

KODIAK- Bear-Salmon Study
Sulua Bay 7/21-10/15 1951

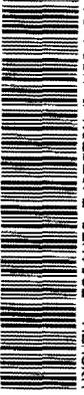
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KODIAK-BEAR-SALMON STUDY, SULUA BAY

by
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KODIAK ISLAND

KODIAK

Sukia Bay



1951 BEAR - SALMON STUDY OUTLINE

SULUA BAY

W.K. CLARK

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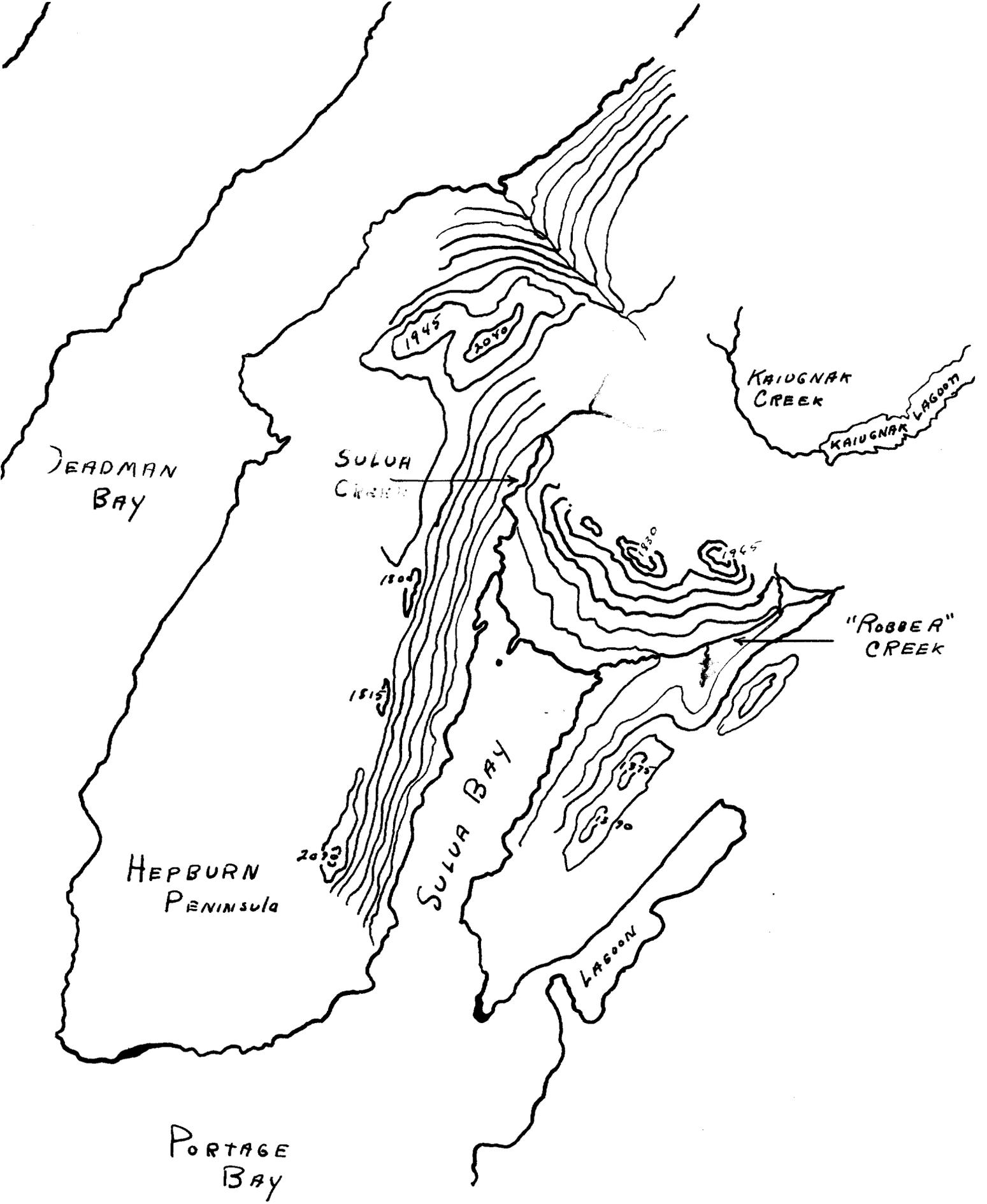


FIGURE II

BEAR - SALMON STUDY 1951

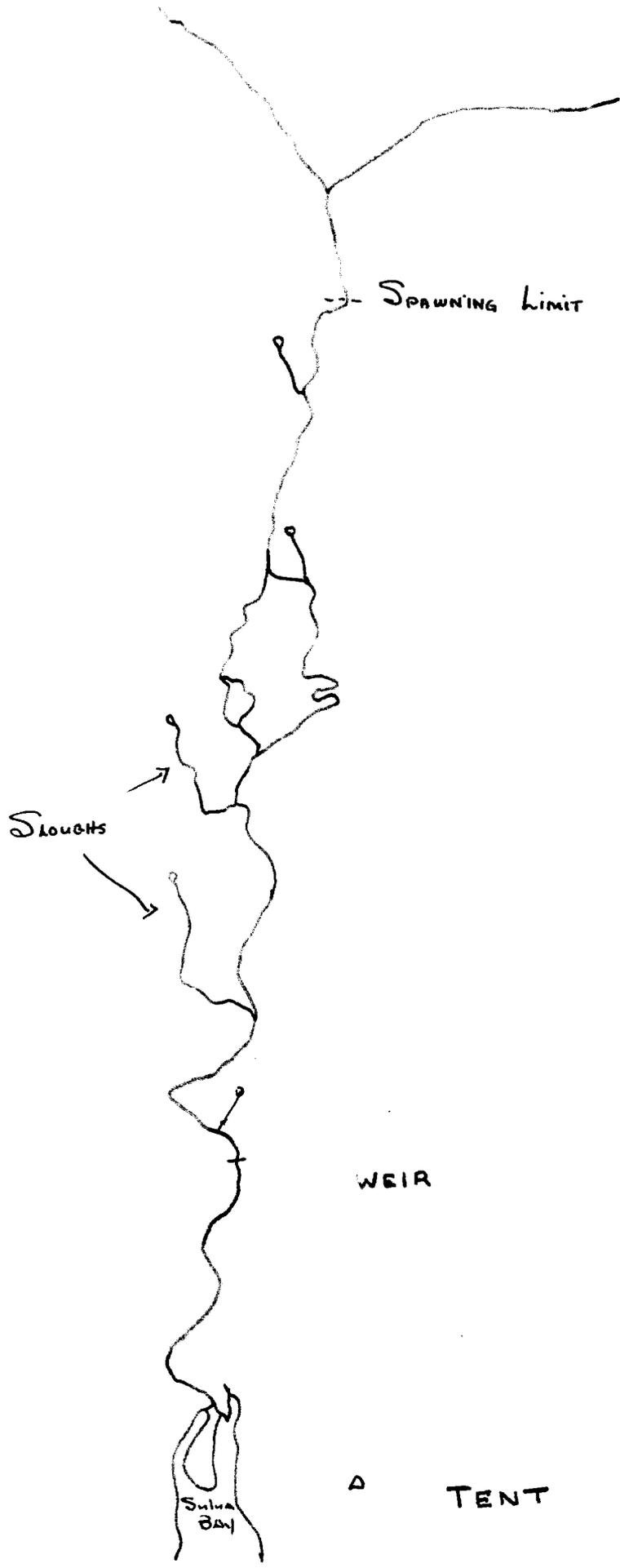
I. INTRODUCTION

A. PURPOSE

In continuing the bear-salmon study on Kodiak Island, part of the 1951 project was concerned with the investigation of a stream where there was normal Brown bear (Ursus middendorffi) activity, and an escapement of 10,000 or more pink salmon, Oncorhynchus gorbuscha. Of course, the unspawned bear-take figures were the data of most concern. In general the procedure followed was the same as in 1950, i.e., use of a weir tally and stream surveys plus the collection of observational and other data.

B. LOCATION AND DESCRIPTION

The stream chosen is located on the south end of Kodiak Island (see map) at the head of Sulua Bay in the Alitak area. This is the largest stream flowing into the Bay and is tentatively called Sulua Creek. The section used by the salmon was roughly $2\frac{1}{2}$ miles in length. It is a winding medium-sized stream, varying from 10 to 20 feet in width, with a moderate rate of descent. There are few deep pools and four good spawning riffles averaging over 150 yards in length and at least 15 feet in width, where most of the pink salmon



1 in. = 1/4 mi

FIGURE III

spawned. Many chums or dogs, Oncorhynchus keta, used the more quiet shallow sloughs that entered the main creek via former stream beds. Three sloughs were used extensively and two others to some degree. There are no falls of any kind in the spawning stretch, for the valley is well filled with silt and gravel and apparently at one time the head of the Bay was much farther inland than at present.

(See photo)

The banks of the stream are open for the entire spawning distance with some willows, Salix ssp., in evidence at the upper end, but few overhang the stream. Grasses cover the floor of the valley and the banks of the stream. The chief species is Bluejoint, Calamagrostis canadensis; Tufted Hairgrass, Deschampsia caespitosa, was quite common. Other grasses found near the waters edge included Meadow Barley, Hordeum brachyantherum, Short-awn Foxtail, Alopecurus aequalis. The chief flowers were fireweed, Epilobium angustifolium, and the large members of the Parsnip family, Umbelliferae, Cow parsnip, Heracleum lanatum, Water hemlock, Cicuta douglasii, Angelica Angelica lucida. Horsetail, Equisetum spp., an important bear food, was also plentiful. Near the mouth of the stream sedges were plentiful; the most important as a bear food, Carex lyngbei, found commonly in the regions reached by the highest tides. The low rounded hills immediately surrounding the head of the Bay were covered with crowberry, Empetrum nigrum, cranberry, Vaccinium vitis-idea, and cornel, Cornus suecica, areas called by the writer "Crowberry balds".



