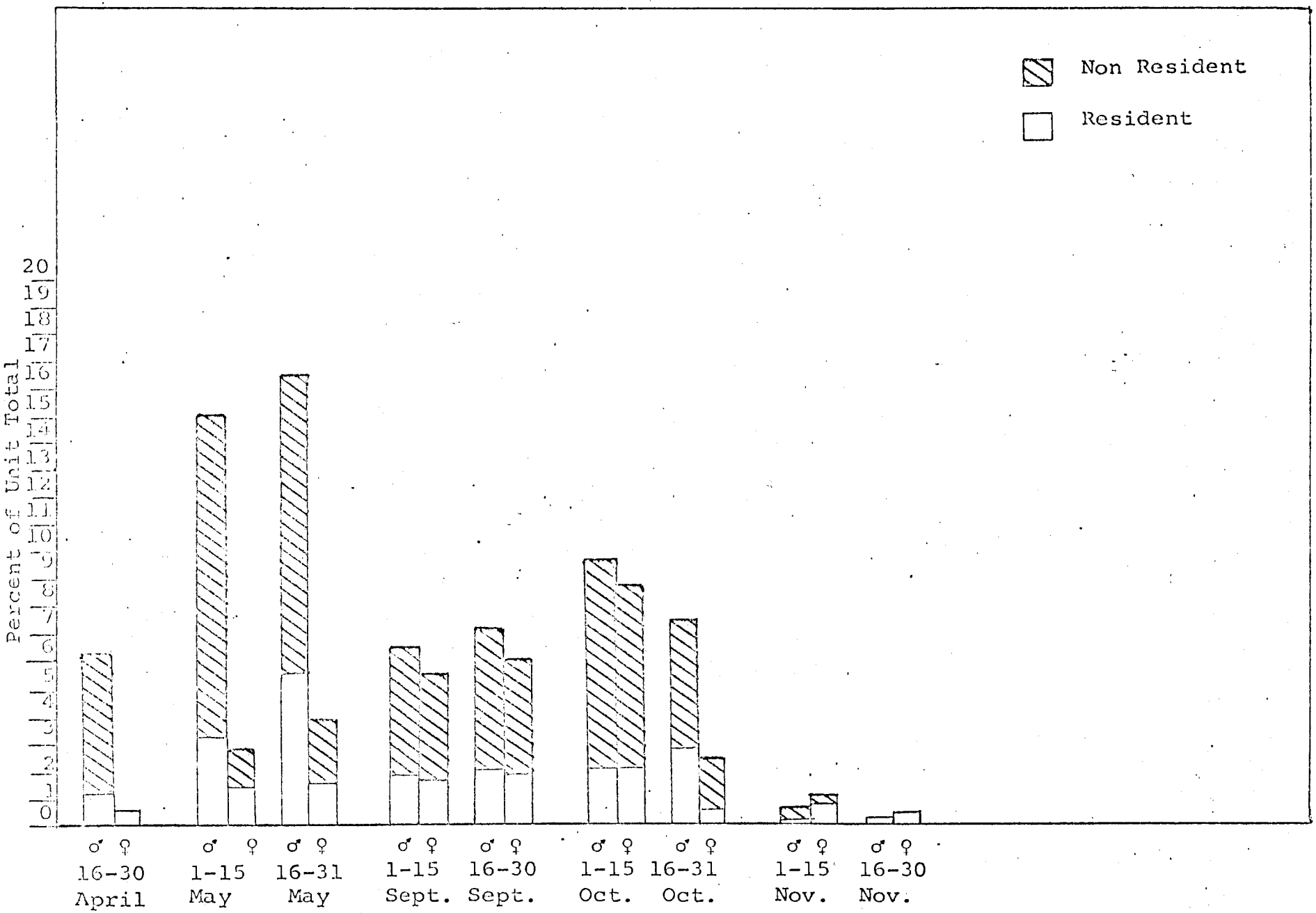


Figure 13. Brown Bear Kill Chronology 1964-1966 Unit 9



3. Different observers often obtain similar total counts but classify different population segments differently.

4. Increased wind velocity decreases the number of bears that are seen.

5. Large samples, i.e., many flights, are needed to give data which are comparable from year to year within statistically acceptable confidence levels. For instance, in the Black-Chignik Lakes area, 15 replicate morning and 33 replicate evening flights would be needed to estimate means for comparison from year to year of the number of bears seen within 10 percent with only a 5 percent chance of being wrong.

