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GEOGRAPHICAL DISTRIBUTION OF SOCKEYE SALMON (*Oncorhynchus nerka*) AND CHINOOK SALMON (*O. tshawytscha*) HARVEST BY UPPER SUBDISTRICT SET NETS, UPPER COOK INLET, ALASKA, 1978-1982

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February 1987

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TABLE OF CONTENTS

	Page
LIST OF FIGURES	i
LIST OF APPENDIX TABLES	ii
LIST OF APPENDIX FIGURES	iii
ABSTRACT	iv
INTRODUCTION	1
METHODS	1
RESULTS	3
DISCUSSION	5
LITERATURE CITED	9
APPENDICES	10

LIST OF FIGURES

Figure		Page
1.	Fishing districts, rivers, and major features of Upper Cook Inlet, Alaska	2
2.	Overall mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by geographical and group, 1978-1982	4
3.	Overall mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by geographical area and group, 1978-1982	6
4.	Overall mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by geographical area and group, 1978-1982	7

LIST OF APPENDIX TABLES

Appendix Table		Page
1.	Overall mean chinook salmon harvest per permit by year for selected site groupings, 1978-1982	11
2.	Newman-Keuls multiple range test of chinook salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1978	12
3.	Newman-Keuls multiple range test of chinook salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1979	13
4.	Newman-Keuls multiple range test of chinook salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1981	14
5.	Newman-Keuls multiple range test of chinook salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1982	15
6.	Overall mean sockeye salmon harvest per permit by year for selected site groupings, 1978-1982	16
7.	Newman-Keuls multiple range test of sockeye salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1978	17
8.	Newman-Keuls multiple range test of sockeye salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1979	18
9.	Newman-Keuls multiple range test of sockeye salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1980	19
10.	Newman-Keuls multiple range test of sockeye salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1981	20
11.	Newman-Keuls multiple range test of sockeye salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1982	21
12.	Overall mean sockeye salmon to chinook salmon harvest ratio by permit for selected site groupings, 1978-1982	22

LIST OF APPENDIX FIGURES

Appendix Figure		Page
1.	Grand mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1978 . .	23
2.	Grand mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1979 . .	24
3.	Grand mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1980 . .	25
4.	Grand mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1981 . .	26
5.	Grand mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1982 . .	27
6.	Grand mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1978 . .	28
7.	Grand mean sockeye salmon harvet per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1979 . .	29
8.	Grand mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1980 . .	30
9.	Grand mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1981 . .	31
10.	Grand mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1982 . .	32
11.	Grand mean sockeye/chinook salmon harvest per set gillnet in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1978 . .	33
12.	Grand mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1979	34
13.	Grand mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1980	35
14.	Grand mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1981	36
15.	Grand mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1982	37

ABSTRACT

Alaska Department of Fish and Game fish ticket records for 226 Upper Subdistrict set gillnet permit holders (65% of total) in Upper Cook Inlet, Alaska were compiled for the period 1978-1982 to evaluate the geographical distribution of the harvest of chinook salmon *(Oncorhynchus tshawytscha)* and sockeye salmon *(O. nerka)*. Harvest patterns for chinook salmon were relatively high near Ninilchik Beach, decreased in the Clam Gulch area, and then increased to a high (average 67 fish/permit) on Kalifonsky Beach near the Kenai River mouth. A similar pattern was noted for sockeye salmon with relatively high catches (2,724 to 4,580 fish/permit) near the Kasilof and Kenai River mouths. No obvious differential harvest patterns by area were evident in the data set.

KEY WORDS: Upper Cook Inlet, Alaska, sockeye salmon, chinook salmon, set gillnet commercial harvest.

INTRODUCTION

Increasing competition for the salmon resources of Upper Cook Inlet by commercial, recreational, subsistence, and personal use fishermen has resulted in an attempt by the Alaska Department of Fish and Game (ADF&G) to increase their resource data base and management options to meet these demands. In this context, the Upper Subdistrict set gillnet fishery (commonly referred to as the eastside setnet fishery; Figure 1) has been the focal point of controversy relative to the interception of Kenai River chinook salmon *(Oncorhynchus tshawytscha)*. Sport fishing interests and the Alaska Board of Fisheries have inquired whether: (1) there are areas of inordinately high commercial harvest rates of Kenai River chinook salmon in the eastside setnet fishery; and (2) if these areas exist, what are the corresponding sockeye salmon *(O. nerka)* harvest rates? The intent of this report is to present data relative to these topics.

METHODS

The study area consisted of a portion of the Upper Subdistrict of the Central District, Upper Cook Inlet, Alaska. Upper Cook Inlet is defined as that portion of Cook Inlet north of the latitude of Anchor Point and is divided into two management districts, Central and Northern. The study area was limited to the water immediately adjacent to the western shore of the Kenai Peninsula between the lower boundary of the Upper Subdistrict at Ninilchik and the upper boundary at Boulder Point (Figure 1). While both drift and set gillnet commercial fishing gear may operate in the Upper Subdistrict, only the set gillnet fishery harvest data were examined as this fishery is the focus of a controversy relative to the magnitude of the chinook salmon harvest.

Historical harvest records (ADF&G fish ticket data) for 226 Upper Subdistrict set gillnet fishermen (permit holders) were compiled for the period 1978-1982. These 226 permit holders (which represented approximately 75 fishing sites) had maintained continuity in fishing a specific locale for the study period.

Because of the nature of the Upper Subdistrict set gillnet fishery, harvest data by permit may not represent the actual catch for the gear associated with that permit. For example, in a family operation, all fish harvested may be sold under a single permit although a number of permits and associated gear were fished. Therefore, in an effort to standardize the harvest statistics, the following computation was made:

$$\bar{x} = \sum_{i=1}^{n} x/n$$

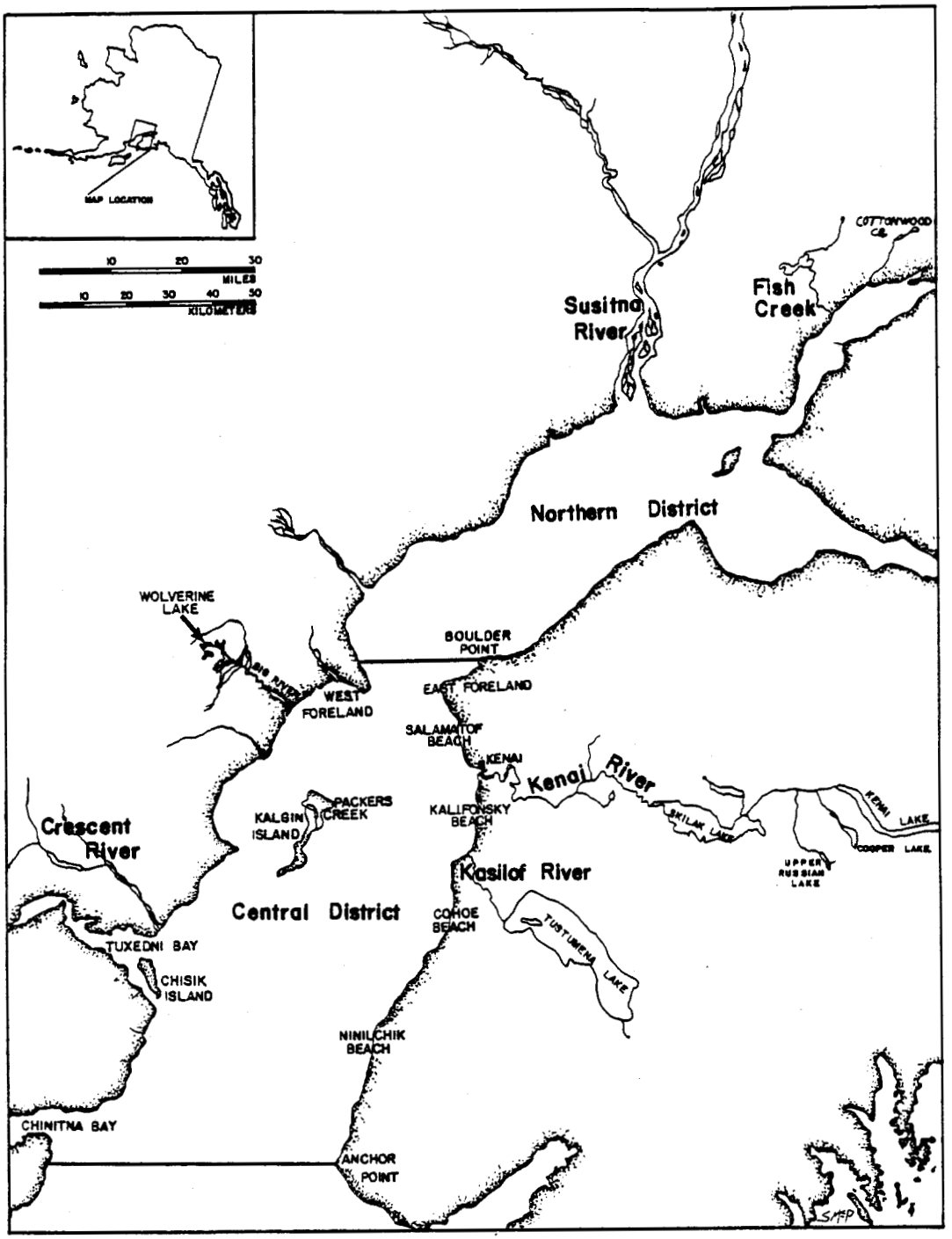

Figure 1. Fishing districts, rivers, and major features of Upper Cook Inlet, Alaska.

where:

$\bar{x}$ = mean salmon harvest/permit at a site per year
x = total salmon harvest per permit
n = total number of permits fishing the site (ranged from one to nine in the data set)

Further complicating the analysis and reporting of data is the confidentiality of fish ticket information. To maintain confidentiality, the data were averaged over four site groupings (except for one data set which used three) as follows:

$$\bar{\bar{x}} = \sum_{i=1}^{n} \bar{x}/N$$

where:

$\bar{\bar{x}}$ = grand mean salmon harvest/permit per year
N = total number of sites in a group (ranged from 3 to 4)

In an effort to provide further perspective, the grand mean salmon harvest/permit by year were summed over all years and an overall mean computed for the study period.

A one way analysis of variance test was used to test the null hypothesis that mean salmon harvest/permit for four geographical areas (Ninilchik, Cohoe, Kalifonsky, and Salamatof beaches; Figure 1) were equal. A Newman-Keuls multiple range test (Zar 1974) was also employed to identify where differences were located among the sample means.

RESULTS

Approximately 350 set gillnet permit holders fish the Upper Subdistrict setnet salmon fishery. Therefore, the harvest statistics for the 226 set gillnet permits analyzed in this report represented approximately 65% of the available data set.