SULUA CREEK DRAINAGE
(looking northeast)



HEAD OF
SULUA BAY
(looking southeast)

TENT AT EXTREME
HEAD OF SULUA BAY
(looking south)



Alder growth, Alnus fruticosa, the bears' retreat, was thickest on the slopes from about 150 feet to 1,000 feet altitude and approached the spawning section no closer than 100 yards.

C. DURATION, PERSONNEL, ETC.

The period covered by the investigation extended from July 21 to October 15. The writer and wife, Shirley, lived in a tent on the brow of a hill (see photo) overlooking the lower end of the stream and the tide flats at the head of the Bay. This spot was nearly a half-mile from the weir site and should not have affected bear activity in the vicinity of the weir.

II. METHODS

A. WEIR TALLIES

By use of a weir it was hoped to get a tally of the escapement. Actually various factors to be explained later, entered in that affected accuracy of the final figure. The weir was also used to catch salmon remains drifting downstream.

B. SURVEYS

In conjunction with the weir tally, numerous surveys of the upper stream and banks were made. An attempt was made to account for as many fish as possible.

PINKS

DOGS

DATE	Male			Female			?	Male			Female			?
	S	U	?	S	U	?	?	S	U	?	S	U	?	?
NATURAL														
BEAR-TAKEN														
?														
BANK BEAR-TAKEN														

S - Spawmed Out, U - Unspawmed, ? - Unknown

Figure 4

Sample of Daily Salmon Remains Tally Sheet

Two other areas were investigated but no weir used. One, tentatively called "Robber" Creek, flows into the northeast end of Sulua Bay approximately four miles from Sulua Creek and has little more than a mile of spawning grounds. A few bank surveys were made on this creek. It was thus named by the writer because three men were apprehended in the act of seining salmon at its mouth on August 18.

At Kaiugnak Creek, whose headwaters join those of Sulua to the northeast, during two hurried visits general surveys were made.

The data found on the surveys were kept on small daily forms (see figure 4) and then transferred to the larger seasonal record (Tables). The daily form is small enough to be carried in the pocket or field notebook. This feature is especially helpful during rainy weather; a larger form is harder to carry and easily gets wet.

All fish examined were dissected, if a sufficient amount remained, to learn spawning conditions. To prevent duplication remnants were thrown well back from the stream into heavy vegetation. At the weir tallied carcasses were pitched into the stream below.

C. OBSERVATION, SCAT EXAMINATION, PLANT AND SEED COLLECTION

More bear-salmon data were collected by noting movements, feeding habits, etc., whenever bear appeared. Tracks and other signs were noted, as well as condition of foods other than salmon.

Some scats were collected but many others were examined in the field and contents recorded.

Numerous plants and seeds were collected during the season, many of which are important in food and cover requirements of the bear.

III. RESULTS

A. WEIR

1. Description

Before the writer arrived at Sulua Bay on July 21 the weir was first constructed at a point approximately $1/5$ mile up the stream by Messrs. Chapados, Lutz and Dunk. This was too close to the mouth, for high tides carried the pickets nearly two miles down the bay. With the help of Chapados, Lutz and Mrs. Clark the weir was reassembled at a site fully $1/3$ mile from the mouth. Here it was thought that even the highest (10 foot) tides would not affect operation. As it happened, water went over the top and around the ends of the weir during the highest tides, interfering with good operation. The weir was in operation from 26 July to 13 October.

2. Workability

The weir was about 20 feet long, $2/3$ of which was constructed with 6 foot pickets, the other third was completed with 4 foot lengths. Chicken wire was used on the top of this lower section to raise the



WEIR CONSTRUCTION
(L. Refuge Exp., Paul Chapoton)
(r. Biol. Aid, John Lutz)

SALMON
BULW
WEIR



TALLYING
(E. Clark)

the height somewhat. The wire was hard to clean, acting as a dam, and was knocked down by fish and seals during high tides. Better operation would have resulted had the weir been assembled entirely with 6 foot pickets, which could easily have been done if available.

Some trouble from fast high water due to heavy rains was encountered. Twice the gravel was washed away from the base of some of the wickets and once the water washed around the ends of the weir.

Between these various difficulties a large number of fish went upstream uncounted at the weir. An attempt was made to estimate the numbers by a rough count of fish in the stream above the weir early in the run.

3. Escapement

Since Sulua is a stream with several quiet sloughs, chum salmon were found in large numbers. From examination of the escapement tables it is seen that easily one-third as many chums were there as pinks. The total pink tally, 10,895, includes those roughly counted above the weir, but does not take in part of an estimated 1,000 or more, chiefly chums, that got by later. The tally of chums totaled 3,487 which figure does not include any of the 1,000. Silver salmon, Oncorhynchus kisutch, appeared in September and early October; the total reached only 199 although a few additional ones may have passed over the weir uncounted. Some of these could have been chums due to misidentification in poor light and murky water at times.

The escapement figure for all species was 14,581; another 1,000 (plus) estimated would bring the final figure well over 15,000. Pinks did not run heavily until nearly mid-August and diminished in early September. This period coincided with heavy rains. Chums were numerous from mid-August until September 20.

4. Return

Upon perusal of the tables concerning tally of fish carcasses at the weir it is noted that relatively few bear-taken remains appear. The term bear-taken is being used rather than bear-killed because numbers of salmon taken by bear, especially in the latter part of the season, are known to be dead. The writer has seen them paw out dead ones and has found newly taken fish in a deteriorated condition with few or no live fish in the stream.

The weir caught the remains of nearly all fish drifting downstream, although at least 50 pinks and several chums were known to have gone over the weir during heavy rains and high tides. The results of the return tally follow:

	<u>Pinks</u>	<u>Chums</u>
Total Return	4840	1159
Number bear-taken	87	13
% bear-taken	1.75	1.12
No. unspawned bear-taken	35	4



**UNSPAWNED
HEAD-TAKEN SALMON**
Skin and cranial
portion eaten.

**UNSPAWNED
HEAD-TAKEN
SALMON REMAINS**

Gonads, stomach and
lower portion of
skull uneaten.



**PINK CARCASSES
AT WEIR**
(externally similar)
Top 2 - unspawned
Next to bottom - 1/2 spawned
Bottom - spawned

	Pinks	Chums
% Unspawned bear-taken	0.72	.34
No. unspawned natural death	537	125
% Unspawned natural death	11.01	10.78

The unspawned salmon, i.e. salmon with firm gonads and considerable thick milt proved to be numerous among those that died naturally. Of these, unspawned males appeared about four times as frequently as females among the pinks and over seven times as often among the chums. Many of the fish had been visited by the gulls and after the eyes were gouged out a hole was pecked posterior to the pectoral fin and the eggs of the females eaten; then the internal organs taken, although often the stomach was excluded as were the gonads of the male. Such fish, wherein the spawning condition could not be ascertained, were placed in the "unknown" category, under "natural death".

B. SURVEYS

1. Sulua Creek

Since the weir caught few bear-taken remains, many trips were made to the upper stream. Dead fish were tallied both in the stream and on the banks; "stranded" or "washouts" found on low gravel bars after high waters subsided were placed in the "stream" category. Sloughs were also checked and data kept separate from that of the main stream (see Tables III,VI) As the spawning season



"STRANDEES" ON UPPER STREAM



CARCASSES AT WEIR

approached the close there were many fish left in the upper reaches due to low water, heavy natural dieoff and disturbance of carcasses by gulls. During this period there was much greater bear activity than earlier in the season. Of course there is less chance of bear taking unspawned salmon at this time, but greater likelihood of pawing out dead ones. If a certain percentage of these dead fish are unspawned, as the data above show, the bear will be charged with unspawned fish which they did not kill, or if killed the fish might have died unspawned naturally. It would seem that this could be also a possibility with species of salmon other than pinks and chums. After October first nearly all fish carcasses, not too old or too dry, on gravel bars and in the stream, had been investigated by bear up to October 15 when the writer left the area. Many of these were little eaten but usually showed some bear damage.

A glance at the tables for stream and slough counts indicates that approximately the same number of pink remains were checked in the upper stretches as at the weir, whereas nearly twice as many chums were recorded against the weir tally. The higher percentage of chums is due to the fact that most spawned in shallow sloughs with little chance of drifting back to the weir. Bank remnant tallies approached the thousand mark in both species. Following are the results of the stream, slough and bank counts:

	<u>Pinks</u>			<u>Chums</u>		
	Totals	Unsp.B-T*	%Unsp.B-T*	Totals	Unsp.B-T*	%Unsp.B-T*
Stream			:			
Above weir	4790	7	.14	1652	14	.85
			:			

TABLE 1

WEIR RECORDS - 1951

<u>DATE</u>	<u>PINKS</u>	<u>CHUMS</u>	<u>SILVERS</u>	<u>COMMENTS</u>
AUG. 5	4	9		
6	3	16		
7		1		
8				
9				
10				
11				
12	659*	24*		*Counted above damaged weir.
13	140	4		
14	1284	35		
15	738	16		
16	506	4		
17	1127 plus 2500**	10 plus 275**		**Estimate of those over weir due to seals; also high tides.
18	349	13		
19	82	15		
20	58	16		
21	595	20		
22	949	25		
23	75	68		
24	1	2		
25		1		
26	3	24		
27	4	14		
28	3	9		
29	50***	50***		***Estimate - damaged weir
30	80	80		
31	54	62		
Sept. 1	706	651	27	
2	16	50	2	Tally only - more fish went through hole in weir
3	712	551	9	
4	70	46	6	
5		20		
6	4	9	2	
7	19	88	10	
8	16	144	38	
9	12	42	7	
10	24	356	40	
11	1	19	1	
12	3	151	3	
13	29	103	8	A few possibly uncounted - hole in weir
14	6	22		
15	5	24	9	
16	4	18	4	

TABLE 1 -CONTINUED

<u>DATE</u>	<u>PINKS</u>	<u>CHUMS</u>	<u>SILVERS</u>	<u>COMMENTS</u>
Sept. 17		27	8	
18	2	37	6	
19	2*	50*		*Weir damaged - estimate.
20		4**	2**	**" " - actual
21				count.
22				
23				
24				
25		1		
26		5		
27		67	7	
28		34	6	
29		146	1	
30		22***	1***	***Weir damaged- actual
				count.
Oct. 1				A few fish over weir on
2				high tide.
3				
4				
5				
6		1		
7				
8				
9		1		
10		3	1	
11		2	1	
TOTAL	10,895	3487	199	GRAND TOTAL <u>14,581</u>

Weir removed on October 13.