6. Different segments of a bear population may exhibit different activity patterns throughout the day. Thus large males might fish only at night and not be seen in surveys during the day.

7. Bear density and distribution on salmon streams are related to presence and abundance of fish in a stream being surveyed and in adjacent streams. An effort should be made to survey bears each year at the same stage of the fish run on each stream. Salmon runs can vary in their timing from year to year, and it is not always possible to do this. Fairly large areas rather than individual streams would probably furnish more valid comparisons from year to year, as bears probably travel to a certain extent in order to stay on streams with good number of fish.

8. Food other than fish might affect the number of bears on streams. For instance there might be fewer bears on streams in years of poor fish runs and good berry crops than in years when the opposite food situation existed. Also, surveys should be done before fish runs have peaked out and bears are starring to leave the streams to feed on berries.

9. The amount and type of vegetative cover varies from area to area on the Peninsula. Therefore, bear density data is probably not comparable from area to area.

Aerial surveys of differing coverages were flown in 1958, 1959, 1965, 1966, and 1967. In order to make data more comparable from year to year and to reduce flying somewhat, bear trend count areas were delineated in 1966. These are salmon stream bear concentration areas located from Becharof Lake to False Pass. (Figure 14). The total number of bears seen and bears seen per hour can be compared for the same areas from year to year. Composition data furnishes indicators and comparisons of productivity, survival, and changes in population that might be caused by hunting. Because of the shortcomings which have been listed for aerial surveys, particularly the large sample size needed for statistically valid comparisons, the following should be considered as a discussion of the data rather than definite conclusions.

Density

Total number and bears seen per hour by area are listed in Tables 3 and 4. It is difficult to draw even inferences regarding changes in density when comparisons must be made from year to year of a large area which has been flown with different intensities of coverage each year. Thus the low bears per hour figure for 1967 in Table 3 is partly because more time was spent flying in 1967, and therefore areas where bears were less concentrated were counted. Comparisons are probably more valid of areas which have been surveyed with about the same intensity from year to year (Table 4).

Productivity and Survival of Young

An indication of productivity is obtained from the percent of cubs, yearlings, and females with young in the total population. Insight into survival is obtained from cub and yearling average litter size data and by comparing the percent of cubs one year with the percent of yearlings the next.

Counts made in 1958 and 1959 show somewhat similar ratios of females with young, young, and single bears, and ratios from counts made in 1962, 1965, 1966, and 1967 are similary (Table 5). The percentages of females with young and young are less, and the percentages of single bears are greater in 1958 and 1959 than in suceeding years. This may indicate that increased harvests after 1959 reduced the number of single bears, rather than that productivity increased after 1959.

For all counts made on trend count areas from 1962 through 1967, the productive female segment has been fairly constant, 21 to 28 percent. (Table 6). Percent cubs and percent yearlings show some variation. Part of this may be because of difference in productivity and survival in different years and different areas. Part may be because of wrong classification; small yearlings may in some cases be mistaken for large cubs and vice versa. Part may also be sampling error; composition that does not fit the general pattern was recorded mostly in areas where low counts were obtained. When cubs and yearlings are combined and all counts considered for all areas, the percent of this age group in the total population varies from 44 to 61 percent and averages 52 percent. The percent of single bears ranges from 14 to 35 percent and averages 23 percent. When data from all counts are combined, 21 percent of the population have been classed as

yearlings. This can be considered the increment that has gone beyond most measurable natural mortality and is added to the population annually. As has been pointed out, however, this figure should not be considered definite. Sample sizes have been small, and different activity patterns throughout the day may cause a greater percentage of females with young to be counted than single bears.

Theoretically, the percent of yearlings compared with the percent of cubs the previous year should indicate the amount of mortality from cub to yearling stage. Table 6 shows considerable variation in this figure. It is not known if these figures truly indicate mortality or as caused in part by misclassification and inadequate sample sizes.

Likewise, change in cub average litter size one year to yearling average litter size the next year should indicate mortality within litters. Litter size data are presented in Tables 7 and 8. In most cases, there is a drop as would be expected. Shortcomings of surveys preclude drawing conclusions.