Harvest levels of chinook salmon for the period 1978-1982 followed a trend (Appendix Figures 1-5; Appendix Table 1) typified in the overall mean chinook salmon harvest per permit for the 5-year period (Figure 2). Initially, harvest levels were relatively high near Ninilchik (41 chinook salmon/permit), decreasing to 13 fish/permit, then increasing steadily to a high on Kalifonsky Beach adjacent to the Kenai River mouth (67 fish/permit). This was followed by a decreasing northward trend along Salamatof Beach to 8 fish/permit at the district boundary at Boulder Point. Analysis of variance indicated significant differences in harvest levels for most years between areas. The only exception was in 1980 where the null hypothesis of no difference in mean chinook salmon harvest/permit was accepted ($p>.05$). The Newman-Keuls multiple range test applied to 1978, 1979, 1981, and 1982 data (Appendix Tables 2-5) suggested that chinook salmon were consistently harvested at a higher number on Kalifonsky Beach when compared individually

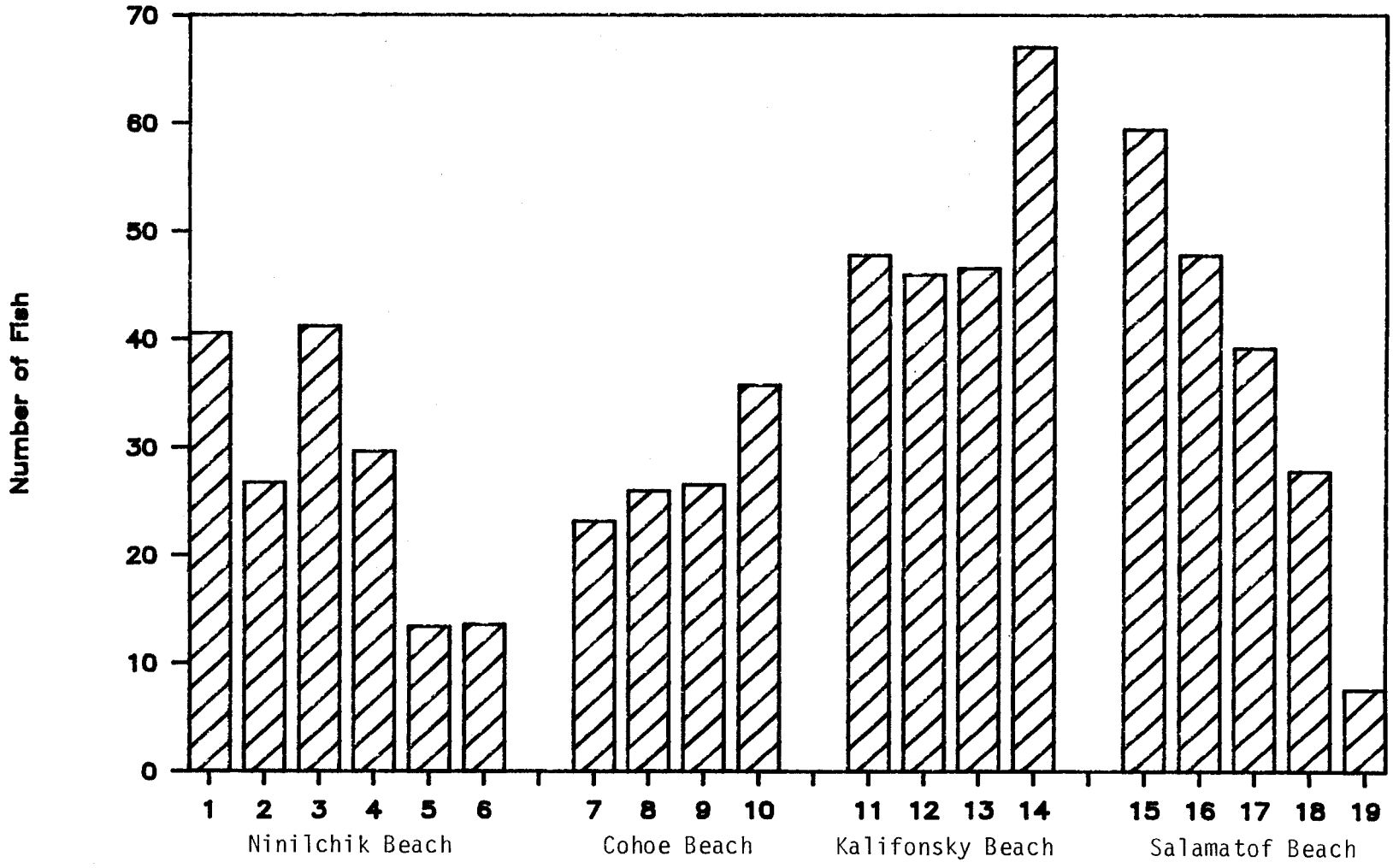

Figure 2. Overall mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by geographical area and group, 1978-1982.

to the other three areas. Mean chinook salmon harvest/permit on Kalifonsky Beach ranged from approximately 65 fish/permit in 1982 to 41 fish/permit in 1979. Ninilchik and Cohoe Beach harvest levels were approximately equal on an annual basis during the study period with mean harvest levels ranging from 15-42 and 21-28 fish/permit, respectively. Salamatof Beach was not statistically different in mean harvest level relative to Kalifonsky Beach in 1978 and 1979.

Sockeye salmon harvest levels by geographical area were similar to the chinook salmon harvest pattern with slight modification (Appendix Figures 6-10; Appendix Table 6). The overall mean sockeye salmon harvest pattern for the period 1978-1982 (Figure 3) indicated initially high harvest levels at Ninilchik (2,028 sockeye salmon/permit), decreasing to 504 fish/permit, then increasing steadily to 2,724 fish/permit on Cohoe Beach adjacent to the Kasilof River mouth. Harvest levels then decreased slightly to 1,950 fish/permit near the middle of Kalifonsky Beach and then increased to a high of 4,580 fish/permit on Salamatof Beach near the Kenai River mouth. A rapid decrease from 3,021 fish/permit near the middle of Salamatof Beach to 1,212 fish/permit at the district boundary at Boulder Point was also evident in the data set.

Analysis of variance indicated that the null hypothesis of the difference in sockeye salmon harvest levels between areas was rejected for all years ($p>.05$). Salamatof Beach had the highest mean sockeye salmon harvest/permit for all years, ranging from 1,239 sockeye salmon/permit in 1979 to 6,564 fish/permit in 1982 (Appendix Tables 7-11). Conversely, Ninilchik Beach had the lowest harvest level in 4 of the 5 study years with the sockeye salmon harvest ranging from 589 fish/permit in 1979 to 1,530 fish/permit in 1981. The Newman-Keuls multiple range analysis indicated that the Kalifonsky Beach harvest levels of sockeye salmon were similar to Salamatof Beach in 3 (1979, 1980, 1981) of the 5 years (Appendix Tables 7, 9, and 10) with harvest levels ranging from 859 to 3,722 fish/permit. Harvest of sockeye salmon on Cohoe Beach was similar to Ninilchik Beach for 2 years (1978, 1979), similar to Kalifonsky Beach in 1980 and 1982, and different (lower) from all other areas in 1981 (Appendix Tables 7-11).

A sockeye salmon/chinook salmon harvest ratio was calculated for all areas between 1978-1982 (Appendix Figures 11-15; Appendix Table 12). As expected, based on the above data, Kalifonsky Beach had the lowest overall ratios, ranging from 42 to 51 sockeye salmon for every chinook salmon harvested (Figure 4). In contrast, ratios per group on Ninilchik Beach ranged from 43 to 96, Cohoe Beach from 51 to 101, and on Salamatof Beach from 83 to 194 sockeye salmon per chinook salmon harvested (Figure 4). However, examination of the data indicated that extreme variability did occur between years on each beach. For example, the ratio of sockeye salmon to chinook salmon for the southern grouping on Ninilchik Beach ranged from 32 (1982) to 209 (1981; Appendix Figures 14 and 15).

DISCUSSION

The central question of this investigation was whether there were areas of set gillnet fishing in the Upper Subdistrict where relatively high chinook

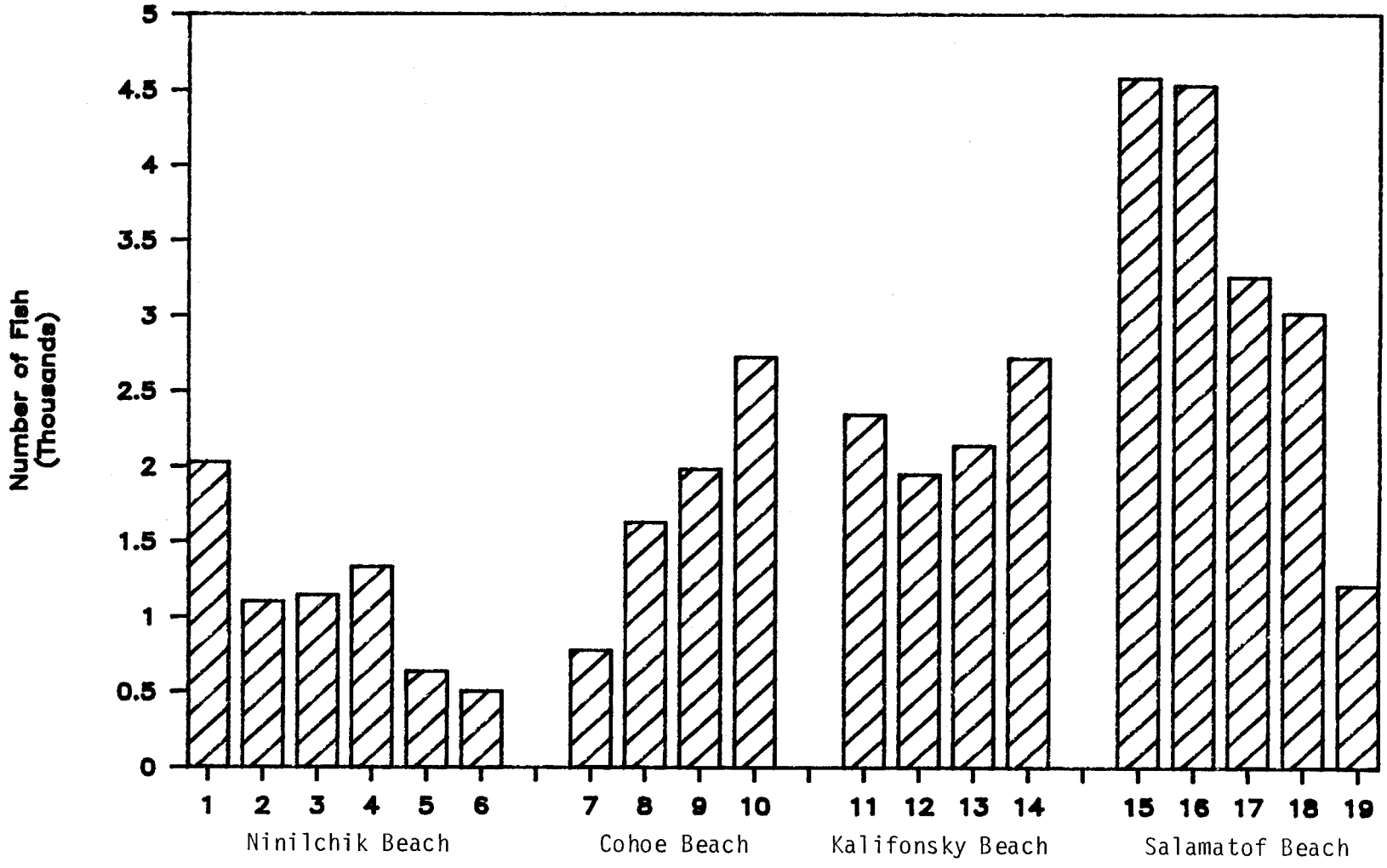

Figure 3. Overall mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by geographical area and group, 1978-1982.