Probably at least 1,000 fish went up the stream uncounted due to weir failures.

	<u>PINKS</u>			<u>CHUMS</u>		
	Totals	Unsp.B-T*	%Unsp B-T*	Totals	Unsp.B-T*	%Unsp.B-T*
Slough	68	1	1.47	510	13	2.55
Total	4858	8	.16	2162	27	1.24
Stream bank	904	65	7.19	581	28	4.82
Slough bank	19	0		308	3	.97
Total	923	65	7.04	889	31	3.49
Grand Total	5781	73	1.26	3051	58	1.90

* - Bear-taken

Upon comparing these figures with weir results it is seen that the percentage of unspawned bear-taken salmon ran higher above the weir, but not high enough to indicate abnormal damage by bear to the escapement. The greatest number of unspawned fish were present when there was little bear activity. This period coincided with the ripening of a bumper crop of elderberry, Sambucus racemosus pubens, which apparently attracted the bears more than the salmon. At that time little bear sign was noted along the creek but plenty on the lower slopes in the elderberry areas. If weir return and survey figures are combined the following results are obtained:

	<u>PINKS</u>		
	Totals	Unsp. B-T	% Unsp. B-T
Weir	4940	35	0.72

PINKS

	Totals	Unsp. B-T	%Unsp. B-T
Surveys	5781	73	1.26
Total	10,621	108	1.02

CHUMS

SILVERS

	Totals	Unsp. B-T	%Unsp. B-T	:	Totals	Unsp. B-T	%Unsp. B-T
Weir	1159	4	0.35	:	15	1	6.67
Surveys	3051	58	1.90	:	2		
Total	4210	62	1.47	:	17	1	5.88

GRAND TOTALS

Total all salmon.....	14,848
Unspawned B-T.....	171
%Unspawned B-T.....	1.15

The resulting unspawned bear-taken percentage is very low and shows that bears of Sulua Creek area are but very slightly affecting the pink and chum runs. Applying the same unspawned figure to escapement estimate of pinks and chums of over 15,000 there would be a slight change downward. Upon comparing the escapement tally with return weir and survey counts the difference is small for the pinks, but much greater for the chums, as follows:

	<u>PINKS</u>	<u>CHUMS</u>	<u>SILVERS</u>	<u>TOTALS</u>
Driftback & Surveys	10,621	4,210	17	14,848
Approx. No live fish in creek Oct 15	5	80	75	15,008
Escapement	10,895	3,487	199	14,581

In attempting to account for every fish possible above the weir, the results are fairly satisfactory in spite of weir failures. As can be seen, the pink counts approximate each other but the chum differ considerably. In fact, the escapement figure (3,487) is less than the return and survey results.(4,210) The rough estimate of at least 1,000 fish uncounted due to weir difficulties accounts to some extent for the disparity.

2. Other Creeks

a. "Robber" Creek

The run here is short and earlier than at Sulua Creek; the stream itself is faster and averaging hardly 10 feet in width, especially when rains are light. Five trips were made to "Robber" Creek during which escapement estimates and bank surveys were made. The first visit was on August 9 when there was little bear activity and less than 500 fish in the stream, the last was on September 24 when there was only an occasional spawned-out dying female pink found. The escapement was estimated roughly at 2,000. In early August the creek mouth was robbed of more than 600 fish by poaching fishermen. These salmon were very essential to future runs as the spawning area was not fully utilized by any means.

The few chums were added to the pinks to arrive at an unspawned bear-take of 12.87% of those examined or 3.5% of the estimated 2,000 escapement.

b. Kaiugnak Creek

Kaiugnak Creek is similar to "Robber" but slightly larger.

The first trip to the stream was made on September 8 when the upper end was hastily surveyed to indicate salmon nearly to the foot of the falls, about $1\frac{1}{2}$ miles from its mouth. Even then the fish were practically through spawning for there were few gulls in the area. At the time of the visit some gulls were seen flying from Kaiugnak to Sulua drainage.

One other trip was made to Kaiugnak on September 14 when the stream was traversed from the mouth to the end of the spawning stretch. There was only an occasional live fish to be seen; and only a few gulls at its mouth. Even the bear-taken remnants on the banks appeared much deteriorated. The mouth of the stream was littered with fish heads, etc. Since the stream is fast most material washed down to the lagoon. Bear trails and feeding spots were numerous but no bear were seen. Apparently most of the animals had returned to the elderberry thickets or had left the valley for more heavily fish populated streams. The bear trail from Kaiugnak to Sulua Creek drainage showed heavy travel prior to the visit of September 8. Between that time and September 14 hardly a fresh track had been made.

A rough count of remnants found chiefly on the banks indicated 61 male and 91 female, total 152 positive bear-taken pinks of unknown spawning condition in the creek proper. A slough near the mouth showed 59 male and 25 female chums, total 84, taken by bear. If the number of pinks and chums, 236, is applied to a 10,000 escapement figure (writer's estimate) 2.36% salmon were bear-taken, a conservative result. Roy Lindsley, Fisheries Enforcement Agent,

estimates that an escapement of 15,000 fish would adequately seed the spawning area. McFarland, superintendent of Libby's Cannery at Moser Bay, on several flights estimated 8,000 or 9,000 fish.

If another pink salmon study is contemplated in the future, Kaiugnak Creek would apparently be a good site in 1953, '55 etc. A small weir could be easily constructed and checked for the short time needed. There seemed to be little snagging in the upper stretches. Except for hank remains probably nearly everything would be washed back to the weir. Bear are numerous and due to the early escapement would probably be found fishing in the first part of the run, since the elderberries would hardly have ripened. The unspawned percentage would possibly be higher than Sulua Creek but probably not excessive. There are fine observation points and the stream is not closed in by brush for long stretches.

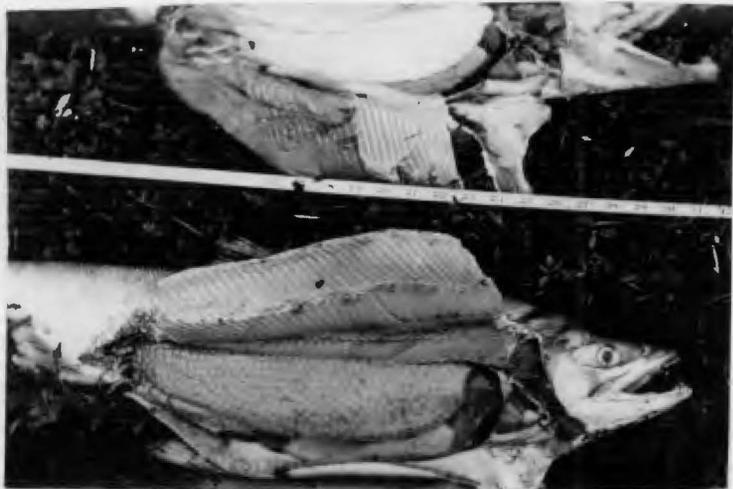
C. SALMON LOSS BELOW WEIR

1. Foundering

Few fish were noted at the extreme head of the Bay until the first heavy rains in August when the main run of pinks started up the creek. For two days 11 and 12 August, the total number of pinks found dead without marks on the flats was 380 (Table VIII) These were examined and marked to prevent double counting. No reason for their death could be ascertained, but most were found where there was little or no water when the tides lowered. It is also possible that the fish

**FOUNDERED
UNSPAWNED
SALMON**

**Above, Male Chum
Below, Female Pink**



**FOUNDERED
UNSPAWNED
SILVERS**

**Above, Male
Below, Female**

**FOUNDERED
FEMALE
PINKS**

**Lower carcass
shows gull damage.
(Condition approximately
2 hrs. after death.)**



had not become adjusted to the fresh water and could not survive in the excessive flood waters. Seals may also have kept the salmon agitated and further up the head of the bay than normally. On the 13th and 14th of August the dead dropped to 37. Surprisingly on the 13th, few more than 20 of previously marked specimens were found. Of course the presence of over 500 gulls in the area accounted for the lesser number of remains. It takes but a short time for gulls to reduce a fresh salmon carcass to only backbone, skin and jaws (see photo). Through observation the writer noted that seals might occasionally pick up some fresh carcasses but usually desire live fish.

By early September the number of foundered pinks reached a total of 470 known unspawned. This represents 3.92% of the total weir escapement plus known losses below the weir (10,895 plus 1,091 equals 11,986). Of much less importance, small numbers of foundered chums, silvers and reds O. nerka, (see Tables) were checked also. The chums were 15 in number, all unspawned which meant only .34% of the total return, plus those accounted for below the weir.