To summarize, aerial survey has shortcomings yet may be the most feasible way to assess bear populations on the Alaska Peninsula. To utilize survey efforts the most effectively, surveys should be confined to key areas and replicated both within years and from year to year. Surveys indicate more single bears in 1958 and 1959 than in 1962, 1965, 1966, and 1967. Perhaps hunting has caused this reduction in the number of single bears. The number of cubs and yearlings, about 50 percent, suggests that productivity is probably satisfactory.

Figure 14. Alaska Peninsula Brown Bear Trend Count Areas.

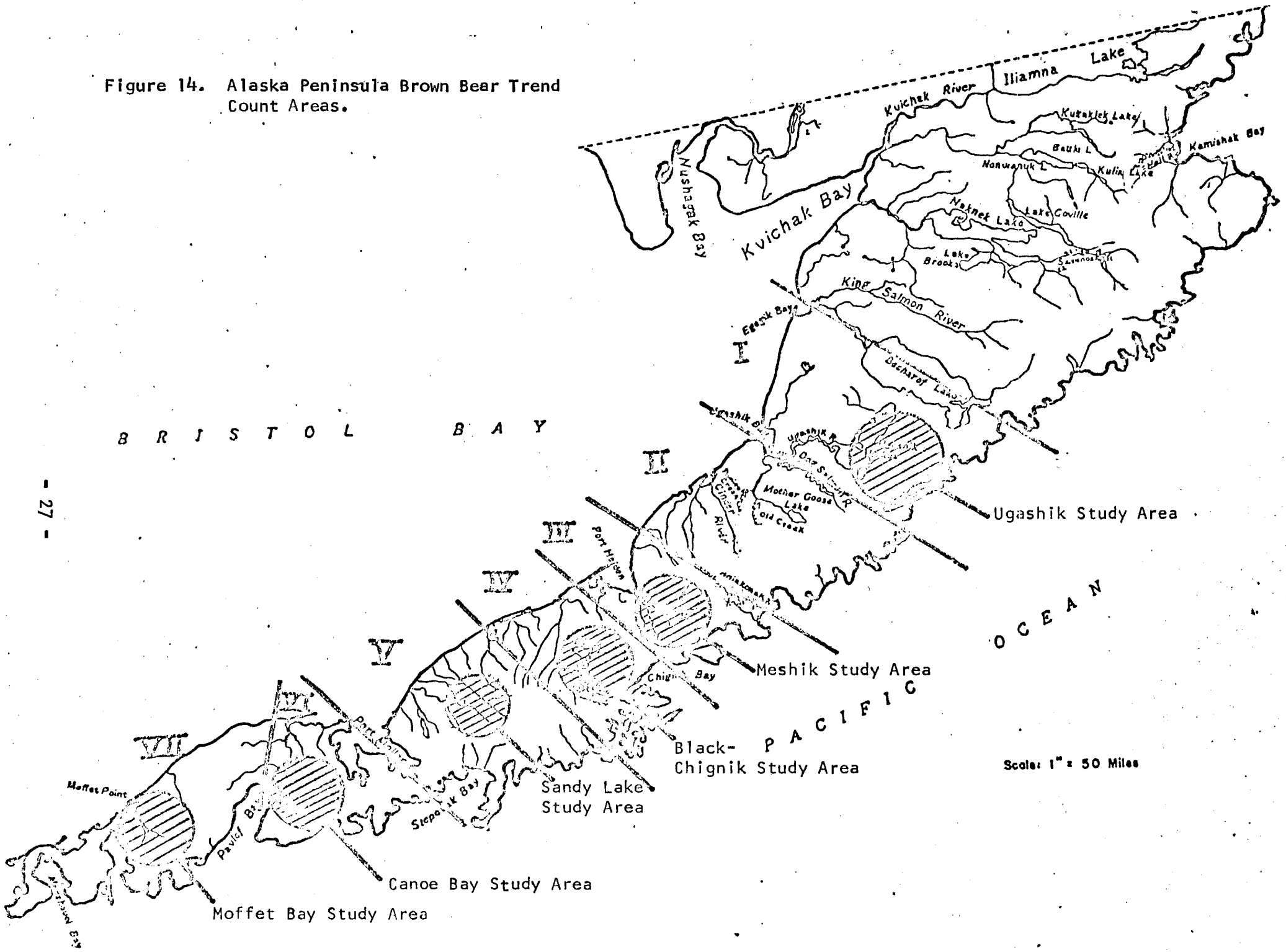


Table 3. Brown Bear Aerial Survey Data, All Areas Combined, Alaska Peninsula.