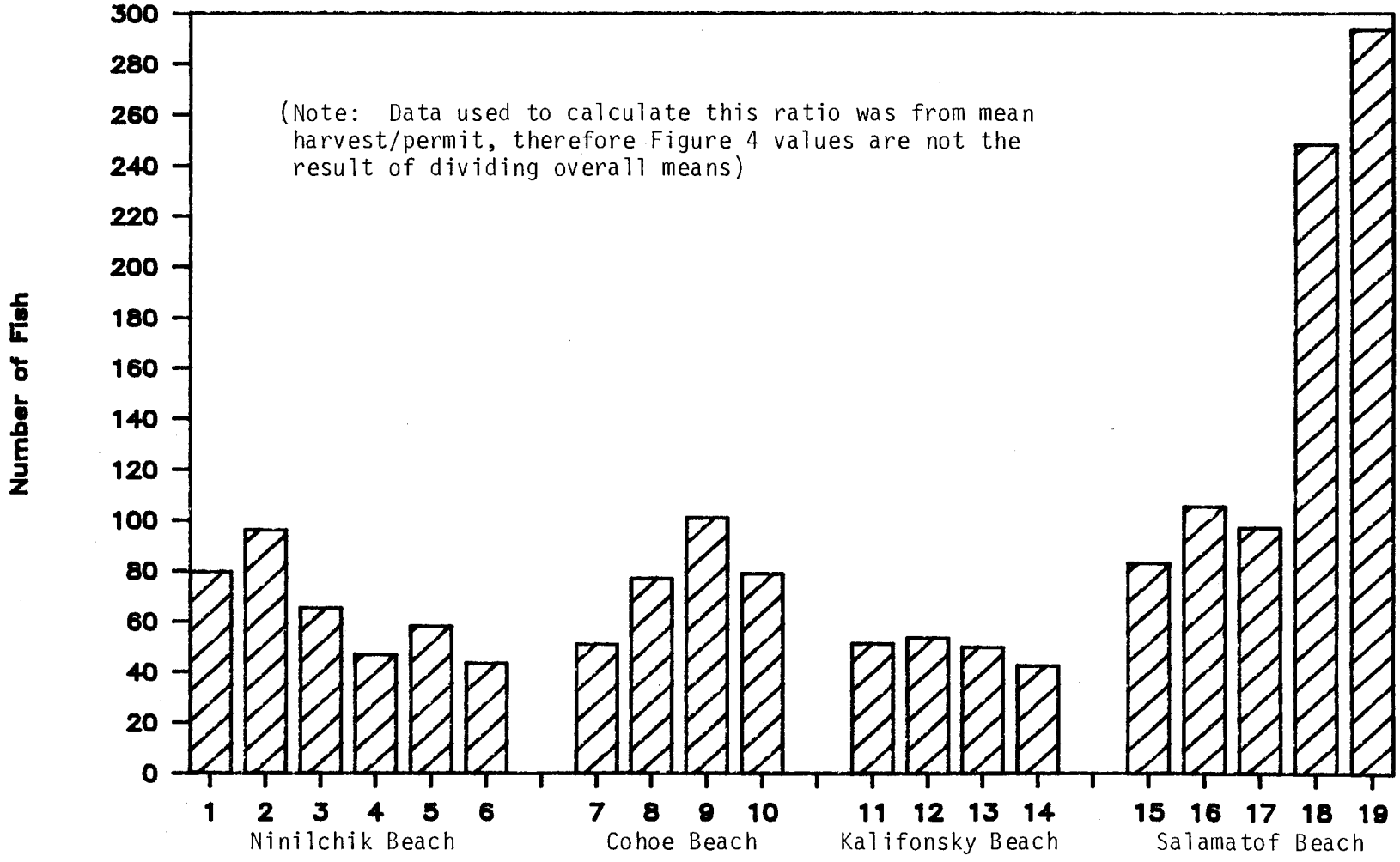

Figure 4. Overall mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by geographical area and group, 1978-1982.

salmon harvest occurred without a corresponding high sockeye salmon harvest. It was assumed that if these areas existed, an alternative to the present management and allocation options for Kenai River chinook salmon may be available. Based on the data, there does not appears to be manageable units to meet these criteria. Areas of relatively high chinook salmon harvest corresponded to areas of relatively high sockeye salmon harvest. Conversely, low harvest areas for both species occurred simultaneously. This is interpreted to mean that average sockeye/chinook salmon ratios are fairly uniform along the majority of the study area.

The analysis did provide additional information relative to the geographical harvest of chinook salmon. Higher catch levels near the mouth of the Kenai River appear contradictory to the popular belief that the majority of chinook salmon migrate nearshore throughout the set gillnet fishery. While these data do not refute this, the harvest pattern does not support it. If the majority of chinook salmon are migrating nearshore, one might expect higher harvest levels near Ninilchik with harvest rates declining toward the Kenai River as fish are removed from the available population by the commercial fishery. The harvest pattern from 1978 through 1982 was just the opposite with increasing success per permit near the river mouth. Increased gear efficiency and/or increased numbers of fish in the areas adjacent to the Kenai and Kasilof River mouths would account for the observed pattern. To date, no data exist to identify the controlling factor.

In contrast to the chinook salmon harvest patterns, sockeye salmon harvest patterns were as expected relative to the known migratory pathways of Kasilof and Kenai River stocks. Significant portions of these stocks migrate outside the set gillnet fishery (Waltemyer 1983) and, consequently, do not become available for harvest until they are in close proximity to the river mouths. Therefore, higher harvest levels near the Kasilof River are to be expected. Concurrently, the high harvest levels on Salamatof Beach correspond to the more abundant Kenai River stocks moving from the middle of Cook Inlet to the Kenai River through this area.

In summary, there is no panacea to the current conflict over chinook salmon versus sockeye salmon harvest through elimination of commercial fishing operations in specific geographical areas. However, these data do suggest further research needs and avenues. For example, the characteristics of the set gillnet fishery near the Kenai River mouth need further definition. Factors such as: (1) location of set gillnet gear from shore, (2) tidal phases, (3) run timing, (4) depth of capture in the gear, etc., needs evaluation relative to assessing differential harvest rates for chinook salmon versus sockeye salmon. The proximity of these sites to the river mouth could conceivably allow additional escapement of chinook salmon if differential harvest rates were evident.

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APPENDICES

Appendix Table 1. Overall mean chinook salmon harvest per permit by year for selected site groupings, 1978-1982.

Site Group	Year 1978	1979	1980	1981	1982	Five Year Mean
1	61	37	26	12	67	41
2	23	13	27	11	60	27
3	42	34	45	22	63	41
4	40	18	31	24	35	30
5	13	9	15	12	18	13
6	15	10	20	12	11	14
7	39	14	16	17	30	23
8	24	14	24	27	41	26
9	28	21	30	13	41	27
10	33	34	35	38	39	36
11	47	45	36	42	69	48
12	40	39	42	42	67	46
13	80	23	38	44	48	47
14	76	57	60	64	78	67
15	72	51	46	64	64	59
16	55	51	40	50	43	48
17	53	36	27	35	45	39
18	46	33	17	19	24	28
19	10	6	10	2	10	8

Appendix Table 2. Newman-Keuls multiple range test of chinook salmon harvest/permit by area, Upper Cook Inlet, Alaska, 1978.

Rank of Sample Means	Cohoe (1)	Ninilchik (2)	Salamatof (3)	Kalifonsky (4)
Sample Mean (x)	31.03	31.90	46.52	60.87
Size of Samples	16	25	20	16

Comparison	S.E.[1]	q.	p.	q 0.05	Conclusion
4 versus 1	7.44	4.01	4	3.737	Reject Ho:4=1
4 versus 2	6.74	4.30	3	3.399	Reject Ho:4=2
4 versus 3	7.06	2.03	2	2.829	Accept Ho:4=3
3 versus 1	7.06	2.19	3	3.399	Accept Ho:3=1
3 versus 2	6.31	2.32	2	2.829	Accept Ho:3=2
2 versus 1	6.74	0.13	2	2.829	Accept Ho:2=1

[1] S.E. = standard error, q = studentized ranges, p = number of means in range of means being tested, q 0.05 = critical value.

Appendix Table 3. Newman-Keuls multiple range test of chinook salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1979.

Rank of Sample Means	Ninilchik (1)	Cohoe (2)	Salamatof (3)	Kalifonsky (4)
Sample Mean (x)	20.14	20.55	35.11	40.86
Size of Samples	24	16	20	16

Comparison	S.E.[1]	q.	p.	q 0.05	Conclusion
4 versus 1	4.24	4.87	4	3.737	Reject Ho:4=1
4 versus 2	4.65	4.37	3	3.399	Reject Ho:4=2
4 versus 3	4.41	1.30	2	2.829	Accept Ho:4=3
3 versus 1	3.98	3.66	3	3.399	Reject Ho:3=1
3 versus 2	4.41	3.39	2	2.829	Reject Ho:3=2
2 versus 1	4.24	0.10	2	2.829	Accept Ho:2=1

[1] S.E. = standard error, q = studentized ranges, p = number of means in range of means being tested, q 0.05 = critical value.

Appendix Table 4. Newman-Keuls multiple range test of chinook salmon harvest/permit by area, Upper Cook Inlet, Alaska, 1981.

Rank of Sample Means	Ninilchik (1)	Cohoe (2)	Salamatof (3)	Kalifonsky (4)
Sample Mean (x)	15.10	23.86	33.96	49.89
Size of Samples	24	16	20	16

Comparison	S.E.[1]	q.	p.	q 0.05	Conclusion
4 versus 1	4.40	7.92	4	3.737	Reject Ho:4=1
4 versus 2	4.82	5.40	3	3.399	Reject Ho:4=2
4 versus 3	4.57	3.49	2	2.829	Reject Ho:4=3
3 versus 1	4.13	4.57	3	3.399	Reject Ho:3=1
3 versus 2	4.57	2.21	2	2.829	Accept Ho:3=2
2 versus 1	4.40	1.99	2	2.829	Accept Ho:2=1

[1] S.E. = standard error, q = studentized ranges, p = number of means in range of means being tested, q 0.05 = critical value.

Appendix Table 5. Newman-Keuls multiple range test of chinook salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1982.

Rank of Sample Means	Salamatof (1)	Cohoe (2)	Ninilchik (3)	Kalifonsky (4)
Sample Mean (x)	36.82	37.73	42.31	65.17
Size of Samples	20	16	24	16

Comparison	S.E.[1]	q.	p.	q 0.05	Conclusion
4 versus 1	6.04	4.69	2	3.737	Reject Ho:4=1
4 versus 2	6.36	4.31	3	3.399	Reject Ho:4=2
4 versus 3	5.81	3.93	2	2.829	Reject Ho:4=3
3 versus 1	5.45	1.01	3	3.399	Accept Ho:3=1
3 versus 2	5.81	6.79	2	2.829	Accept Ho:3=2
2 versus 1	6.04	0.15	2	2.829	Accept Ho:2=1

[1] S.E. = standard error, q = studentized ranges, p = number of means in range of means being tested, q 0.05 = critical value.

Appendix Table 6. Overall mean sockeye salmon harvest per permit by year for selected site groupings, 1978-1982.

Site Group	Year 1978	1979	1980	1981	1982	Five Year Mean
1	2062	1150	2292	2530	2104	2028
2	1175	586	1283	1409	1054	1101
3	970	703	1518	1539	983	1143
4	1079	601	1706	2221	1052	1332
5	512	307	712	872	781	637
6	368	194	718	696	545	504
7	875	403	753	733	1146	782
8	1048	584	1771	1390	3353	1629
9	1993	801	3062	1180	2882	1984
10	2412	962	3252	2560	4432	2724
11	3233	1239	2120	1412	3703	2341
12	2360	678	1953	1383	3378	1950
13	3027	584	1843	1551	3677	2136
14	4473	846	2380	1759	4133	2718
15	6112	1307	3031	3246	9203	4580
16	6923	1716	2799	2736	8478	4530
17	3940	1155	2139	2085	6974	3259
18	3328	1244	1929	2199	6404	3021
19	918	774	1197	1410	1760	1212

Appendix Table 7. Newman-Keuls multiple range test of sockeye salmon harvest/permit by area, Upper Cook Inlet, Alaska, 1978.

Rank of Sample Means	Ninilchik (1)	Cohoe (2)	Kalifonsky (3)	Salamatof (4)
Sample Mean (x)	1,040	1,581	3,273	4,244
Size of Samples	25	16	16	20

Comparison	S.E.[1]	q.	p.	q 0.05	Conclusion
4 versus 1	318.2	10.1	4	3.737	Reject Ho:4=1
4 versus 2	355.8	7.5	3	3.399	Reject Ho:4=2
4 versus 3	355.8	2.7	2	2.829	Accept Ho:4=3
3 versus 1	339.6	6.6	3	3.399	Reject Ho:3=1
3 versus 2	375.0	4.5	2	2.829	Reject Ho:3=2
2 versus 1	339.6	1.6	2	2.829	Accept Ho:2=1

[1] S.E. = standard error, q = studentized ranges, p = number of means in range of means being tested, q 0.05 = critical value.

Appendix Table 8. Newman-Keuls multiple range test of sockeye salmon harvest/permit by area, Upper Cook Inlet, Alaska, 1979.

Rank of Sample Means	Ninilchik (1)	Cohoe (2)	Kalifonsky (3)	Salamatof (4)
Sample Mean (x)	589	687	859	1,239
Size of Samples	25	16	16	20

Comparison	S.E.[1]	q.	p.	q 0.05	Conclusion
4 versus 1	87.0	7.5	4	3.737	Reject Ho:4=1
4 versus 2	97.3	5.7	3	3.399	Reject Ho:4=2
4 versus 3	97.3	3.9	2	2.829	Reject Ho:4=3
3 versus 1	92.8	2.9	3	3.399	Accept Ho:3=1
3 versus 2	102.5	1.7	2	2.829	Accept Ho:3=2
2 versus 1	92.8	1.1	2	2.829	Accept Ho:2=1

[1] S.E. = standard error, q = studentized ranges, p = number of means in range of means being tested, q 0.05 = critical value.

Appendix Table 9. Newman-Keuls multiple range test of sockeye salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1980.