No reds were counted through the weir; the few found, 4, were unspawned but appeared to be in poor condition.

The silvers found dead were only nine but the weir escapement and loss below the weir only totaled 235 for a loss of 3.83% unspawned.

2. Seals

Since the highest tides reached well over a half mile up the stream there was enough water for the seals to get up a considerable

distance. The seals were often observed directly in back of the weir and when 10 foot tides occurred a few were brave enough to go well above the weir. All data possible were collected and observations made to measure losses of the ascending fish. As many as 15 seals were observed in the Creek at one time, so there could be considerable damage done. Their feeding methods were destructive for they usually took only fresh unspawned salmon. Two types of attack were noted: rushing and sneaking. Nearly every successful seal had a struggle with other seals to retain its victim. Occasionally a seal would pick up fish remains, eggs, etc., but these were generally from fresh fish. One light-colored seal with few spots particularly investigated and ate parts of carcasses. It also caught live fish at times. It may have been a fairly old animal for it ate slowly, almost with difficulty and spent most of its non-swimming time on its back. Only one other of the group, a dark one, spent any appreciable time on its back.

In the narrow channel it was fairly easy for a seal to pin its victim against the banks, but often the salmon would escape sudden destruction by leaping into sedge and grass to suffer a lingering death if unable to return to the stream as the tide lowered. Seals thus took their tolls in three ways, namely:

- 1 - Catching directly
- 2 - Causing stranding
- 3 - Injuring

Figures show that these activities were destructive, although most data were found on spawning condition of stranded victims because

carcasses were complete, whereas those caught and eaten often consisted of little more than part of the head (see photo). Nearly all stranded fish were unspawned; the caught fish must have been also, for they were fresh from the Bay. This represents a total loss to the escapement since fish spawned in the tidal area below the weir only rarely, when the tides were too low for seal ascension.

After the middle of September seals were active above the weir. In part this was due to fewer fish below but also to high tides, rain and the unsuitable weir. Many of the seals victims' remains were caught on the barrier while a few more were left in the stream and small sloughs above. These included the following:

	<u>PINKS</u>			<u>CHUMS</u>			<u>SILVERS</u>		
	Spawned	Unsp.	Unknw	Sp.	Unsp.	Unkwn.	Sp.	Unsp.	Unkwn
Weir	16	6	73	1	18	16		1	4
Above weir	<u>3</u>	<u>9</u>	<u>1</u>	<u>1</u>	<u>5</u>	<u>3</u>		-	-
Totals	19	15	74	2	23	19		1	4

Since the return figures seem closer to the true escapement than the weir tallys, they are used in the following computations. Also the loss below the weir and the fish still alive above are added to arrive at the final totals of ascending fish. Seals have had a chance at all these fish, therefor these totals should be used rather than simple return results.

SEAL-CAUSED DEATHS

(Tables II, V, VIII and IX)

	<u>PINKS</u>		<u>CHUMS</u>		<u>SILVERS</u>	
	No.	%	No.	%	No.	%
Totals	11,717		4,402		128	
<u>No. Unsp.</u>						
Below weir	321	2.74	91	2.05	26	20.31
Above weir	<u>15</u>	<u>0.13</u>	<u>23</u>	<u>0.51</u>	<u>1</u>	<u>0.78</u>
Totals	336	2.87	114	2.56	27	21.09
<u>No. Unkwn</u>						
Below weir	201	1.72	4	0.09	1	0.78
Above weir	<u>74</u>	<u>0.63</u>	<u>19</u>	<u>0.43</u>	<u>4</u>	<u>3.13</u>
Totals	275	2.35	23	0.52	5	3.91
TOTAL	611	5.22	137	3.08	32	25.00

Seals definitely are known to have raided the ascending fish of at least 2.87% unspawned pinks and 2.56% unspawned chums. The actual percentage taken is probably higher, since most of the "unknown" category were probably unspawned also.

Another figure that increases the true ratio of unspawned seal kills even more so are the number of salmon seen being caught and eaten by seals and the fact that during the first half of August, 23 unspawned and 3 "unknown" pink "deaths" were attributed to natural



CONDITION OF WEIR
AS TIDE LOWERS
Seal visible at left.



SEAL ACTIVITY BEHIND WEIR

SEAL
GOING OVER
WEIR



reasons. From later observation it would seem that many of these were caused by seals. Returning to the observed seal kills; the writer attempted to note the number of fish actually seen caught and eaten by seals during the spring tides. In most instances, the species and sex of the salmon could not be definitely identified. The few fish that were identified indicated a preference for unspawned female pinks when there was much choice. Pinks generally seemed more attractive than chums when both species were available. From Table II a,b, the seal killed remains at the weir further indicate the preferences of the seals as follows:

	<u>PINKS</u>			:	<u>CHUMS</u>		
	Male	Female	TOTAL		Male	Female	TOTAL
Spawned	5	11	16	:		1	1
Unspawned	3	3	6	:	5	13	18
Unknown	<u>17</u>	<u>56</u>	<u>73</u>	:	<u>4</u>	<u>12</u>	<u>16</u>
TOTALS	25	70	95	:	9	26	35

As can be seen the females far outnumber males, while pinks overshadow chums. There are more unspawned chums than spawned but the pinks show less for unspawned. The chief reason is that these are above-the-weir fish and taken quite late in the pink's spawning period (after mid-September) the ratio of unspawned to spawned is lower. Also as with the bear, seals rarely pass up the eggs, thus throwing many fish into the "unknown" column. The gonads of male salmon were little noticed among remains either. In most instances, there is little more than the

head left, after the seals finish fighting over a victim (see photo)

Below the weir the records (Table IX a,b) show a somewhat different picture; although the end results are similar here is not such a noticeable difference in preference.

From Table VIII, IX it will be seen that seal-caused deaths ran:

PINKS

	Male	Female	Sex also Unknown	TOTAL
Spawned	1	3		4
Unspawned	183	138		321
Unknown	<u>76</u>	<u>149</u>	<u>3</u>	<u>228</u>
TOTALS	260	290	3	553

CHUMS

SILVERS

	Male	Female	TOTAL	:	Male	Female	TOTAL
Spawned		1	1	:			
Unspawned	75	16	91	:	12	14	26
Unknown	<u>2</u>	<u>2</u>	<u>4</u>	:	<u>1</u>	<u>—</u>	<u>1</u>
TOTALS	77	19	96	:	13	14	27

For the three species, unspawned fish were much more numerous than spawned, 438 to 5, also greater than unknown 438 to 233. Since there were so many stranded specimens (over 65%) included in the above findings, seal preference is hard to ascertain in this instance. The large number of unspawned male chums in comparison to unspawned females is partly understandable; when the weir returns of Table II are checked



DEAD UNSPANDED
PINK SALMON
Apparently driven into
slough by seals.

STRANDED UNSPANDED
PINK SALMON
IN SEDGE
apparently seal - caused



SEAL - KILLED
PINK SALMON
REMAINS,
showing chewed
appearance and tooth marks

it is seen that males outnumbered females dying naturally, 646 to 296. If the sex ratio is anywhere near equal when the fish come into the bays the females may be caught by attacking seals in preference to males. The chums seem to move upstream more stragglingly than pinks and would suffer more from seals percentagewise.

During August few seals were seen in action but fish remains counted in the stream and on its banks were recorded (Table IX). In September with fewer fish in the stream there was a better chance to watch the activity of the seals at the weir. In mid-August the bottoms of some of the deeper pools of the lower stream were literally covered with torn fish carcasses. When the main run moved farther upstream destruction was not as noticable. The weir acted as a barrier, somewhat but when hard pressed, salmon could go over it or around one end during high tide. It was also a barrier to the seals at first and prevented some destruction above the weir. However, they gradually became familiar with it and went around or over.

Results of sight "seal-kills" are given below:

<u>PERIOD</u>	<u>NUMBER KILLED</u>
September 4 - 9	37
September 15 - 18	33
September 30 - October 1	<u>6</u>
TOTAL	76

3. Bear

Since there was little bear activity below the weir throughout the study period little damage was done to ascending fish. In fact, of 15 bank pink remains and one chum located, 11 were unspawned. These fish were taken before mid-August. No bear were observed fishing below the weir after that. The 15 fish were taken on 4 visits of apparently lone bears. Three fish were consumed on one visit, 4 each on the others. In most cases the fish were almost completely devoured.

The little bear sign seen later indicated that they were feeding on "weir" carcasses and also on "strandeers" caused by seals. This was definitely proven in most instances, for stranded specimens were marked to prevent duplication.

4. Bear-vs-Seal Losses

After high tides sometimes, fish remains were found on gravel bars and banks; the causative agent might have been either bear or seal. Upon familiarity with remains it was quite easy to differentiate. Heads of seal-killed fish were usually well chewed and showed lacerations of the seals' cutting sawlike teeth (see photos). Usually heads of bear-taken fish showed few cuts and often had a piece bitten from the cranial area. (See photos). Most mangled remains found in pools and on the bottom were blamed on seals. The tidal area was generally too deep for bear fishing success.

In obtaining totals by which to compare bear-take with seal-kill, all the fish checked plus the sight seal kills were used. This

probably is not entirely fair, for the bear do not have such a chance at the fish in the lower stream due to tides and deeper water. Of course any fish the seals take on the way up are not available to bear on the upper stream. This number is not excessive but might be kept in mind. A comparison of the bear and seal depredations follows:

	UNSPAWNED		CHECKED		TOTALS
	Bear-take	%	Seal-take	%	
Pinks	119	1.02	336	2.87	11,717
Chums	62	1.39	114	2.57	4,402
Silvers	<u>1</u>	.78	<u>27</u>	21.10	<u>128</u>
	182		477		16,247
					Sight seal-kill.....76
					TOTAL FISH CHECKED, ALL SPECIES 16,323
					% UNSPAWNED " " " "
					Bear-take 1.11
					Seal-take 2.92

The figure unspawned bear-take, 1.11% is but little less than the figure for all salmon checked at the weir and above, 1.15%.