YEAR	♀♀ W/YOUNG		CUBS		YEARLINGS		CUBS & YEARLINGS		SMALL BEARS		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1958	133	17	167	21	115	15	282	36	364	47	779	100
1959	50	19	72	27	26	10	98	37	119	44	267	100
1962	439	26	512	30	376	22	888	52	391	23	1718	100
1965	90	26	102	30	86	25	188	55	65	19	343	100
1966	62	22	92	33	45	16	137	49	80	29	279	100
1967	83	25	126	38	49	15	175	52	77	23	335	100

Table 4. Brown Bear Aerial Survey Data, Meshik-Aniakchak Rivers to False Pass, Alaska Peninsula.

	1958		1959		1966		1967	
	No.	%	No.	%	No.	%	No.	%
Females w/young	55	15	25	18	62	23	106	25
Cubs	65	18	34	25	96	35	151	35
Yearlings	52	14	17	12	37	14	64	15
Cubs and yearlings	117	32	51	37	133	49	215	50
Single bears	189	52	63	45	79	29	106	25
Total Bears	361		139		274		427	
Hours flown	21.2		6.7		10.2		33.4	
Bears per hour	17.1		20.9		26.9		12.8	

Table 5. Brown Bear Aerial Survey Data, Alaska Peninsula Trend Count Areas.

Area	Year	Dates	No. of Bears	Hours Flown	Bears Per Hour	% Single Bears
Ugashik Lakes	1965	9/12-13	65	3.6	18.1	29
	1966	8/23	55	2.8	19.6	27
	1967	8/10-11	58	2.4	24.2	31
Meshik Drainage	1965	9/13	0	0.5	0	-
	1966	8/11	0	2.2	0	-
	1967	8/10	10	2.0	5.0	20
Black-Chignik Lakes	1962	7/31	118	2.5	47.2	22
	1965	8/6	123	2.5	49.2	16
	1966	8/9	108	2.5	43.2	31
	1967 1/	8/10	82	2.7	30.4	20
Sandy Lake	1965	8/10	42	0.9	46.7	24
	1966	8/10	37	0.7	52.9	19
	1967 2/	8/11	19	0.4	47.5	11
Canoe Bay	1966	8/21	19	0.3	63.3	32
	1967	8/11	37	1.5	24.7	24
Moffett Bay	1966	8/21	60	1.6	37.5	32
	1967	8/10	55	2.5	22.0	35

1/ Oil exploration helicopter working in area prior to count.

2/ Helicopter working in area prior to and during count. It is believed that bears were more wary and that some had moved out of area because of this.

Table 6. Aerial Survey Brown Bear Composition Data, Alaska Peninsula Trend Count Areas.

Study Area and Year	PERCENT OF POPULATION					Sample Size
	♀♀ W/Young	Cubs	Yearlings	Cubs and Yearlings	Single Bears	
Ugashik Lakes						
1965	22	22	28	49	29	65
1966	22	24	27	51	27	55
1967	21	29	19	48	31	58
Black-Chignik Lakes						
1962	26	30	22	52	23	1718
1965	28	32	25	57	15	236
1966	22	34	13	47	31	108
1967	27	45	10	55	17	157
Sandy Lake						
1965	26	31	19	50	24	42
1966	22	51	8	59	19	37
1967	25	39	21	61	14	28
Moffet Bay						
1966	23	33	12	45	32	60
1967	22	31	13	44	35	55
Canoe Bay						
1966	21	16	32	47	32	19
1967	24	27	24	51	24	37
Average - All Observations	25	31	21	52	23	2675
Range	21-28	16-51	8-32	44-61	15-35	

Table 7. Unit 9 Brown Bear Aerial Survey Average Litter Sizes.

YEAR	CUB	YEARLING
1958	2.2	2.1
1959	2.1	1.7
1965	2.1	2.0
1966	2.2	2.2
1967	2.1	2.0

Table 8. Black-Chignik Lakes Brown Bear Aerial Survey Average Litter Sizes.