Rank of Sample Means	Ninilchik (1)	Kalifonsky (2)	Cohoe (3)	Salamatof (4)
Sample Mean (x)	1,384	2,073	2,209	2,218
Size of Samples	25	16	16	20

Comparison	S.E.[1]	q.	p.	q 0.05	Conclusion
4 versus 1	208.1	4.00	4	3.737	Reject Ho:4=1
4 versus 2	232.7	0.60	3	3.399	Accept Ho:4=2
4 versus 3	232.7	0.04	2	2.829	Accept Ho:4=3
3 versus 1	222.1	3.70	3	3.399	Reject Ho:3=1
3 versus 2	245.3	0.60	2	2.829	Accept Ho:3=2
2 versus 1	222.1	3.10	2	2.829	Reject Ho:2=1

[1] S.E. = standard error, q = studentized ranges, p = number of means in range of means being tested, q 0.05 = critical value.

Appendix Table 10. Newman-Keuls multiple range test of sockeye salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1981.

Rank of Sample Means	Cohoe (1)	Ninilchik (2)	Kalifonsky (3)	Salamatof (4)
Sample Mean (x)	1,466	1,530	1,616	2,334
Size of Samples	16	25	16	20

Comparison	S.E.[1]	q.	p.	q 0.05	Conclusion
4 versus 1	215.8	4.0	4	3.737	Reject Ho:4=1
4 versus 2	240.8	3.3	3	3.399	Accept Ho:4=2
4 versus 3	215.8	3.3	2	2.829	Reject Ho:4=3
3 versus 1	227.5	0.7	3	3.399	Accept Ho:3=1
3 versus 2	206.0	0.4	2	2.829	Accept Ho:3=2
2 versus 1	206.0	0.3	2	2.829	Accept Ho:2=1

[1] S.E. = standard error, q = studentized ranges, p = number of means in range of means being tested, q 0.05 = critical value.

Appendix Table 11. Newman-Keuls multiple range test of sockeye salmon harvest/ permit by area, Upper Cook Inlet, Alaska, 1982.

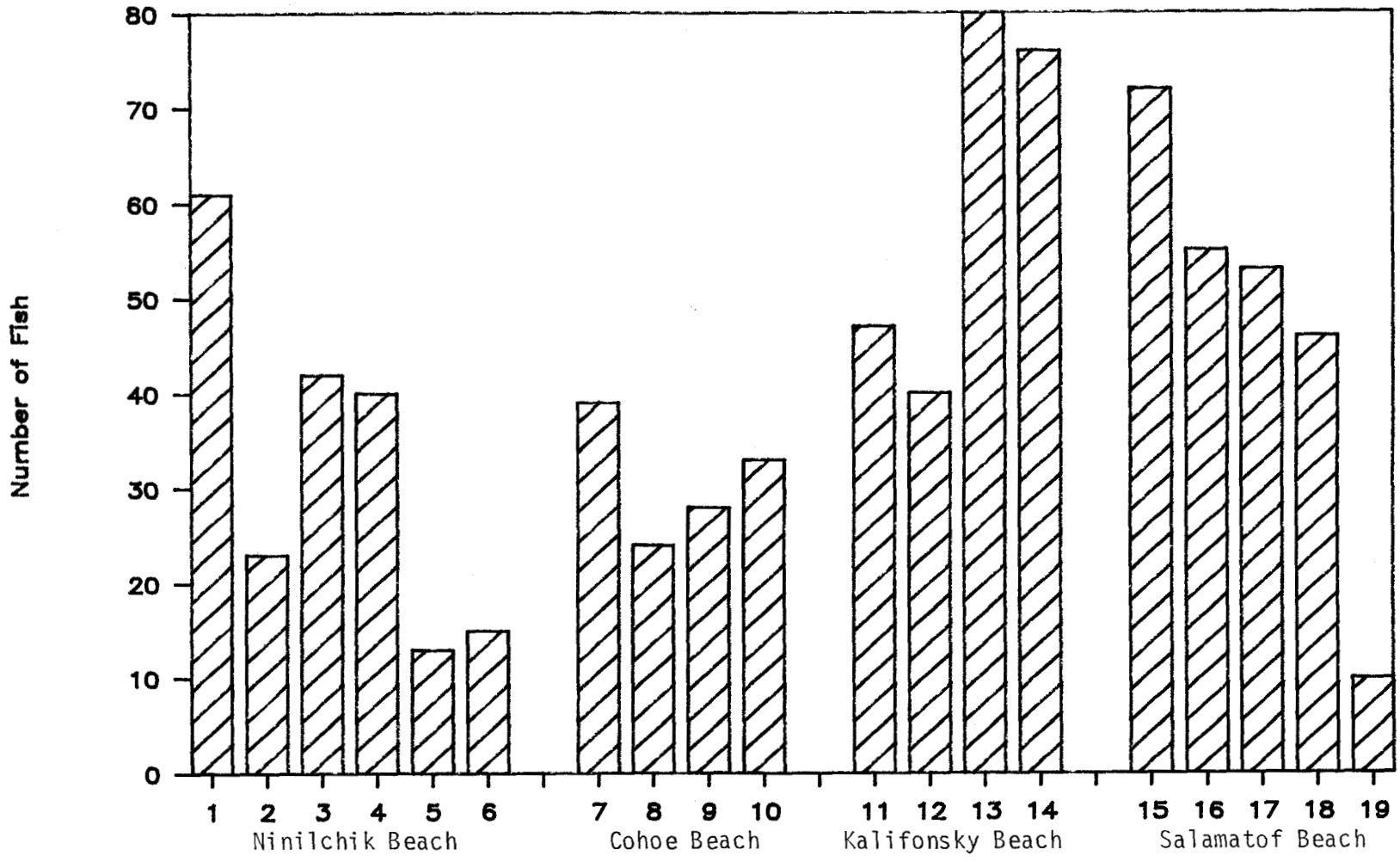
Rank of Sample Means	Ninilchik (1)	Cohoe (2)	Kalifonsky (3)	Salamatof (4)
Sample Mean (x)	1,094	2,953	3,722	6,564
Size of Samples	25	16	16	20

Comparison	S.E.[1]	q.	p.	q 0.05	Conclusion
4 versus 1	448.5	12.2	4	3.737	Reject Ho:4=1
4 versus 2	501.4	7.2	3	3.399	Reject Ho:4=2
4 versus 3	501.4	5.7	2	2.829	Reject Ho:4=3
3 versus 1	478.6	5.5	3	3.399	Reject Ho:3=1
3 versus 2	528.5	1.5	2	2.829	Accept Ho:3=2
2 versus 1	478.6	3.9	2	2.829	Reject Ho:2=1

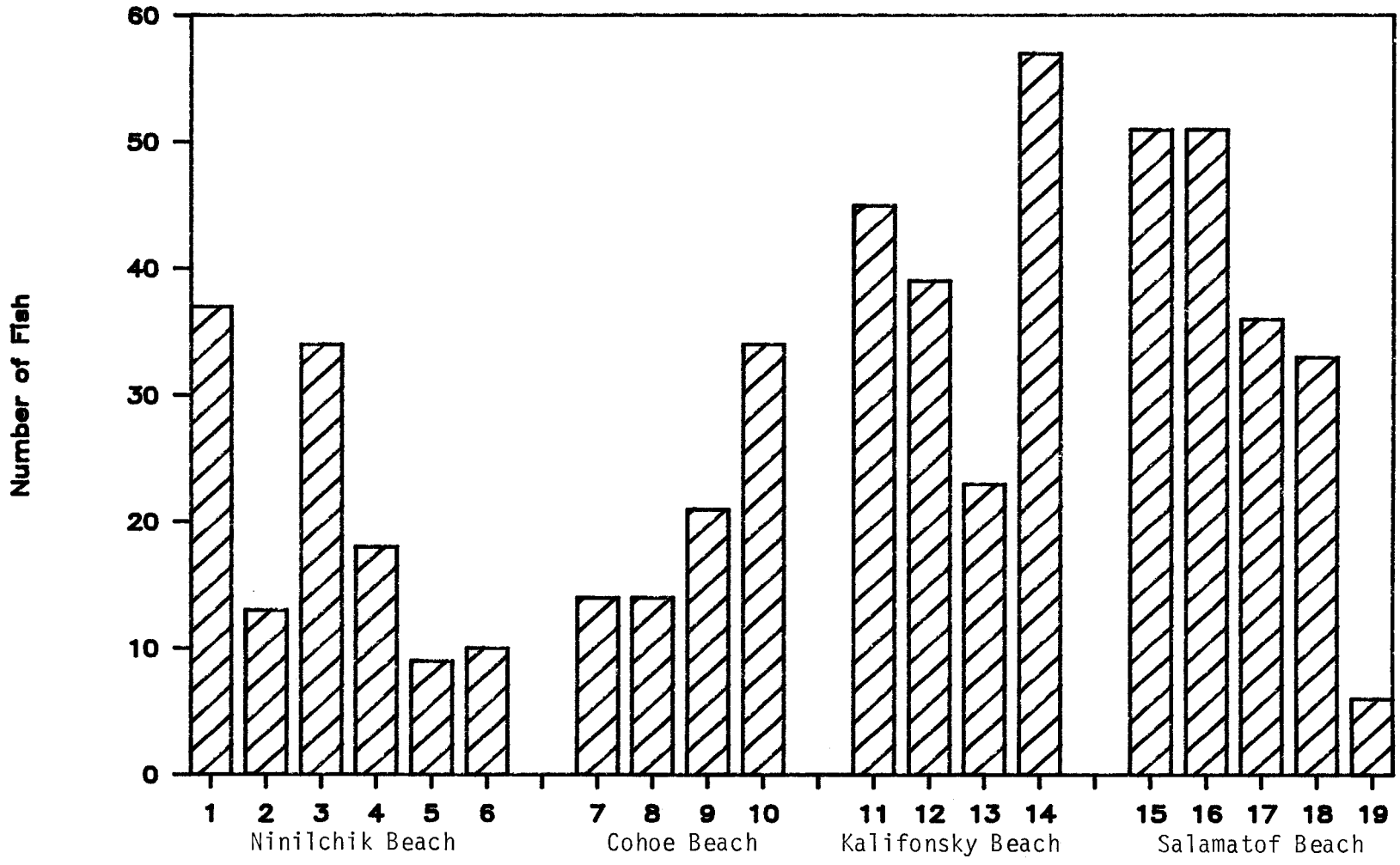
[1] S.E. = standard error, q = studentized ranges, p = number of means in range of means being tested, q 0.05 = critical value.

Appendix Table 12. Overall mean sockeye salmon to chinook salmon harvest ratio by permit for selected site groupings, 1978-1982.