D. BEAR OBSERVATIONS

1. Numbers

In the Sulua drainage the greatest number of bear seen on one day and known to be different individuals was 7. At least three

others inhabited the area and were seen at various times. These were distinguished by size and also by their tracks; using the measurement of distance across the palm and diameter of scats as a basis of differentiation. Of the seven seen at one time there were really only three units of the bear population because there was one female with three cubs, one with one cub and a single. There is a possibility that in using units rather than individuals better results in determining the number of bear might be obtained. A constant would be needed, approximately 2; probably a little more if unseen bear are included.

A total of 29 observations was made, which of course included several duplications. Bear were seen more often in the last of July and from mid-September to mid-October. Only two observations were made during August in the period of heavy fruiting of elderberry.

The female and three cubs were seen and definitely identified six times, the female and single cub five times. Since these two units were unmistakable due to size, color, actions, location etc. of individuals, there was no chance of calling them additional units.

If the other units of single individuals were seen as often there would be nearly four more bear to complete the observed population of Sulua Creek. Since some of the singles are the older more wary males which were least seen, then the population of the drainage can be reckoned at 10 minimum on the basis of observations alone. Additional support is given this figure from different palm and scat-diameter measurements when the makers were not seen. Using the unit-

constant method at least ($5\frac{1}{2} \times 2$) or 11 bear are found to inhabit the valley. In addition to the 10 fairly permanent residents, judging from travel on trails into Kaiugnak and "Cottonwood" drainages, there must be at least another half dozen that spend part of the summer in the Sulua area. Nearby "Robber" Creek is so close and easy to reach that there is probably considerable movement back and forth.

2. Movements

It is the writer's opinion at present, that females, unless unduly molested by man will stay in the same drainage most of their lives; although they probably visit nearby drainages at some periods. During the two years in which they usually retain their cubs they seem to move about chiefly in one drainage. The cubs probably leave their mother at the end of two years or the beginning of the third. Of course if there is a definite food shortage in the home drainage at any time, migration to a more fruitful area would take place.

Generally, males seem to move about considerably, especially during the breeding season in early summer. On high saddles and alpine ridges the writer found tracks and scats of the largest bears. Usually from these points, any of the several drainages could be easily visited. In summer 1950 the writer watched a bear move across a three mile saddle from Uganik to Terror Bay drainage in little more than an hour. The mouths of the entering streams were about seven miles apart. No evidence was found by the writer that the bears move very long distances. Probably an area of 25 miles radius would encompass the

territory used by a Kodiak bear in its lifetime unless driven out by man or his activities. Marking of individuals probably will be the best way of obtaining data of this sort.

3. Cover

The author believes that any drainage containing sufficient food during the summer months will hold the bear population to that area. Of course, cover is important but seems to be sufficient over most of the island. There are no spruce on southern Kodiak, but 15-20 foot high dense alder thickets are everywhere, from nearly sea level to an altitude of 700 feet at least. When bear disappear into these their movements are practically impossible to follow, especially when there is also any wind stirring the alders. Their trail can be easily followed later, but at the time it is probably somewhat dangerous. In early October when the trees lose their leaves bear can be observed within the thickets much better. This is also true in spring and early summer, before new leaves appear.

By following bear trails into thickets, the writer observed that bear had made beds anywhere from 50 to 600 feet or more from the lower border. Usually the spot chosen was in the thickest growth in the immediate vicinity. In many cases a well-beaten trail led into a thicket then ran out near the bedding areas. Apparently some areas were used a great deal when plenty of fish and elderberries, Sambucus racemosus pubens, are nearby. Other bear beds seemed little used, maybe once in two weeks or more as feeding locations were changed.

Near the creek, bear beds are hollowed on open gravel areas and used temporarily, especially after a heavy fish meal. From the ground a bedded-down bear is difficult to discern. In 1950 the author was about 20 feet from a bear resting under heavy spruce before a slight movement indicated its location, even though the general position was known. Large bears make a bed approximately 3 feet in diameter and a foot or more in depth (see photo), into which they settle their posterior portions. Their head and shoulders rest on the edge and thus there is presented a smaller mass than were the whole body lying on a flat surface.

4. Food

Before elderberries and fish were available early in the summer, bear seemed to feed considerably on the upper slopes and even well into the alpine areas as fresh vegetation appeared. Here, from sight observations and grazing signs, the following foods were found to be much eaten: (Plant identification after J.P. Anderson "Flora of Alaska and Adjacent Canada")

Seas Coast Angelica	<u>Angelica lucida</u>
Sedges, chiefly	<u>Carex mertensii</u>
Horsetails, chiefly	<u>Equisetum arvense</u>
Lupine	<u>Lupinus nookatensis</u>

Grasses, Graminae, seemed to be grazed only sparingly or incidental to the taking of sedges and horsetails. Angelica and sedge were the favored foods and probably constitute the major portion of

early summer foods. Contents of bumble bee nests also were relished at this time; no mouse nests were seen destroyed.

As elderberries ripened in early August at low elevations, bear trails and browsing signs were numerous at the elderberry bushes. At the same time other berries were beginning to ripen and were eaten along with fish. Some green material, sedge and angelica, was still taken but not often. The switch from vegetation to berries and fish was practically complete.

Foods noted taken by bear until heavy frosts of early October include the following:

FRUITS

Elderberry

Devils Club

Echinopanax horridum

Twisted Stalk

Streptopus amplexifolius

Salmonberry

Rubus spectabilis

Crowberry

Empetrum nigrum

FLOWERS

Water Hemlock

Cicuta douglasii

SALMON

Pink, chum and silver.

Some sedges, chiefly Carex lyngbei cryptocarpa of tidal areas and the basal leaves of a grass, Meadow Barley, Hordeum brachyantherum,



BEAR FOOD

Angelica lucida



CROWBERRY

Empetrum nigrum



BEAR - BED

also Equisetums (E. arvense)etc., were also grazed.

As frosts caused elderberry fruits and others to drop off and few live fish were found in the stream, bears still ate fruit stems, chiefly elderberry, to some extent and stripped skin from fish carcasses but ate less fish flesh.

Most feeding observations were made at dusk. When bear were seen during the day, they seemed to be moving to new areas with little feeding on the way. Apparently these mammals prefer darkness for their food-gathering activities even though unmolested. Although several early morning hikes were taken no bear were seen. On October 13 and 14, both clear nights with a full moon, the writer, using binoculars, observed bear feeding well after dark. In fact on the 14th the entire night, except for short naps, was spent in observation. A total of seven bear were observed but only three units as previously mentioned. Live chums and spawned-out carcasses were taken; very little vegetative feeding was noted. On this night bear were active from 4:30 p.m. until 5:30 a.m. when the eastern sky lightened.

Besides the unknown amount of carcass skin and flesh, minor because of sub-freezing temperatures, a total of 35 live chums were caught at a shallow spawning pool. Since 6 of the bear were seen to fish here, an average of slightly less than 6 fish per animal were taken.

Since the fish averaged at least five pounds, and considering a total of four fish entirely consumed, then 20 pounds of fish were taken by bear.

Early in the spawning season where fishing was apparently done by a single individual three to five fish were caught per night. Probably since berries were plentiful this lesser amount was sufficient, also in October the bear were preparing for the lean winter months. No signs of hibernating were noted by mid-October.

Bears caught fish by rushing in the water and pinning the fish down with the claws of the front paw, then transferring them to the mouth. The victims were usually carried to a bank or gravel bar to be eaten.

Grazing of sedge was done in a manner similar to cattle, but browsing of high shrubs was accompanied by use of the paws in bringing berry-laden branches to the mouth. Bears often stood on their hind legs and broke down the upper branches. Where food was at convenient heights e.g. low elderberries, the fruit was eaten by engulfing in the mouth while walking, or with only a slight hesitation.

As far as this observer could ascertain, weather seemed to be a minor factor in affecting feeding activities. Probably the lowering intensity of light is the main indicator of feeding times.

E. SCAT EXAMINATIONS

1. Appearance

Considerable data on food habits were obtained from qualitative examinations of bear droppings. Early in the season when

considerable vegetation was consumed by the bears, scats resembled horse dung. With a berry-fish diet there was a similiarity to cow manure. By mid-October when much roughage was consumed (fish boges, plant stalks, elderberry fruit stems, etc.) the appearance was more like that of early summer samples.

2. Component Identification

Several of the components of the droppings had distinctive odors so that with some experience they could be identified definitely by smell in conjunction with physical characteristics. For instance - light brown material with a dead fish odor and with or without fish bones was definitely fish - sedge, angelica and elderberry debris each had characteristic odors. By tasting the growing plants and berries the similiarity to scat odors was readily apparent. Identification of seeds, plant parts, fish bones, etc. gave positive proof of foods taken. Cestode segments were fairly common in the later samples. Occasionally a nematode also occurred. Apparently the large amount of roughage dislodged the parasites which probably enjoyed a luxurious and prolific life when berries and fish flesh were the main diet.