YEAR	CUB	YEARLING
1965	2.3	2.5
1966	2.2	2.0
1967	2.1	1.7

MANAGEMENT

A discussion of hunting methods is necessary before considering management practices. Aircraft are used in some way for most brown bear hunting on the Alaska Peninsula. Planes are necessary for transportation there if it is desired to distribute hunting pressure. Without planes, hunting would be limited to and concentrated in a few areas surrounding those villages which are served by commercial airlines. Lack of roads precludes use of standard vehicles. Bears do not spend time on beaches on the Alaska Peninsula as they do in some other parts of the State, and thus they cannot be hunted by boat. Hunting with horses is a possibility which has not yet been tried. Even with horses, hunters would in most cases have to be flown into camps.

Terrain and cover is such on much of the Peninsula, that in addition to transporting hunters to hunting areas, planes can also be used to spot, herd, and land near bears in order to allow them to be taken. This type of hunting became quite common as the number of guides increased. Some pilots without much guiding experience used it when they started guiding; as this occurred, other guides started using planes because they thought they had to in order to compete. A few guides, using airplanes, mass-produced hunts by handling a large number of hunters each for a relatively low fee and often taking the first bear that was seen.

Airplane hunting is critized by some as being unethical, esthetically displeasing, or a poor quality type of hunting. Some persons say that game management agencies should concern themselves only with the biology of a species being managed and not with esthetics and upgrading the quality of hunting. They also say managers should not act as judges concerning what constitutes "good" or "poor" recreation for the hunting public. Others say that game

managers should be concerned with more than biology and that the quality of recreation that can be furnished should be considered when setting management objectives. Esthetics and quality should be considered along with biology especially in the case of brown bears which are hunted almost exclusively for trophies and which are quite limited in numbers and range.

Past Regulations

Prior to 1967, seasons and bag limits were the principal means of management. The bag limit was one bear a year, provided that cubs and females accompanied by cubs were protected. Cubs are defined as bears through their second year of life. Seasons are listed in Table 9.

Seasons and bag limits without other restrictions can be used to control harvests mainly by changing length of seasons, since relatively few hunters take more than one bear even in a life time. Opening and closing dates can also be changed to reduce the harvest of females or the number of bears with poor hides. A regulation was also in effect prior to 1967 which stated that when an aircraft was used as an aid in taking bears, it could be used only to fly to a camp or to a site in order to establish a camp, and that a camp had to be established prior to hunting. The regulation was difficult to enforce and was violated by a substantial number of hunters.

Recent and Present Regulations

Airplane hunting was restricted somewhat after July 1, 1967, by a regulation which permitted planes used in connection with hunting to be landed only at pre-registered camps. This was proposed primarily to stop the actual hunting of bears with planes, but was also advocated by some as a means to reduce the harvest. The original proposal specified that a number of camp locations could be registered, but that locations could not be changed during theseason. The proposal was modified and the final regulation stated that camp locations

Table 9. Unit 9 Open Hunting Seasons for Brown Bears.

Year	Season
1960-61	Oct. 1 - May 31
1961-62	Sept. 10 - May 31 north of Becharof L. Oct. 1 - May 31 south of Becharof L.
1962-63	Oct. 1 - May 31 north of Dog Salmon R. - Wide Bay Sept. 10 - May 31 south of Dog Salmon R. - Wide Bay
1963-64	Sept. 1 - May 31
1964-65	Sept. 1 - May 31
1965-66	Sept. 1 - May 31 north of Meshik R. - Kajulik Bay Sept. 15 - May 31 south of Meshik R. - Kajulik Bay
1966-67	Sept. 1 - May 20 north of Meshik R. - Kajulik Bay Sept. 15 - May 20 south of Meshik R. - Kajulik Bay
1967-68	Sept. 15 - May 10

could be changed. Thus during the fall of 1967 when the regulation was first effective, hunters could locate a bear with a plane, register a camp nearby, and use the plane to land near the bear as before. Enforcement personnel were handicapped because it was difficult for them to keep informed of changes in camp locations. Nevertheless, the harvest was reduced (100 bears taken during the 1967 fall season as compared to 129 taken during the 1966 fall season).

In the spring of 1968, the season ended May 10 instead of May 20 and an emergency regulation stated that camp locations could not be changed. There was no enforcement work, and some guides hunted with planes in complete violation of the registered camp regulation. The harvest was 68 as compared with 111 in the spring of 1967.

Two other regulations became effective July 1, 1967. One prohibited hunting in Unit 9 the day a hunter was airborne. This was difficult to enforce and was probably violated at times. The other new regulation required brown bear hunters throughout the State to hire a registered guide. This measure was lobbied for and pushed through the Legislature by the guides, ostensibly because it would result in better trophies and a safer hunt for non-residents.