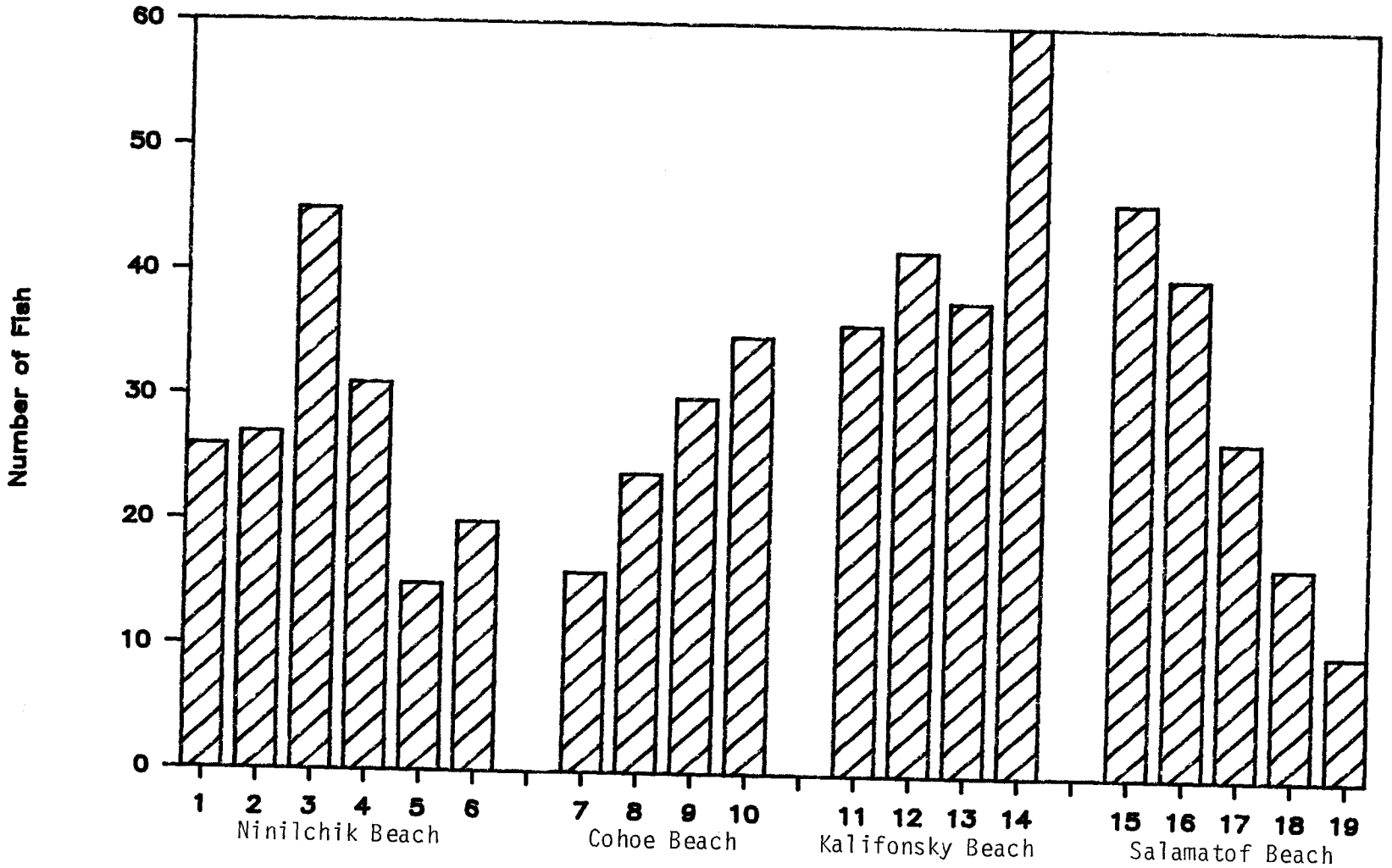
Site Group	Year 1978	1979	1980	1981	1982	Five Year Mean
1	39	33	86	209	32	80
2	67	55	76	264	19	96
3	24	29	52	203	18	65
4	27	33	52	90	32	47
5	61	35	51	85	58	58
6	41	20	44	66	46	43
7	33	63	67	53	39	51
8	45	40	157	56	87	77
9	154	48	134	96	74	101
10	78	28	99	72	117	79
11	72	31	60	37	56	51
12	114	19	48	35	51	53
13	57	26	52	38	76	50
14	61	15	54	30	52	42
15	93	28	82	53	159	83
16	134	37	94	57	205	105
17	85	33	100	67	200	97
18	118	55	499	235	336	249
19	149	154	204	626	335	294



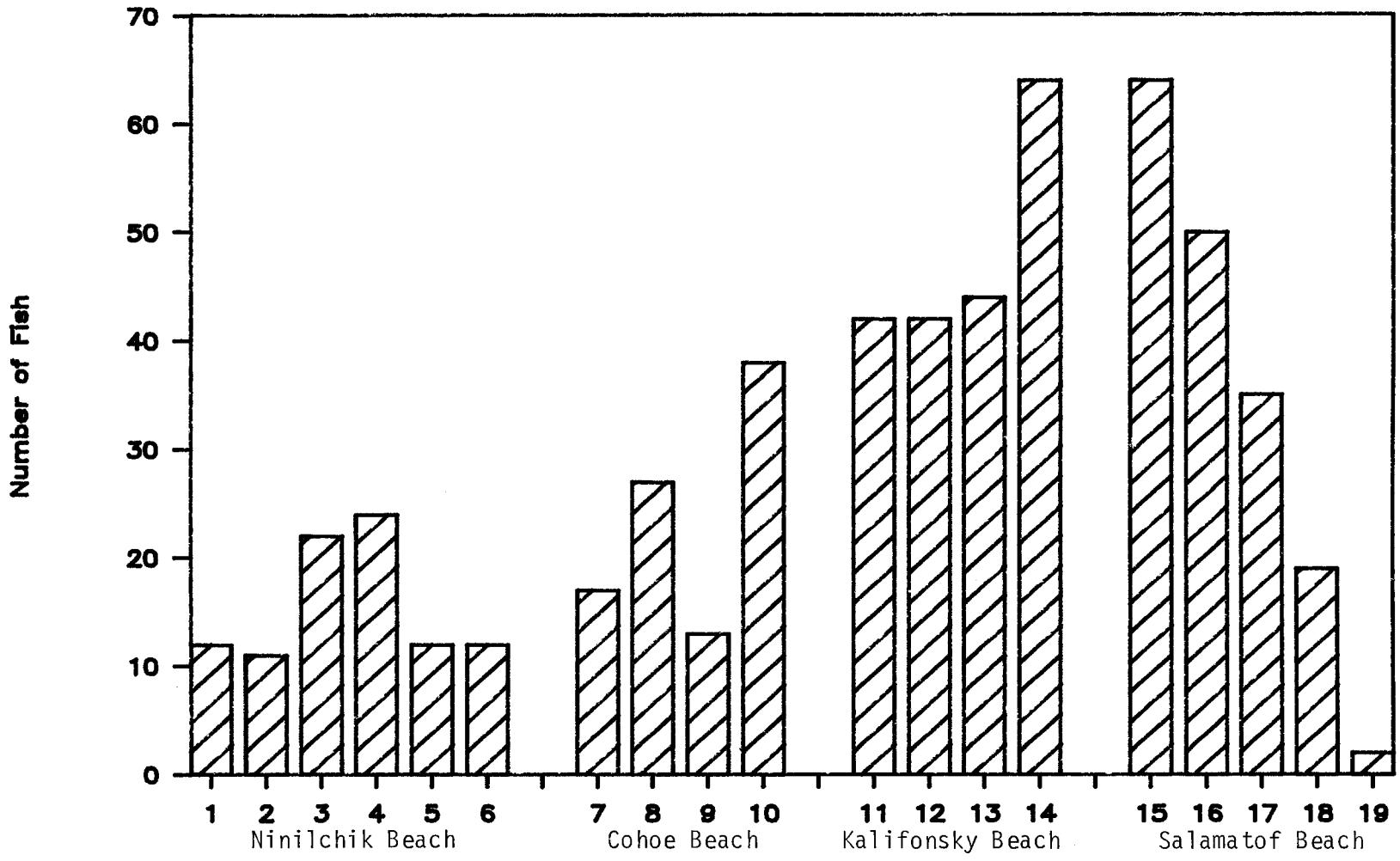
Appendix Figure 1. Grand mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1978.



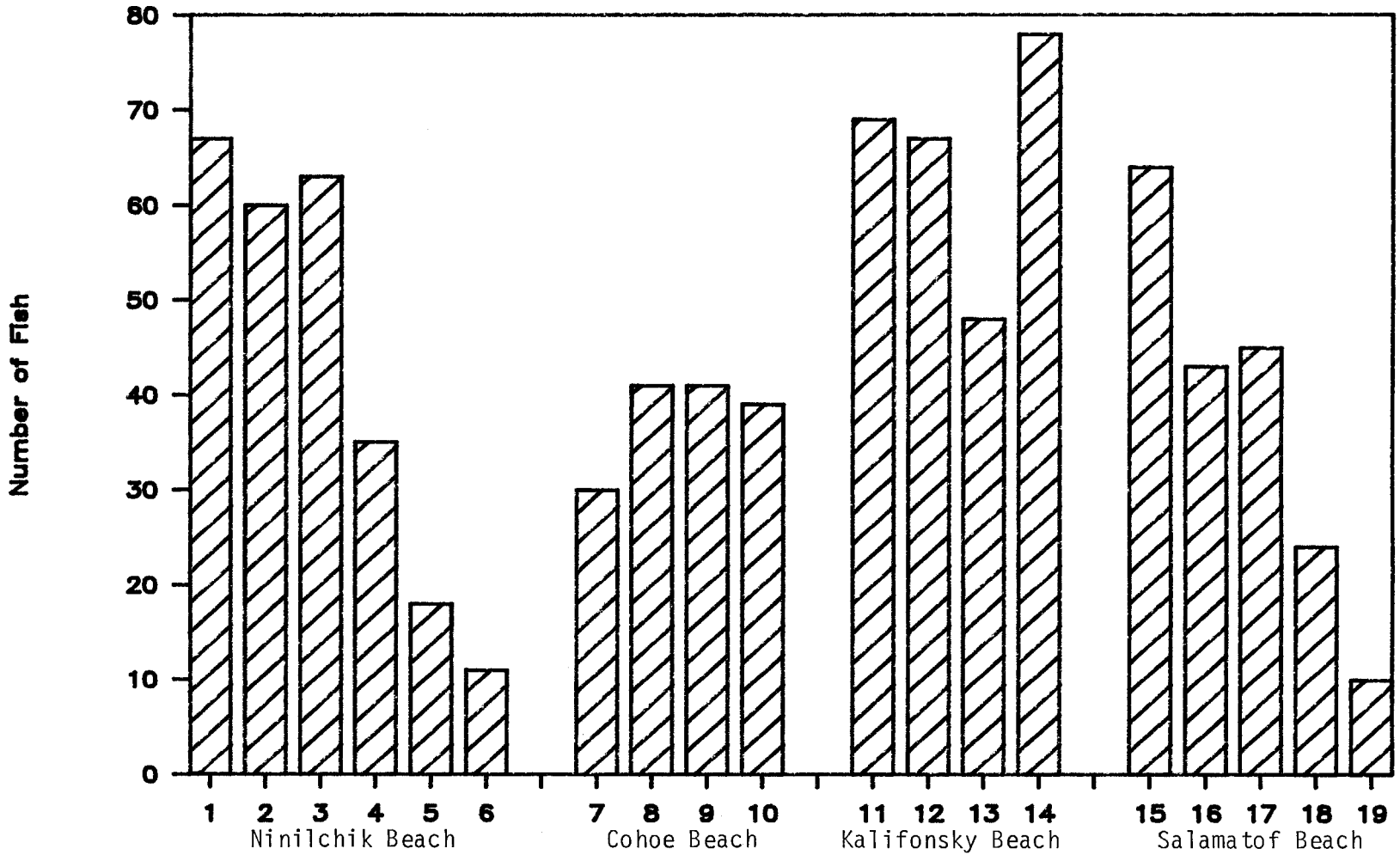
Appendix Figure 2. Grand mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1979.