3. Qualitative Analysis

As table X indicates, elderberry far outstripped all other foods in rate of appearance - 210 of the total 278 scats. Devils Club , fish and sedges appeared 83, 75 and 53 times respectively. Other items appeared but 23 times or less. Only 4 foods were found to make up the entire bulk of a scat - elderberry (67) sedge (17)

TABLE X

APPEARANCE OF FOODS IN 278 BEAR SCATS, SULUA CREEK DRAINAGE AND VICINITY, (JULY 23 TO OCTOBER 15, 1951)

Percentages of Appearance -- T-100%; D- dominant (50 -100%); S- subdominant (below 50%)

	July 23 - 31			Aug. 1-31			Sept. 1-30			Oct. 1-15			TOTALS		
	T	D	S	T	D	S	T	D	S	T	D	S	T	D	S
<u>SEDGES</u> <u>Carex spp.</u>	5	15	6	12	5	3		2	2			3	17	22	14 = 53
<u>ANGELICA</u> <u>Angelica lucida</u>		2	6		3	6		1	1					6	13 = 19
<u>GRASSES</u> <u>Graminae</u>		1	11			3						6		1	20 = 21
<u>DEVILS CLUB</u> <u>Echinopanax horridum</u>					1	12		11	42		3	14		15	68 = 83
<u>HORSETAILS</u> <u>Equisetum spp.</u>	5	3	3	2	4		1	2					5	6	9 = 20
<u>ELDERBERRY</u> <u>Sambucus racemosa</u>				12	13	4	52	68	24	3	17	17	67	98	45 = 210

TABLE X (CONT'D)

APPEARANCE OF FOODS IN 278 BEAR SCATS, SULUA CREEK DRAINAGE AND VICINITY, (JULY 23 TO OCTOBER 15, 1951)

Percentages of Appearance - - T-100%; D-dominant (50-100%; S-subdominant (below 50%)

	July 23-31			Aug. 1-31			Sept. 1-30			Oct. 1-15			TOTALS			
	T	D	S	T	D	S	T	D	S	T	D	S	T	D	S	
TWISTED STALK <u>Streptopus amplexifolius</u>					1	2			19			1			22	-23
CROWBERRY <u>Empetrum nigrum</u>						3			15							18 -18
LUPINE <u>Lupinus nootkatensis</u>		2	3		1	4			1					3	8	-11
SALMONBERRY <u>Rubus spectabilis</u>						2										2 -2
BLUEBERRY <u>Vaccinium ovalifolium</u>									1							1 -1
SALMON <u>Oncorhynchus</u>						11		8	28	10	15	3	10	23	42	-75
TOTAL NUMBER OF SCATS						34			52						145	
																47
																278

-32a-

fish (16) and horsetail (5); elderberry again far outstripped the others. Devils Club, although the plant was not too common in the area, was often a companion component with elderberry. It grew among the alders.

Droppings left by cubs usually contained the same foods found in those of their mother, but a few contained more variety and others were 100% Equisetum. The latter in early stages is a tender plant and probably much relished and easy to obtain by the little fellows.

F. ADDITIONAL DATA

1. Stream Temperature

There appeared to be little daily variation in water temperature, due partly to continuous cool cloudy weather. At first, temperatures were taken at different hours but when no variation was apparent only one daily reading was made. All readings were Centigrade. On the first day, July 23rd, the stream temperature was 9°; on the last day October 13th 7.5°. The lowest recorded was 6° on September 30th; the highest 15.5° on August 26th. From the first of August until September 19 the temperature varied only three points, from 12° to 14°, except for the one high on August 26th. This period coincided with the upstream movement and spawning of the greatest

number of pinks and chums. Usually more fish were tallied through the weir in the afternoon than at other times.

2. Salmon Measurements

From measurements and weights taken of individual fish, not tagged, it was found that roughly one pound was lost by males and one and a half pounds by females during the spawning process. This refers to normal size pinks; similar chums lost slightly more.

3. Collection of Plants and Seeds

Some plants and seeds were collected to aid in identification of bear foods. Most specimens were already present in the collection at the Kodiak office.

IV. SUMMARY AND CONCLUSIONS

1. Due to weir failure an accurate escapement figure was not obtained. The total was 14,581 for all salmon while "returns" at the weir plus upstream surveys totalled 15,008. Pinks made up approximately 2/3 of the salmon checked.

2. From examination of "driftbacks" at the weir the percentage of "natural death" unspawned pinks was 11.08 and chums 10.79 of the respective returns.

3. Since bears were found to take no more than 1.15% unspawned pinks and chums in the Sulua Creek drainage it is apparent that they did little damage to the escapement.

4. One reason for so little damage was the occurrence of a bumper crop of elderberries at the time of heaviest spawning. Bears seemed to prefer the berries to fresh fish.

5. Losses on nearby "Robber" Creek of unspawned salmon to bear were 3.5% of an estimated 2,000 escapement, chiefly pinks.

6. A rough survey of Kaiugnak Creek indicates that there is an earlier run with possibly slightly more bear damage, chiefly because the elderberry crop is not as mature. If further pink salmon-bear studies are contemplated this creek should be considered for an easy and fast operation.

7. Salmon loss below the weir was due primarily to foundering and seals. There was very little bear activity. Unspawned pink loss through foundering was 3.92%. Seals raided ascending pinks of 2.83% and chums 2.50% unspawned individuals. Nearly all seal victims were unspawned salmon just leaving salt water.

8. Seals caused deaths of salmon in three ways: catching directly, causing stranding in sedge, etc., and injury.

9. Sight seal kills from September 4 to October¹ were 76.

10. Unspawned bear-take for all salmon was 1.11% and seal-take 2.92%

11. The minimum number of bear, from direct observation, in the Sulua Creek drainage was reckoned at ten. Another six probably visited the area at some time during the study.

12. It is the writers belief that unless molested, female bear tend to remain in one drainage much of their lifetime while males, especially in early summer during breeding season do much more roaming. Even they probably do not cover an area 25 miles in radius. Marking experiments are definitely needed for accurate information.

13. Bear enjoyed ample cover in the alder thickets not far from the creek. Their beds were located from 50 to 600 feet within. The size was approximately 3 feet in diameter and 1 foot in depth.

14. Elderberry was the most important food of bears during the pink and chum spawning period. Spawned fish and carcasses were important after frosts occurred. Twisted stalk appeared frequently but not in large amounts. Sedges and horsetails were important prior to the ripening of berries. Grass appeared but little, even early; it seemed to be incidental in many cases. Devils Club appeared often.

15. Stream temperatures taken daily varied little. Seasonal high temperatures 12 - 14° Centigrade coincided with upstream movement

of the main run.

16. Roughly male salmon lost one pound during spawning, females lost one and a half pounds.

To sum up, bears of Sulua Creek did negligible damage to the pink - chum run there in 1951.

Kodiak, Alaska; November 22, 1951. Webster K. Clark.

BEAR-SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek

Species of Salmon O. gorbuscha

Location of Stream Sulus Bay, Kodiak Island

Portion of Stream Driftback at weir

Investigator W.K. Clark

1951 DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS	
	spawned		Unspawned		Unknown		Sex also un- known	Spawned		Unspawned		Unknown		Sex also un- known	Spawned		Unspawned		Unknown		Sex also un- known		
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F			
Aug. 19				1																			1
20				1																	1		2
21			1	2																1	1		5
22			3	2									1							3			9
23				1																			1
24			2							1													3
25				2													1						3
26		1		2																			3
27																							0
28			1																				1
29			2	2																	1	1	6
30	1									3							1						5
31			1																				1
Sept. 1			1	1						1													2
2	4	1	1	1				1		1				1									10
3	3	2	2	1				1		7	2		2	1	1								25
4	4	1	2	2						1	3	2											15
5	10	2	2	2				1		1				2			1	1					22
6	4	1	4	5						3	3	1	1				1	1					61

*M - Male, F - Female

TABLE II a

BEAR-SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek

Species of Salmon O. gorbuscha

Location of Stream Sulus Bay, Kodiak Island

Portion of Stream Driftback at weir

Investigator W.K. Clark

1951 DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also un- known	Spawned		Unspawned		Unknown		Sex also un- known	Spawned		Unspawned		Unknown		Sex also un- known	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
Sept. 7	51	5	5	2					1		3	3						2				52
8	45	7	4	4				1	1	1	1	4	2									70
9	54	5	4	3								1				3				1		77
10	91	13	18	4					1			1	1								1	130
11	81	11	8	2				1		1											1	105
12	107	10	18	8		1																144
13	151	28	21	10	4	17		3		1		1				1						237
14	130	20	22	4						2	1											179
15	107	26	32	10								1										176
16	126	36	12	4	8	5										1 ^s	2 ^s	1 ^s	6 ^s	17 ^s		218
17	149	42	22	4	3	7									2 ^s	(1)3 ^s	1 ^s	1 ^s	9 ^s	25 ^s		269
18	179	37	27	1	6	11		1				2				4 ^s		1 ^s	1 ^s	(3)6 ^s		279
19	311	68	42	4	10	6		2	1												2 ^s	446
20	72	19	7	1	3	2																101
21	87	43	5	4	4	4						2			1					3	1	144
22	112	58	17		3	2														1	2	195
23	156	60	13	4	3	2														1	2	241
24	137	46	19	4	3	4															1	314

*M - Male, F - Female

• - seal kill

TABLE II a (Cont.)

SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek

Species of Salmon O. gorbuscha

Location of Stream Sulus Bay, Kodiak Island

Portion of Stream Driftback at weir

Investigator W. A. Clark

DATE	NATURAL DEATH							SEAL - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
1951																						
Sept. 25	117	58	15	1		6				1										1	189	
26	138	79	17	2	3	10		1				1									251	
27	107	40	16	3	1	4															171	
28	81	42	13			3															150	
29	53	27	10		3	4		1													98	
30	28	12	4	2	6	5															57	
Oct. 1	54	33	8		1	21													1 ^s	3 ^s	121	
2	38	30	9		1	7													1	2 ^s	88	
3	9	3	3			2								1 ^s							18	
4	22	11	6		2	12								2 ^s	3 ^s					3	61	
5	6	13	2		1	6													1		29	
6	12	7																			19	
7	6	5																			11	
8	18	18	2		2	6															46	
9	7	10				2															19	
10	6	8	4			1			1			1									21	
11	8	7	1		1	3															20	
12	1	3			2	4						1								1 ^s	12	
TOTAL	2900	948	431	105	70	157		13	4	25	10	20	11	4	2	1	8	4	11	19	1	

M - Male, F - Female Sub-Totals 4612

s - Seal Kills

87
Seal kills 5 11 3 3 17 56 46 474⁵
95

TABLE II a (Concl.)