It was believed that restrictions on the use of aircraft would result in smaller bears and an increase in the percent of females in the harvest, since hunters would be able to look over fewer bears than when hunting with aircraft and therefore be less selective. Average hide sizes and sex ratios did not change as expected (Table 1).

Present regulations, as enacted by the Board of Fish and Game and effective July 1, 1968, are quite restrictive. These allow a guide to participate in only three bear hunts throughout the State in any 1 year, and on the Alaska

Peninsula allow each guide to operate out of only two pre-registered camps. Camps must be registered before the season starts, and camp locations cannot be changed during the season. Registered or master guides or outfitters may hire other guides to work for them. Bears taken for a hunter by a registered guide working for another guide do not count against the hiring guide's allotment; bears taken by an assistant guide do count against the hiring guide's allotment. Resident hunters not employing a guide may register only one camp. Restrictions on use of aircraft are still in effect, i.e., planes may be used only for transportation to and between camps, and hunters may not hunt the day they are airborne. Another new regulation announced July 1, 1968, but not to become effective for 4 years places the bag limit at one bear each 4 years. During the 4-year period, 1964-67, 5.1 percent less bears would have been taken had this regulation been in effect. About one-third of these were taken by guides, possibly for other than recreational purposes.

The new regulations are causing concern among some guides who say they will not make as much money as they formerly did. The Department cannot justify the present restrictiveness of regulations on the basis of biological data it possesses. Admittedly, the data have shortcomings which have been discussed, and a desire for caution could be used for justification. The new camp regulation will also affect unguided residents, perhaps in an unduely restrictive manner, in that they will be able to camp in only one location while hunting. It would seem reasonable that residents, some without prior knowledge of the area, should have more freedom of movement than would be allowed from one camp.

Future

Unit 9 can perhaps best be managed by dividing it into two sub-units, one north and one south of the Naknek River and Katmai National Monument. The two

areas are quite different in that it is more difficult to hunt bears in the northern area, and relatively few are taken, probably considerably fewer than the annual increment. It is suggested that management practices for this area be about the same as for adjacent Units 16 and 17.

Bears are readily taken in the southern section. Establishment of guide camps there, the increase in brown bear hunting effort in recent years, and the general increase in outdoor recreation indicate that the demand for brown bear hunting will increase, very likely to the extent that maximum permissable harvests may soon be reached. Thus it will be necessary to assess populations and harvest and give considerable thought to management in the southern section.

An ideal management situation exists when population size, annual increment, and mortality (natural, sport, and non-sport) of a game population are known. Unfortunately, the only one of these factors which is known with any preciseness for brown bears on the Peninsula is the sport hunting mortality. Very gross estimates are made here, however, so that a management plan based on an allowable harvest figure can be considered.

The most gross type of population estimate might place the number of bears in the southern section at 2,000. This is based on total counts made on aerial surveys and an estimate that only one-fourth of the bears that are present are seen. Bears are present in areas that are not surveyed, and bears are not seen in areas that are surveyed. About 20 percent of the bears seen on salmon stream aerial surveys are classified as yearlings. This can be considered the age class which is added to the population after going through the period of measurable mortality. A 20 percent figure could be high in that young bears might spend more time on streams than older

bears, especially during the period of the day when surveys are made. A very conservative estimate might then place the annual increment at 10 percent. Based on an estimated population of 2,000, the allowable harvest equal to the annual increment would then be 200. Natural mortality and non-sport kill might reduce the allowable sport harvest to 150, which is believed to be a quite conservative figure. The harvest has been higher than this in recent years with no significant drop in hide size or increase in percent of females taken. Very limited age determination data indicate that perhaps a greater proportion of younger bears are being taken from Unit 9 than from other units. This suggests that hunting selectivity for older bears may have removed a greater proportion of the older bears from the population in Unit 9 than in other units and a need to stop the trend of increasing annual harvests.

A conservative management approach would then be to set regulations which limit the sport kill to 150 in the southern area. Other desirable features of regulations would be:

1. Aircraft to be used only for transportation and not for actual hunting.
2. Fall season to start October 1 to improve trophy quality and shorten period when airplane hunting for moose and caribou would hamper enforcement of regulations restricting airplane hunting for bears.
3. Spring season to last long enough, perhaps to May 20, to allow hunters more time for hunting, since hunting from the ground requires more time than hunting from the air.