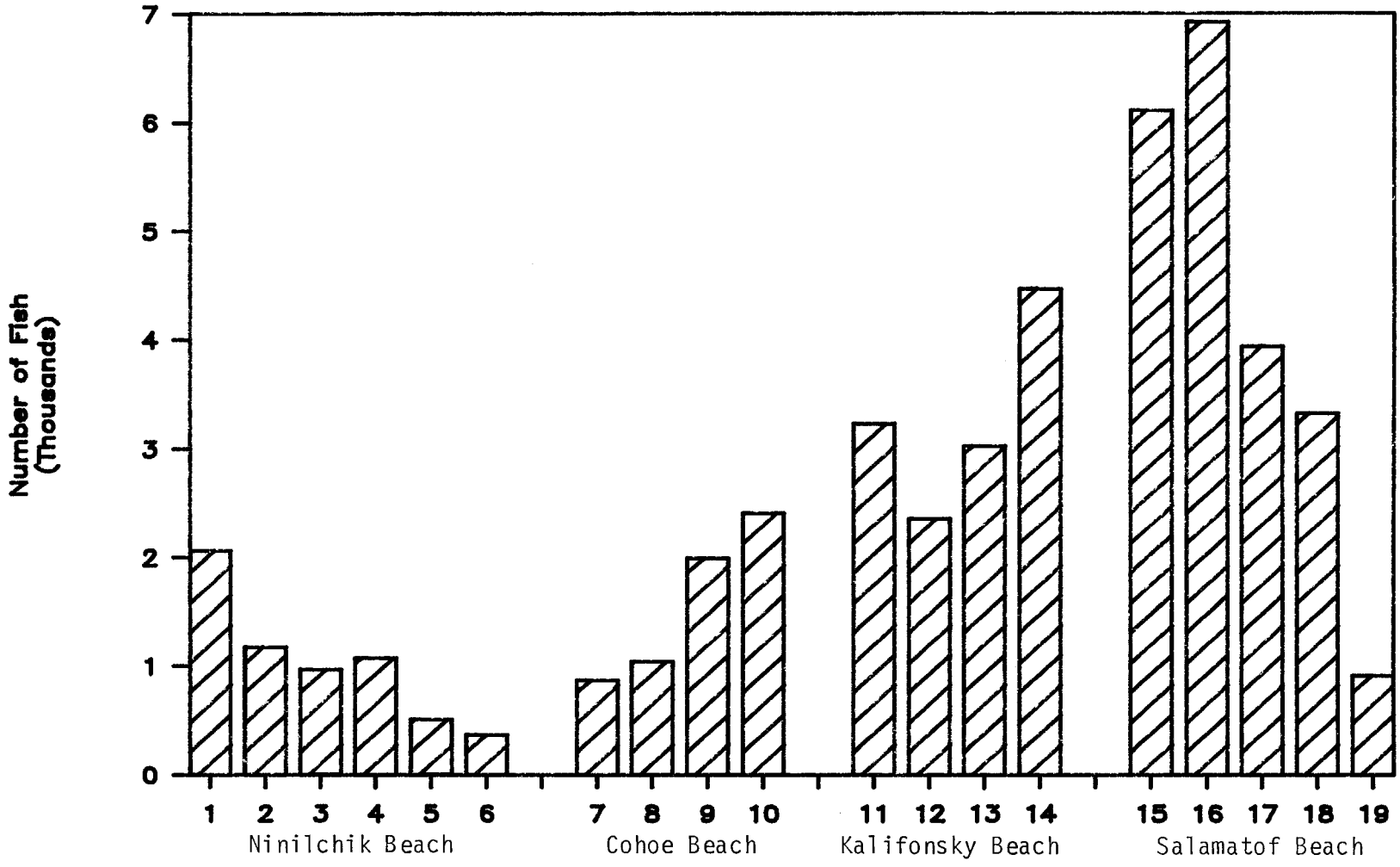
Appendix Figure 3. Grand mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1980.



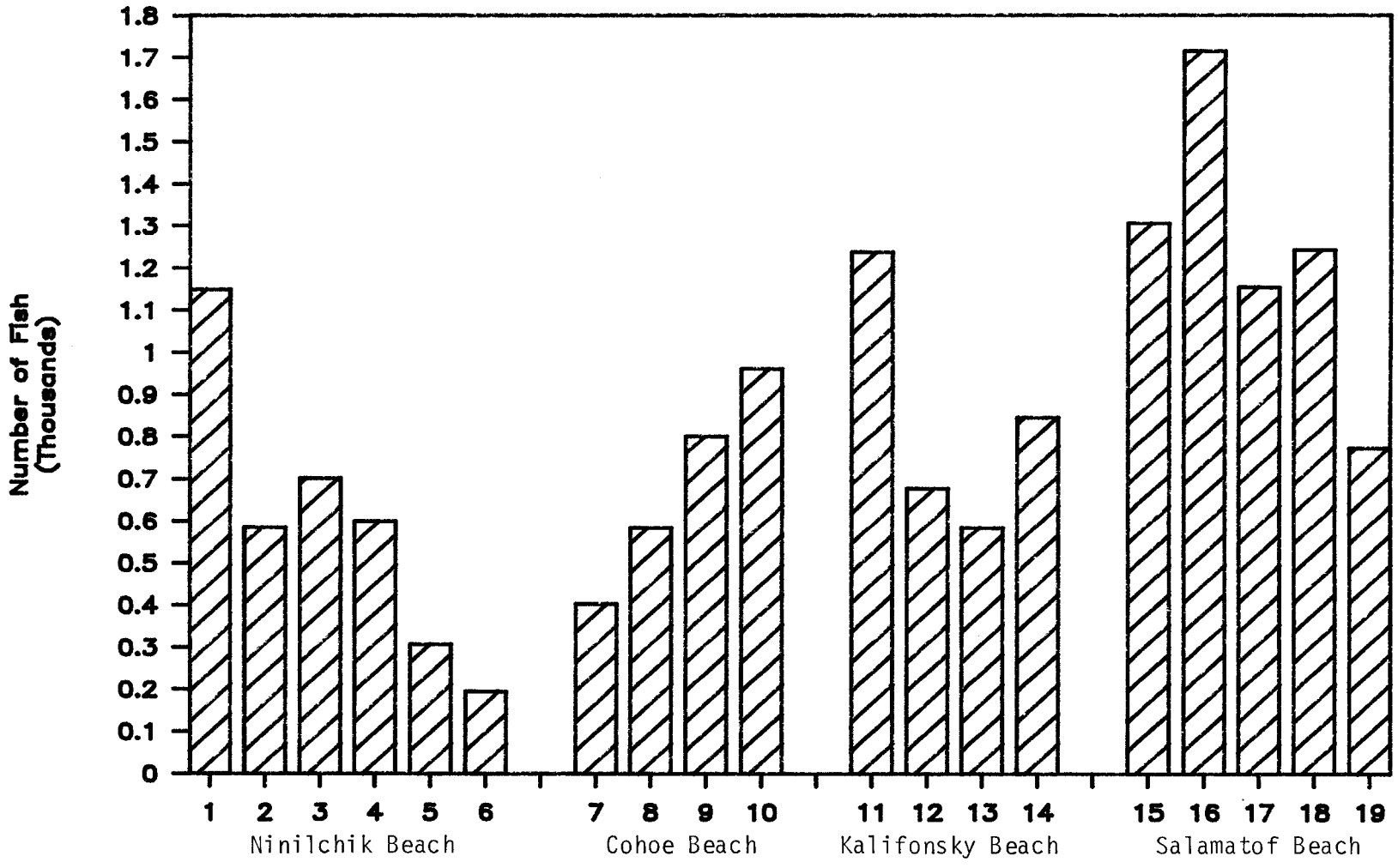
Appendix Figure 4. Grand mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1981.



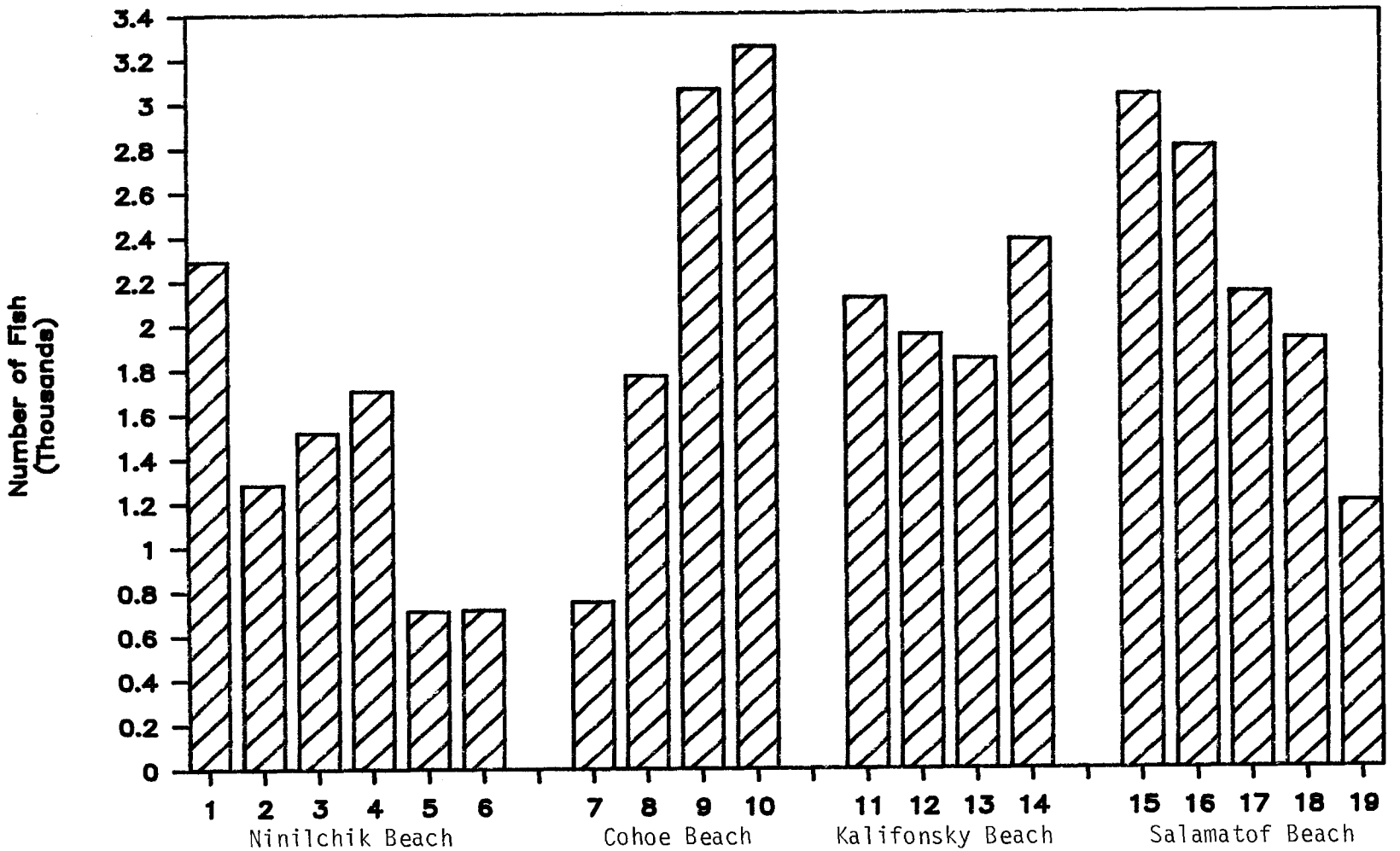
Appendix Figure 5. Grand mean chinook salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1982.



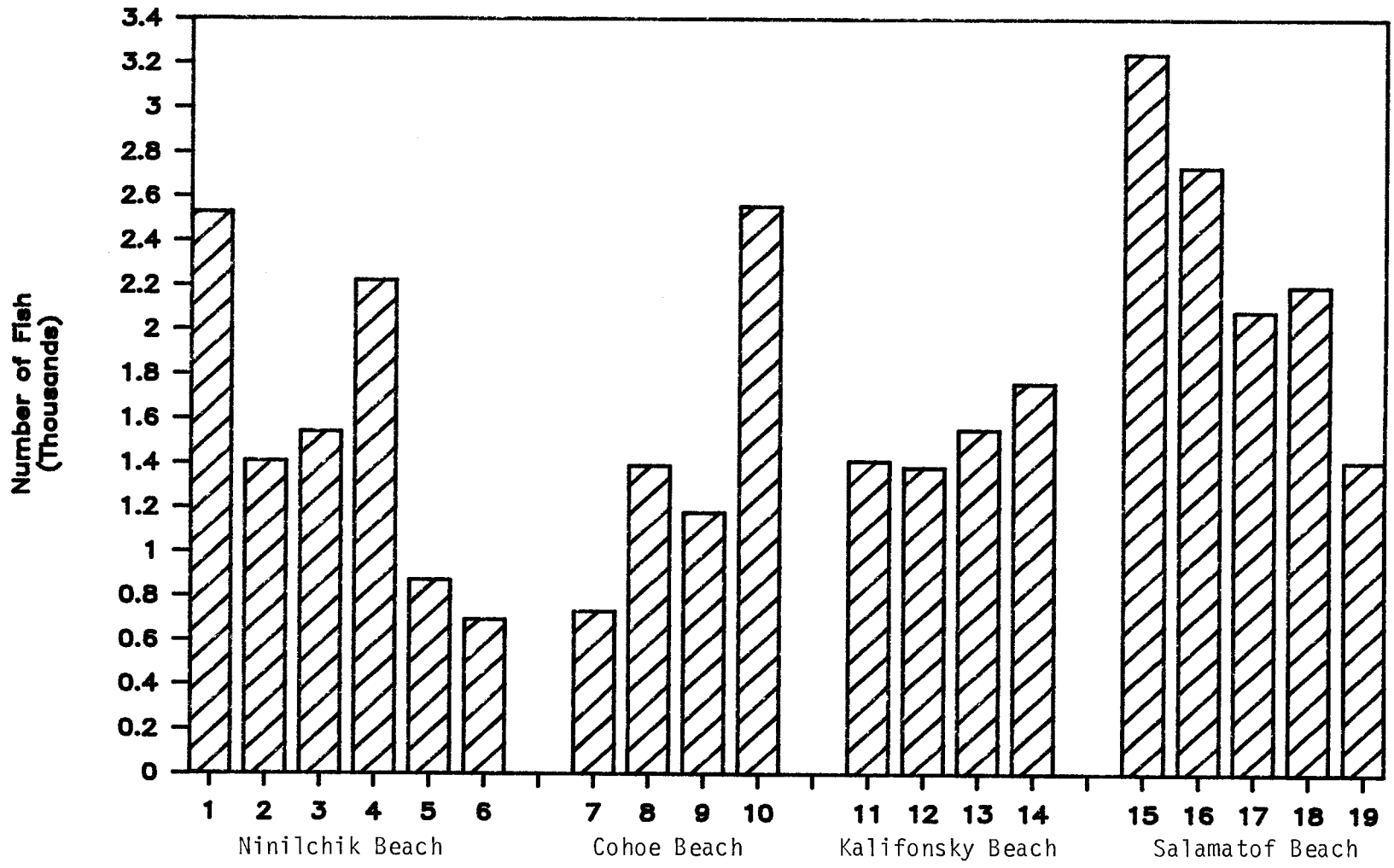
Appendix Figure 6. Grand mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1978.