GRAND TOTAL 4640

SALMON STUDY -- Tally Sheet

Name of Stream Sulua CreekSpecies of Salmon O. ketaLocation of Stream Sulua Bay, Kodiak IslandPortion of Stream Driftback to weirInvestigator W. S. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS	ki
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known		
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F			
1951 Sept. 10	25	11	2	3																		39	
11	18	10	1										1 ^{ki}						1			50	1
12	21	10											1 ^{ki}									31	1
13	57	38	5	3	6																	109	
14	20	8	2	1					2						1							34	
15	30	19	5	1 ^{ki}																		54	1
16	18	12	2																		5 ^s	37	
17	33	14	4																1 ^{ki}	5 ^s		57	2
18	32	22	5																			59	
19	40	27	5		5	3		1													1 ^s	82	
20	23	7	3	1					1													36	
21	22	6	5	1				2							1	1						38	
22	25	12	4		1										1							43	
23	21	7	5																			34	
24	4	7	8																			19	
25	18	5	9																			32	
26	33	12	4			1										2	2 ^s					54	
27	13	2	3	1																		19	
28	12	2	7																			21	

M - Male, F - Female

s - Seal Kill, ki - Silver salmon, O. kisutch

TABLE II b (Cont.)

SALMON STUDY -- Tally Sheet

Name of Stream Sulua Creek
 Location of Stream Sulua Bay, Kodiak Island
 Portion of Stream Driftback to weir

Species of Salmon O.keta
 Investigator W.K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS	ki		
	spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown				
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F				M	F
1951																									
Sept. 29	11	4				3																	18		
30	8	3	4			2											3 ^s						20		
Oct. 1	19	4	3			1											5 ^s						32		
2	10	2	5			1											4 ^s	1 ^s	ki				23	1	
3	2		2														1 ^s	2 ^s					8		
4	9	2	5																3 ^s	1 ^s			20		
5	11		2														1						14		
6	5	1														1 ^s			1				8		
7				2																			2		
8	4	2	1		1	2																	10		
9	6					1																	7		
10	8	1	1	1	1			1															13		
11	7	3	2		1							1								1			15		
12	3	1	1																2 ^s	ki			5		
Sub-																									
Totals	646	296	111	14	18	11		4		4		3	2			1	2	4	2	6					
							1096																15	1124	
														seal kills	1	1	5	13	4	12				35	
TOTALS																Grand total of chums								1159	

M - Male, F - Female
 ki.....1 2
 ki - Silver salmon, s - Seal kills
 (O. kisutch) 1 5

TABLE II b (Concl.)

1 10
 seal kills...1....4 5
 Grand total of silvers..... 15

BEAR SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek
 Location of Stream Sulus Bay, Kodiak, Island
 Portion of Stream Above weir

Species of Salmon O. gorbuscha
 Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
1951 Sept. 6								2	1			4	2			3				2		14
7								4	1			1										6
11												5										5
13	8		1		2			1		1					1					2		16
15	2	1			3	1																7
17	56	15	6		29	47		1	1	1		9	5		1				6	7		184
18	3				3	2																8
21	78	44	17	3	52	132		2	1	1		22	13		4	1	1		44	26		441
22	30	30	7		46	139		1		2		8	5		1	1			21	21		312
23	31	51	3		27	164													11	9		296
25	3	11			1	10						2	9									36
26	55	57	16	5	38	109			1			1	1									283
27	30	30	5		18	80													3			166
29	9	25	1	1	7	53		1	1			5	9							3		115
30	1	16			2	18		1	3			7	13									61
TOTAL	306	280	56	9	228	755		13	9	5		64	57		9	3	1		87	68		1950

*M - Male, F - Female Sub-total 1634

148

168 1950

TABLE III a

SR SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek

Species of Salmon O. gorbuscha

Location of Stream Sulus Creek, Kodiak Island

Portion of Stream Above weir

Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also un- known	Spawned		Unspawned		Unknown		Sex also un- known	Spawned		Unspawned		Unknown		Sex also un- known	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
1951 Oct. 2	65	46	12	4	36	165						1	1						2	1 ³		339
5	19	11			16	31		1				4	2						4	2		90
8	9	38			22	102		2				10	9		1	2			12	22		229
10	6	16	1		22	94		1	1	1		6	17			4			28	12		209
11	40	31	6	1	20	122						9	12						11	39		291
12	17	38			93	230		4	6	1		17	32			1			55	59	3	556
13	9	31			42	328		3	6			35	95		1	4			75	211		840
14	3	30			7	27		7	26			15	47						3	6		171
15				1	4	29			1			6	19						7	48		115
Subtotal	168	241	19	6	262	1128		18	40	2		102	234		2	11			197	401	3	
TOTALS					1824								396							620		2840
Grand TOTAL	474	521	75	15	490	1893		31	49	7		162	291		11	14	1		284	469	3	4790

*M - Male, F - Female

s - Seal kill

TABLE III a (Concl)

BEAR SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek
 Location of Stream Sulus Bay, Kodiak Island
 Portion of Stream Above weir

Species of Salmon O. keta
 Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
1961 Sept. 7								1														2
13	14	1	15		1	9																40
15	8	6	1		1	3				1		1										21
17	7	10	1		1	7		2		1		1							1	1		32
21	24	12	5		8	16		2		1		6	1			1		10	2			88
28	9	8	3		10	26		1		1		7	2		1	1		25	7			101
23	20	7	7		15	15						3						13	5			85
25	3	3				1			1	1		11	1									21
26	22	15	15		2	7		1		3		1										66
27	39	15	6		8	19				2		1								1		91
29	8	4			2	3		2	1			7	11				3	3				44
30	3	2	1					7	2	2		19	5				1	2				44
TOTAL	157	83	54		48	186		16	4	12		57	20		2	1	1		53	21		635

*M - Male, F - Female Sub-totals 448

109

78

635

TABLE III b

BEARSALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek
 Location of Stream Sulus Bay, Kodiak, Island
 Portion of Stream Above weir

Species of Salmon O. keta
 Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS	ki	
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known			
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F _s				
1951 Oct. 2	21	10	14	2	3	16					1		1			1		1 ^s		1	1 ²	1	76	
5	3	4			2	2		1					1				1			3			17	
8					3	1		1					4							4	4		17	
10	2	2			5	4							2			1				2	3		21	
11	4 ^{ki}	3			8	17							8	4		1			1	11	21		76	
12	36	13	10	1	54	51		1					22	6		2		2		77	36		313	1
13	20	7	4		7	17		2	2	1			68	18						100	58		304	
14	12	6	1			1		10					27	16						1	5		79	
15	2				1	3							30 ^{ki}	6						55	18		115	1
Sub-Totals	106	46	32	3	85	112		15	2	2			163	50		4	1	3	1	254	137	1	1017	
TOTALS							382															401		
SUB-GRAND TOTAL	263	129	86	3	131	218		31	6	14			220	70		6	2	4 ^{1s}	1	307	157 ^{2s}	1	1649 ^{3s}	

*M - Male, F - Female GRAND TOTALS 830

341

481 1652

ki - silver salmon, O. kisutch

TABLE III b (Concl.)

TOTAL SILVERS..... 2

W. K. CLARK STUDY -- Tally Sheet

Name of Stream Sulus Creek

Species of Salmon O. gorbuscha

Location of Stream Sulus Bay, Kodiak Island

Portion of Stream Sloughs above weir

Investigator W.K. Clark

DATE	NATURAL DEATH							SEAL - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS	
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known		
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F			
1951-16																						2	
Sept. 18	6	3						2						3								14	
20		1								1				2								4	
23															1							1	
25	1	1			3	4																8	
26														1			3 ^s	2 ^s				3	
29	1													1					1			3	
Oct. 1	3	1			1	5								4							1	15	
2	1	1						1	1								1 ^s				1 ^s	6	
9										3				1							4	8	
11						1																1	
Totals	12	7			4	10		3	4	1			11	5	1						1		
GRAND TOTAL							33							24			1 ^s	3 ^s	4 ^s		1 ^s	2	68

*M - Male, F - Female

s - seal kill

TABLE IV a.