Season opening and closing dates can be readily changed to meet the above standards. Regulations would then still have to be written to achieve the 150 bear limit and restrict aircraft. It is quite possible that restrictions on aircraft would automatically hold the kill at or below 150.

At least two alternatives exist for limiting aircraft. The easiest regulation to enforce would be one which set specifications on planes which could be used in connection with hunting. An example would be to allow no planes smaller than a Cessna 180 to transport bear hunters, hides, or skulls. This would be much easier to enforce than the present regulation but might be undesirable in that it would concentrate hunters in only a few areas where the larger planes could land. The other alternative is to allow planes to be landed only at pre-registered locations which could not be changed during a season. The number of locations which each guide or hunter could register should be limited. Enforcement effort would be needed to make this regulation effective. The number of locations that could be registered would be adjusted from year to year based on previous seasons' harvests so that an annual harvest of 150 was maintained.

It should be realized that there are certain arguments for not restricting airplane hunting. Guides and hunters can look over several bears before shooting one. In theory this should provide better trophies. Also, use of airplanes does not mar the country as do tracks left by ground vehicles and permanent camps established for hunting on foot and with ground vehicles. Marring would probably not be significant, however, compared with what already has been done by oil exploration companies. When all factors are considered, it appears that restrictions on aircraft use are preferable to no restrictions.

If hunting pressure increased because of an increasing number of people registering landing locations, it might then be desirable to shorten the hunting period, preferably by closing either the spring or fall season rather than shortening either one or both. A longer single season might be preferred by guides in that they would have to gear up only once. Also, if there is to be a limit on the amount of enforcement effort that can be done, effort might be more effective during one longer season than during two shorter seasons.

If, even with pre-registered landing locations and the closure of one season, the harvest exceeded 150, it might then be desirable to go to a permit system. It is suggested that residents be exempt from having to participate in drawings for permits. Permits chosen by drawing should be issued to non-residents for the number of bears above the average taken by the residents the past few years. It is suggested that non-residents be required to submit the tag fee with their application. This would discourage some who were not truly interested in hunting. Unsuccessful applicants would have tag fees returned. Issuing a set number of permits in this manner would allow the harvest to be controlled quite closely. Another desirable feature is that by issuing the permit to the hunter, the hunter has much leeway in choosing a guide.

This type of permit system whereby a set number of permits would be issued hunters after a drawing was suggested for polar bears. Guides objected because they said it would be an inconvenience in booking hunters. The regulation was then changed so that each guide could take out a certain number of hunters, the number chosen by knowing the number of polar bear guides and the approximate desired harvest. This type of restriction on the number of hunters that a guide could take out might be an alternative for Unit 9 brown bears in case it was decided that permits could not be issued directly to hunters. One definite advantage is that it would limit the activity of cut-rate guides who mass-produce hunts.

Another factor as important as maintenance of bear stocks by proper control of harvests is maintenance of bear habitat. At least two land use practices could drastically alter habitat on the Alaska Peninsula. These are domestic livestock grazing and oil exploration, drilling, and pumping. It has been

demonstrated on Kodiak Island that bear stocks cannot be maintained where cattle are grazed. Bear stocks would probably also decline if human activity greatly increased because of the presence of oil.

The Bureau of Land Management which administers nearly all of Unit 9 has recently classified the area north of Katmai. They now have the authority to control land use activity here and must also prepare a land-use plan. Under terms of recent agreements between the Department of Fish and Game and the B.L.M., the Department will designate areas important for fish and game and will have an active part in preparing the land-use plan. Wildlife values should receive adequate consideration as land-use planning progresses, and bear habitat may thus be maintained.

The area south of Katmai has not been classified and B.L.M. has only limited control of land use. This is the next area which B.L.M. would like to classify. The Department has agreed to furnish B.L.M. with information to justify the need for classification. If the area is classified, the Department would work with B.L.M. to develop a land-use plan. Classification and development of a land-use plan should proceed as rapidly as possible in order to preserve bear habitat.

LITERATURE CITED

Erickson, A.W., and D.B. Siniff. 1963. A statistical evaluation of factors influencing aerial survey results on brown bears. Trans. N.A. Wildl. Conf. 28:391-409.