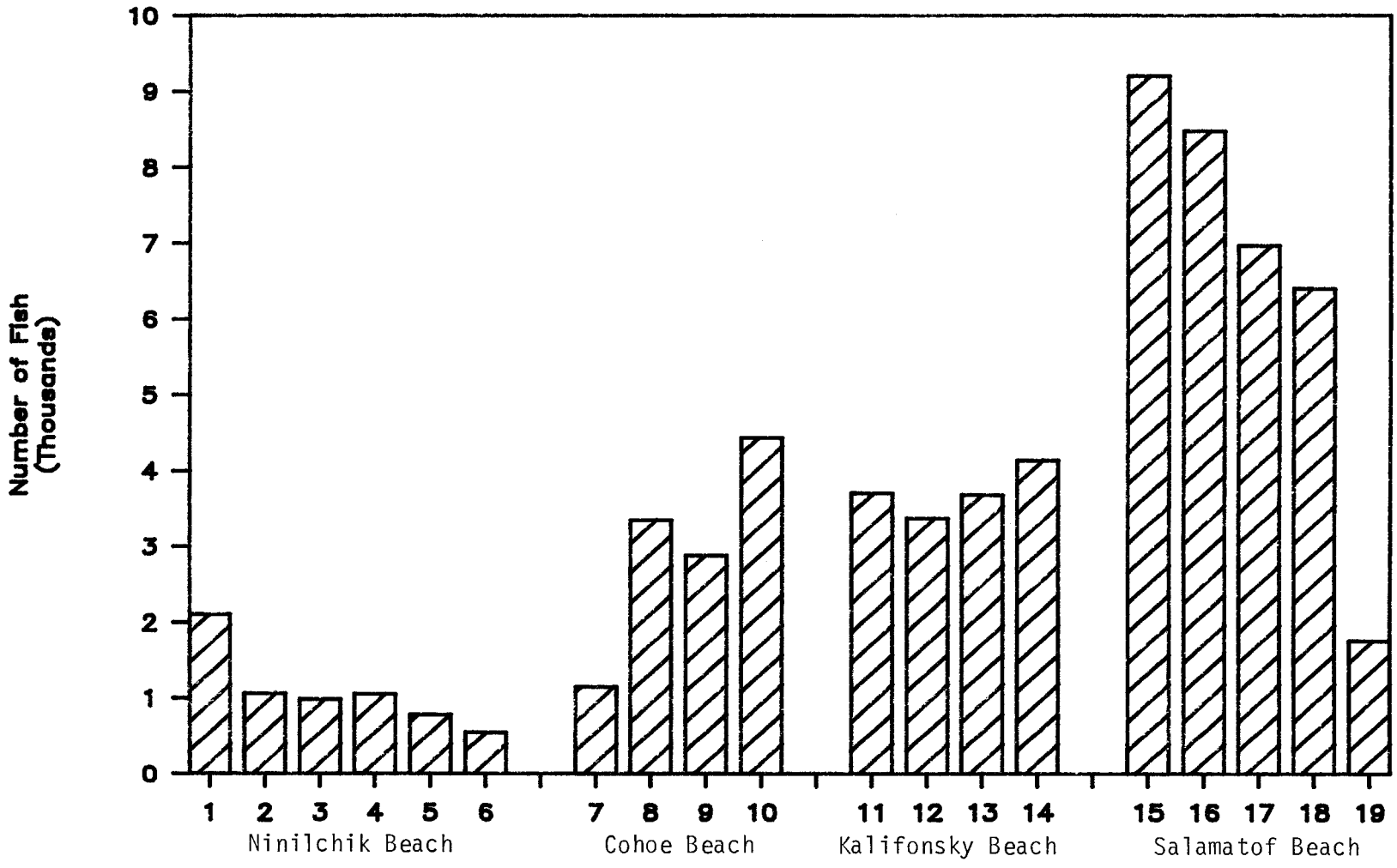
Appendix Figure 7. Grand mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1979.



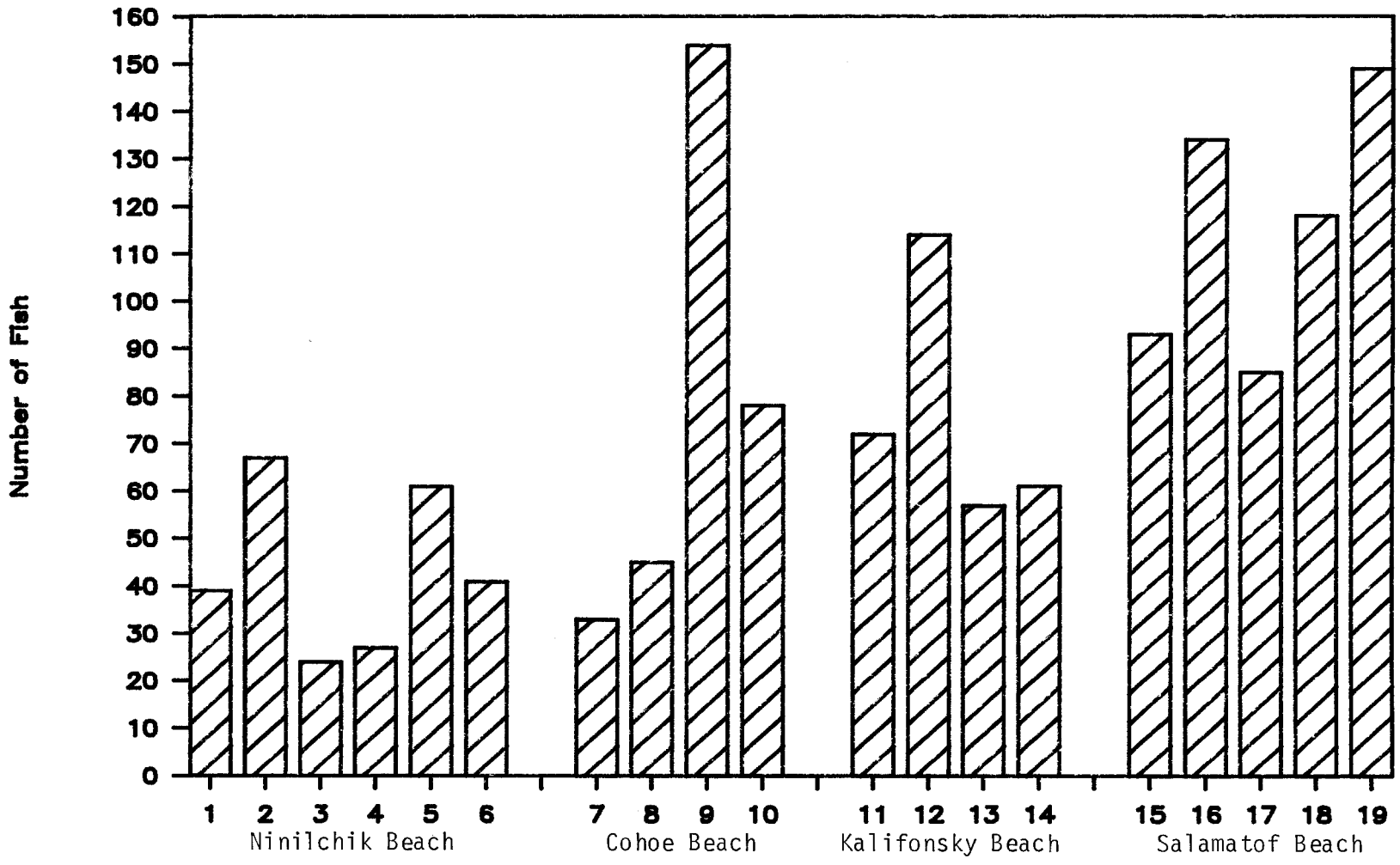
Appendix Figure 8. Grand mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1980.



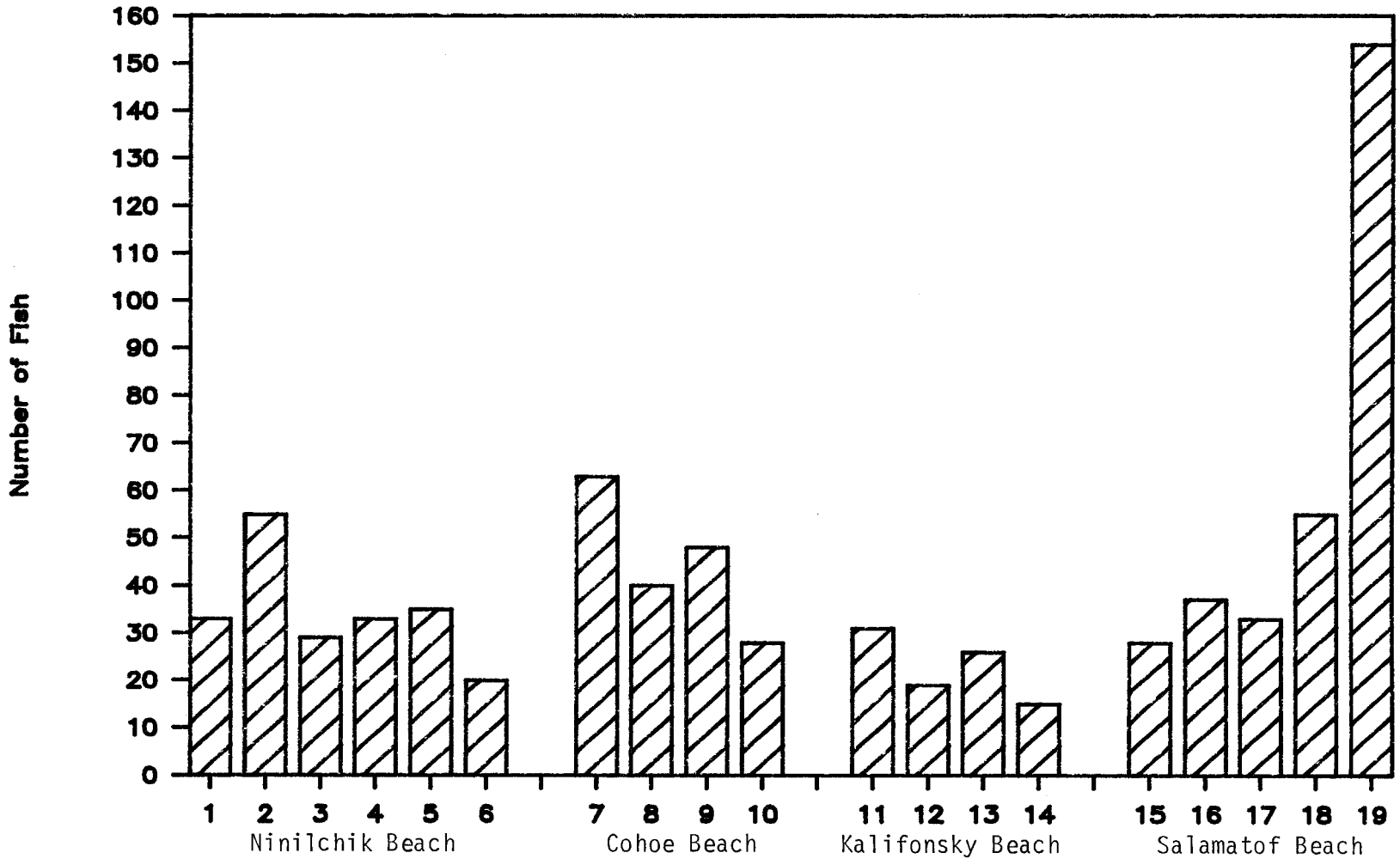
Appendix Figure 9. Grand mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1981.