BEAR SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek

Species of Salmon O. keta

Location of Stream Sulus Bay, Kodiak Island

Portion of Stream Bloughs above weir

Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also	Spawned		Unspawned		Unknown		Sex also	Spawned		Unspawned		Unknown		Sex also	
	M*	F*	M	F	M	F	un-known	M	F	M	F	M	F	un-known	M	F	M	F _{2s}	M	F _{1s}	un-known	
16																						3
Sept. 15	77	26	7	1		12		1					1					1 ^s		1		127
20			1					1	1	1	1	7	9									21
23	42	11	13		1			1		3		21	1		2					5		100
25	4			1																		5
29	22	10	12		2	3		3		3		8	2			1	1					67
Oct. 1	54	19	12		3	15		3		5		22	7		1		1		23	23		178
2	1							1														2
9												2	1							1		4
11													3									3
TOTAL	200	66	45	2	6	30		9	2	12	1	60	24		3	1/1 ^s	2	2 ^s	29	14	1 ^s	53

Grand Total 349

106

53

510

*M - Male, F - Female

s - Seal kill

TABLE IV b

SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek

Species of Salmon O. gorbuscha

Location of Stream Sulus Bay, Kodiak Island

Portion of Stream stream banks above weir

Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS	
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known		
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F			
1961 Aug-17				1									1	1									3
23										1			2	2									7
25								1		7			12	7									42
30								1	1	9			4	1									16
Sept. 1																						1	1
3	2	2						11	14	17	4	23	19			1							93
6	7	4	1	1				5	4	15	3	78	38	2	1					3			162
7	6		1					1	3	3		30	16								2		62
8											1	16	7										24
11								5		3		55	36	2									101
18												1	2										3
20	5	1	1		2	4		4				17	5							1			40
21									1				1							1			3
22										1					1								2
23												4			2sk		1-sk1-sk			2			10
25									2			2	8										12
TOTAL																							

*M - Male, F - Female

sk - seal kill

TABLE V a

THE SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek

Species of Salmon O. gorbuscha

Location of Stream Sulus Bay, Kodiak Island

Portion of Stream Stream banks above weir

Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS	
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known		
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F			
1951 Sept. 26																						5	
27																						1	
29								1	1					3	4							9	
30								3	3					4	10							20	
Oct. 5														2								2	
8								3	3					4	2							12	
10									1					1								2	
11									1													1	
12								7	15					25	32							79	
13								2	6					7	21							36	
14								2	6	1				28	60							97	
15														12	47							59	
TOTAL	20	7	3	2	2	4		46	61	57	6	333	322	22	2 ^{sk}	2 ¹	1	1 ^{sk}	1 ^{sk}	5	2	3	904

*M - Male, F - Female
sk - seal kill

Grand Total 58

849

17

904

TABLE V a (Concl)

I B - SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek
 Location of Stream Sulus Bay, Kodiak Island
 Portion of Stream Stream bank above weir

Species of Salmon O. keta

Investigator W. K. Clark

DATE	NATURAL DEATH							* BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
1961 Aug. 15								2														2
23										1												1
25										1		1										2
Sept. 1								1														1
6										1		4										5
7								2	2				15	8							1	28
8													19	5								24
11										2		5	9									17
16									4	1		1	3									9
20	1												1	1								3
21								1					1	1								3
22													2			1						3
23										2		25	5			1-sk	1-sk		2			36
25									2	1		9	7									19
29								1				7	4									12
30								7	5	8		75	7									102
TOTAL																						

*M - Male, F - Female

sk - seal kill

TABLE V b

BEAR-SALMON STUDY -- Tally Sheet

Name of Stream Suluu Creek

Species of Salmon O keta

Location of Stream Suluu Bay, Kodiak Island

Portion of Stream Stream banks above weir

Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
1951																						
Oct. 5								1	1	1			1									4
8								2		2			6									10
10								1														1
12									1	1			13	2								17
13								7	6	1			44	4								62
14								11		4			36	12								63
15								16	1	2			109	29								157
TOTAL	1							52	22	28			375	97	1	1	sk	1sk		2	1	581

*M - Male, F - Female Grand Total 1

574

6

581

sk - seal kill

TABLE V b (Concl.)

ERR - SALMON STUDY -- Tally Shee

Name of Stream Julius Creek
 Location of Stream Sulus Bay, Kodiak, Island
 Portion of Stream Slough banks above weir

Species of Salmon O. keta

Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
1951																						
Sept. 20		1								2		40	18									61
25								1				2	2									5
29												15	1									16
Oct. 1								4				12	6									22
9								2	3			68	20									93
9								1	1			54	5									61
11								1				1										2
11								2		1		6	2									11
13								10	3			20	4									37
TOTAL		1						21	7	3		218	58									308

*M - Male, F - Female Grand Total 1

307

308

TABLE VI b

BEAR-SALMON STUDY -- Tally Sheet

Name of Stream "Robber" Creek

Species of Salmon O. gorbuscha and keta

Location of Stream Sulus Bay Kodiak Island

Portion of Stream Spawning length (1 mile)

Investigator W.K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
<u>O. gorbuscha</u>																						
Aug. 9										1	1		1	2								
20								13	2	57	1	7	21	9								
27								4	1	4		15	1	3					10	3		
Sept. 10	13	4						6	8	1		25	9	3					3			
24		13					1 8	3	14			15	31		1				4	6		
TOTALS	13	17					1 8	26	25	63	2	62	63	17	1				17	9		324
Sept 10	196 fish remains, chiefly pinks, at tidewater. 40 of them possible bear taken or seal killed																				196	
<u>O. keta</u>																						
Aug. 9										1												
20										2	1		1	2								
27										1		1						2	4			
Sept. 10													8									
24												1										
TOTALS										4	1	10	1	2					2	4		24
TOTAL												70										544

*M - Male, F - Female

TABLE VII

~~Salmon~~ STUDY -- Tally Sheet

Name of Stream Sulus Creek

Species of Salmon O. gorbuscha

Location of Stream Sulus Bay, Kodiak Island

Portion of Stream Tide flats

Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS	
	spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown		
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F			
1951 AUG. 5																					1		1
8											1							2					3
9																		4		1			5
10																		1					1
11													4sk 4sk				21	28		3		52	
12													3sk 4sk	1			161	166				328	
13												1					15	7				21	
14																	5	11				16	
15																	4	5				9	
16												2sk 2sk					1	1				2	
22																	2	2				4	
23																		1			1	2	
24													4sk 3sk					1			1	2	
25																				1	4	5	
26																		3		1		4	
27																	1	2				3	
28																	5	3				8	
29																	2	1				3	
TOTAL																							

*M - Male, F - Female sk - Seal Kill

TABLE VIII a

BEAR-SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek
 Location of Stream Sulus Bay, Kodiak Island
 Portion of Stream Tide Flats

Species of Salmon O. gorbusca
 Investigator W. E. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN						TOTALS		
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown			Sex also un-known	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F			
1951 Aug. 30																							6
31																						sk	6
Sept. 2																							4
3													1										1
5																							1
12	2																						2
TOTAL	2												1	2								1	489

*M - Male, F - Female sk - Seal Kill

13 13 1 Total... Seal Kill

Grand Total

27
516

TABLE VIII a (Concl.)

BEAR-SALMON STUDY -- Tally Sheet

Name of Stream Sulus Creek

Species of Salmon O. keta

Location of Stream Sulus Bay, Kodiak Island

Portion of Stream Tide Flats

Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
1981																						
Aug. 8																						1
23																						1
25																						1
26																						1
27																						1
28																						2
Sept. 1																						4
2																						1
5																						2
Oct. 1																						1
TOTAL																						15

Grand Totals

15

15

*M - Male, F - Female

TABLE VIII b

BEAR SALMON STUDY -- Tally Sheet

Name of Stream Salua Creek

Species of Salmon As indicated below

Location of Stream Salua Bay, Kodiak Island

Portion of Stream Tide Flats

Investigator W. K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN							TOTALS			
	spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown				
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F					
1981																									
Aug. 11								Oncorhynchus nerka																	2
12																							1		
26																							1		
																							TOTALS		
																							4		
								Oncorhynchus kisutch																	
Aug. 31																							6		
Sept. 5																							2		
12																							1		
																							TOTALS		
																							9		
TOTAL																									

*M - Male, F - Female

TABLE VIII c

SALMON STUDY -- Tally Sheet

Name of Stream Sulna CreekSpecies of Salmon O. gorbuschaLocation of Stream Sulna Bay, Kodiak IslandPortion of Stream Tide flats to weirInvestigator W.K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH UNKNOWN SEALS							TOTALS
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
1951 Aug. 6			3				2															5
8			1	1																		2
11			6	2			2															10
12			2																			2
13			4				2	1														7
14			1				1	3								21	19				1	44
15			2	1					4	6			1			29	21	6	13			68
16																16	7	12	33			68
17																35	24					59
18																21	23	42	81			167
19																13	13	1	1			28
21																1						1
22																8	7					15
23																4	6					10
24																5	3					8
26																1						1
Sept. 1																3	2					5
2																1	1	1		7	1	11
TOTAL																						

*M - Male, F - Female

TABLE IX a

SALMON STUDY -- Tally Sheet

Name of Stream Salus Creek

Species of Salmon O. keta

Location of Stream Salus Bay, Kodiak Island

Portion of Stream Tide flats to weir

Investigator W.K. Clark

DATE	NATURAL DEATH							BEAR - TAKEN							CAUSE OF DEATH <u>Seal</u>							TOTALS
	spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	Spawned		Unspawned		Unknown		Sex also unknown	
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F		
Aug. 6										1												1
Sept. 1																	1					1
2																	2	2		1		5
3																	1	3				4
4															1		2					3
5																	1	1				2
6																	1					1
8																	2					2
10																	1					1
11																	1					1
12																	2					2
13																	2	1				3
14																	4	3				7
15																	7	1				8
17																	1					1
18																	6	2				8
21																	2	1				3
23																	2					2
TOTAL																						

*M - Male, F - Female

TABLE IX b

Name of Stream Salma Creek

Species of Salmon O. keta

Location of Stream Salma Bay, Kodiak Island

Portion of Stream Tide flats to weir

Investigator W.K. Clark

DATE	NATURAL DEATH								BEAR - TAKEN								CAUSE OF DEATH - SEALS								TOTALS
	spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known	Spawned		Unspawned		Unknown		Sex also un-known				
	M*	F*	M	F	M	F		M	F	M	F	M	F		M	F	M	F	M	F					
Sept. 29																							7		
30																							6		
Oct. 1																							10		
2																							5		
3																							4		
4																							2		
5																							2		
TOTAL											1						1	75	16	2	2		97		

*M - Male, F - Female **Grand Total**

1

96

97

TABLE IX b (Concl.)