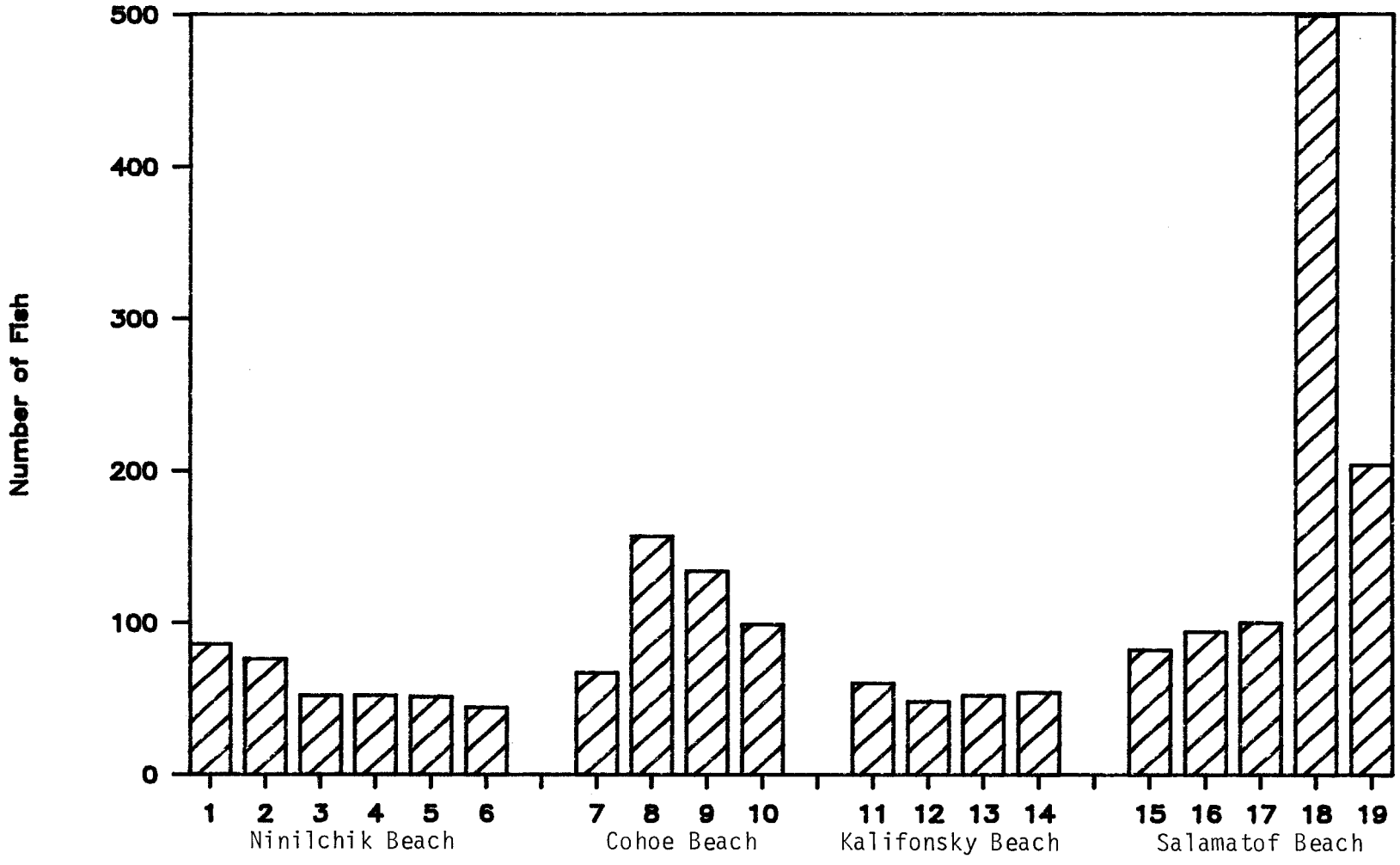
Appendix Figure 10. Grand mean sockeye salmon harvest per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1982.



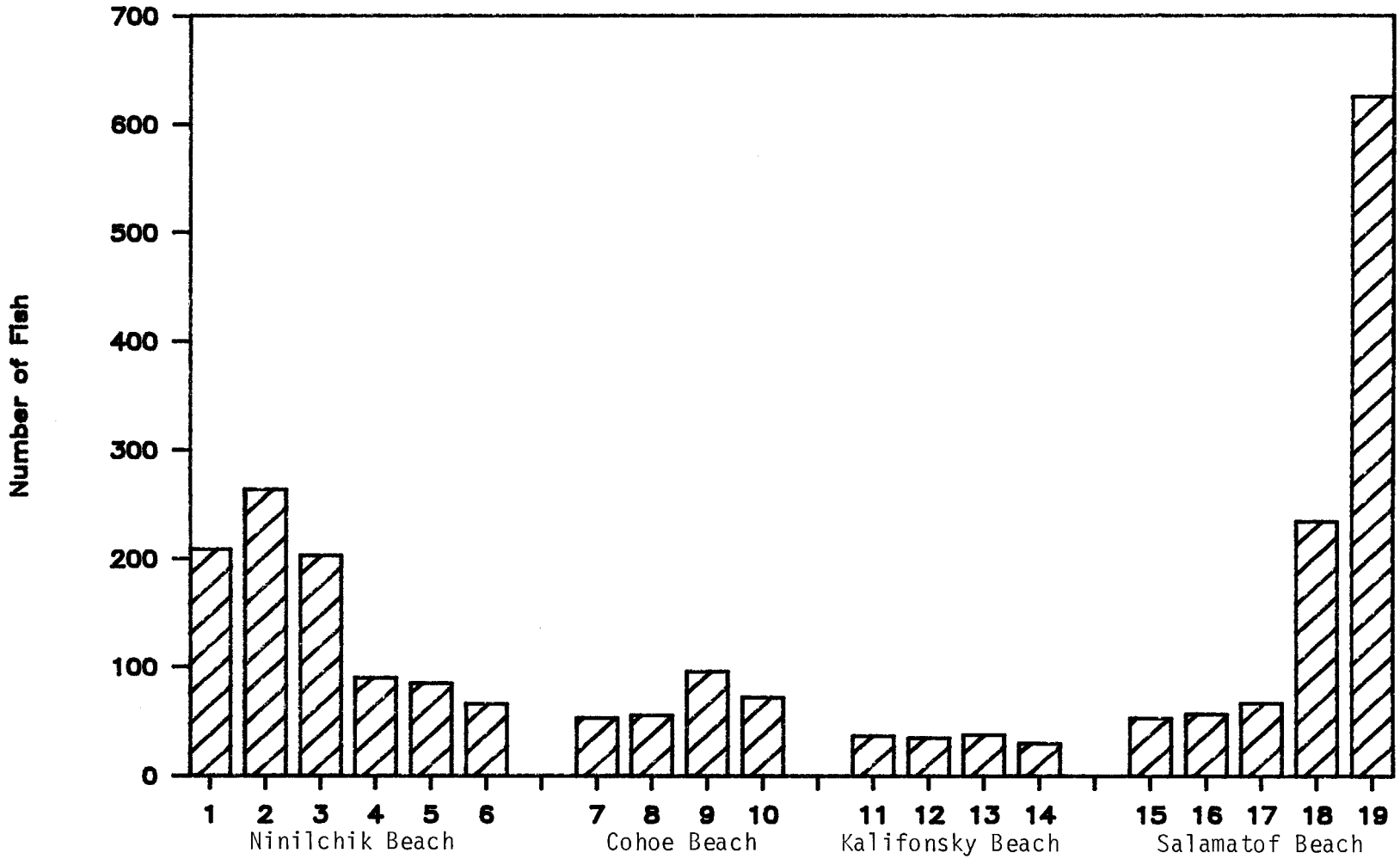
Appendix Figure 11. Grand mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1978.



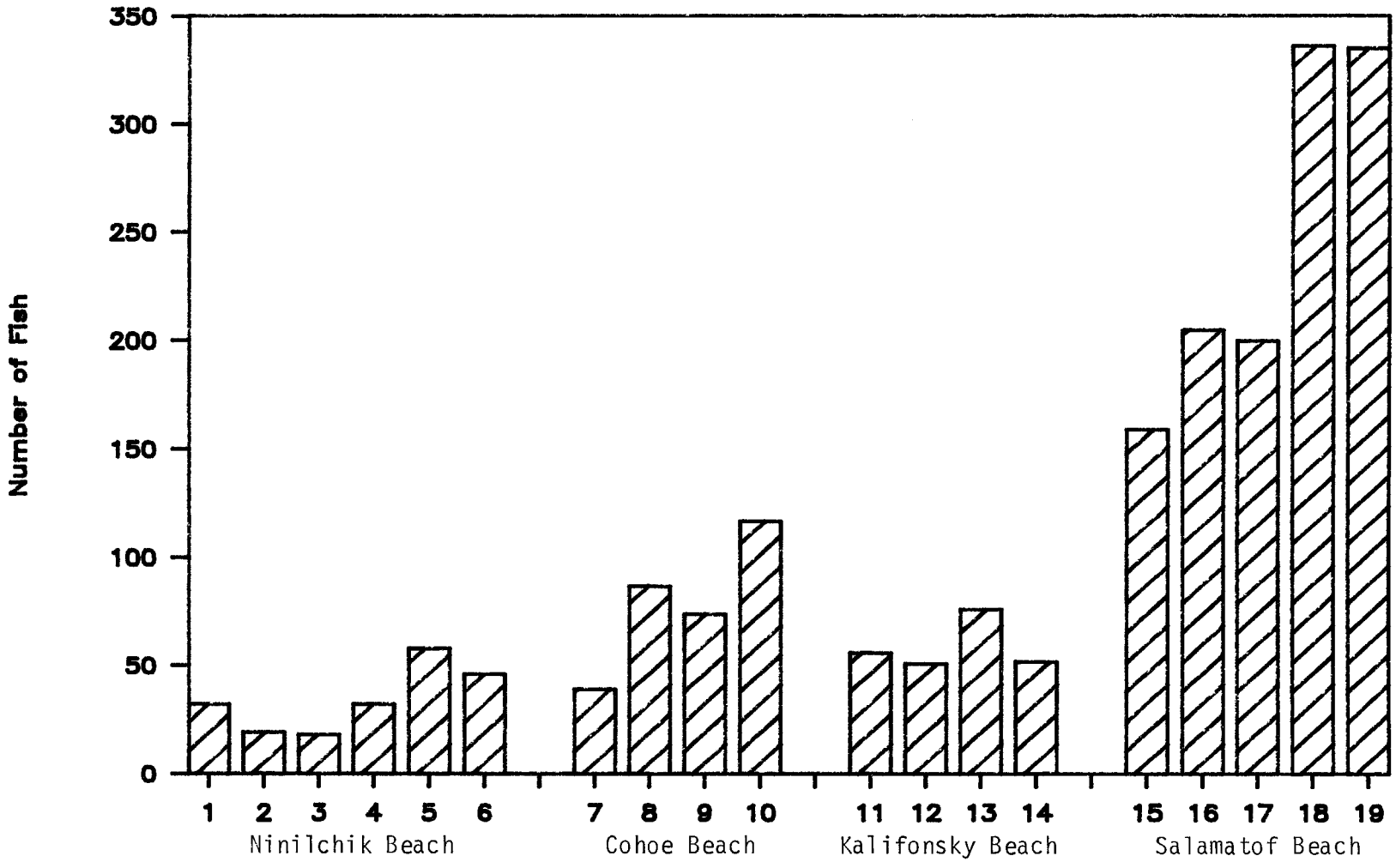
Appendix Figure 12. Grand mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1979.



Appendix Figure 13. Grand mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1980.



Appendix Figure 14. Grand mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1981.



Appendix Figure 15. Grand mean sockeye/chinook salmon harvest ratio per set gillnet permit in the Upper Subdistrict, Upper Cook Inlet, Alaska, by group, 1982.

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