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SUMMARY OF MANAGEMENT TECHNIQUES CATCHES AND ESCAPEMENT FOR THE KUSKOKWIM AREA COHO SALMON STOCKS

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Summary of Management Techniques, Catches and Escapements for the Kuskokwim Area Coho Salmon Stocks.

We have three primary stocks of coho salmon in the Kuskokwim Area commercial fishery. The Kuskokwim, Kanektok and Goodnews Rivers' stocks. The Kuskokwim River stock is harvested in the lower and middle Kuskokwim River, Districts 1 and 2, respectively. The Kanektok stock along with some adjacent drainages is harvested at Quinhagak, District 4. The Goodnews stock along with adjacent drainages is harvested in Goodnews Bay, District 5 (Figure 1).

Unlike the other salmon species in the Kuskokwim Area, the coho salmon subsistence harvest has been relatively insignificant in comparison with the stocks' production capabilities. For this reason, we have not closely monitored the subsistence coho salmon harvest. We are beginning to document this harvest more completely since there is a trend of increasing use by subsistence fishermen. This increased use appears to be connected with the availability of home freezers since the late summer and fall weather preventing the traditional smoking and drying of coho salmon was the primary reason for their unpopularity in the subsistence fishery in the past.

The commercial coho salmon fisheries on the Kuskokwim and Kanektok stocks are well documented from 1960. The Goodnews Bay stock was closed to commercial fishing until 1968. At that time, local interest and the Department's determination that a limited harvest of coho salmon would not

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interfere with the subsistence fishery or the reproductive potential of the stock resulted in an opening by emergency order. There has been annual fishery for all salmon species since that time.

A greater sustained effort by fishermen began in the coho salmon fisheries in all districts except District 2 in the mid 1970's (Table 1). This was primarily a result of increasing processor commitment during August. The increasing effort resulted in an increase in production of coho salmon. The recent favorable environmental conditions that have resulted in record catches statewide; in combination with the reduction in high seas, coho salmon interception as a result of the relocation of the Japanese fleet in 1979 have resulted in record catches in recent years. As a result of these developments, since 1979, coho salmon have been economically the most important species in the Kuskokwim Area.

The area's coho salmon escapement program began in 1959 and 1960 with aerial surveys. The next flurry of surveys was in 1968. The mid 1970's saw a few more coho salmon escapement surveys (Table 2). Weather, fiscal constraints and time availability conspired during the first two decades to prevent a consistent comparable coho salmon survey program. In 1980, awareness of the new economic importance of coho salmon resulted in a new emphasis being placed on coho salmon surveys including decation of a budget. As Table 2 shows inspite of this, most streams have only been surveyable in two or three of those five years. This has been primarily caused by weather and associated high water that is common in late August and early September.

The aerial surveys and recent studies in the Tuluksak and Holitna drainage have at least taught us the problems, if not the solution, to indexing coho salmon escapement by aerial survey. Coho salmon are the most widely distributed of the salmon species in the area. They utilize first through fourth order tributaries for spawning and as a result they are widely dispersed when spawning. For this reason, the best aerial surveys are obtained in late August and early September when the migration is peaking in the relatively short clear water segments of the first order tributaries, between the turbid lower portion and the second order tributaries. Many rivers do not have one of these clear water windows; while the rains of August frequently eliminate the windows where they exist.

We are continuing our aerial index program, but coho salmon appear to be a species whose run timing and habits may limit aerial survey success to reconnaissance surveys and "weather allowing" confirmation of the manager's gut feeling.

The new emphasis on coho salmon also resulted in increased funding for the Kogrukluk River weir to operate through the coho salmon migration. Due to high water plaguing the weir in 1980, the funds were used to operate a "pilot" coho salmon escapement project with sonar on the Aniak River. It was quite successful since the major sonar problem of species apportionment was solved by no other species being present except for about 8 percent of the total count being apportioned to chums during the first week of the project. Our success has not been shared by all areas, however. The Arctic area has attempted to use both substrate and substrateless sonar to count coho salmon escapement in the Unalakleet River for three years. The

project has not been very successful due to apportionment problems caused by char, whitefish and other esturine species. The rapid water level fluctuations have made it difficult to keep the migration path in the ensonified water column and of course the eternal milling problem has cropped up. We believe that sonar has potential for coho salmon escapement enumeration, but as seems to be the case in most sonar applications, location is of critical importance.

In 1981, the extra funding was returned to the Kogrukluk weir, and it has operated through the coho salmon migration since that time (Table 3). In 1985, we did run into high water problems again which required opening the weir for 16 days. This time period was estimated based on the previous years' percent of migration for that period. This is probably a conservative estimate since Leon Shaul told us that their tagging studies at weir sites indicated that migration passage rates peak during high water events. The success that coho salmon show in navigating beaver dams indicates that this may also be the case in the Kuskokwim Area. We applied the weir results to management in 1984 by establishing a provisional escapement objective of 25,000 coho salmon.

Three data points is a weak base, but our reasoning was that 1981 was a typical catch achieved with a scheduled fishery. The 1982 was a record catch with the same schedule and that 1983 was a poor catch with an early closure due to poor CPUE in the fishery. On that basis, 1983 was classified as a poor escapement, 1981 was felt to be a low acceptable escapement and 1982 was felt to be a high escapement. The midpoint between 1981's 11,500 and 1982's 39,000 seemed like a reasonable target until the

data base improved. The 1981 escapement produced the third largest catch on record and also doubled the parent year escapement in 1985. The question of how representative of the Kuskokwim drainage coho salmon population the Kogrukluk River population is, along with numerous other questions, remain to be answered.

The most recent addition to our arsenal of coho projects is the drift gill net test fishery in the Kuskokwim River at Bethel that we began during the 1983 coho salmon return. The initial pilot project in 1983 was successful enough that we shifted our entire test fishing effort for all species to it in 1984. This project is providing a total escapement estimate post-season and provides valuable information for inseason management. The catch composition of the commercial catch is accurately forecasted by this test fishery, and as we become more experienced with the program, we are gaining valuable insight into species abundance. Preliminary figures indicate that the exploitation rate of the Kuskokwim coho salmon stock has been 58 percent in 1981, 54 percent in 1984 and 49 percent in 1985. This project, by providing a repeatable index of run magnitude, holds the promise of allowing the development a much more exact management program in the future.

Management Strategies

The coho salmon management strategies vary with district and are still evolving. I'll start with the simplest strategies and end with the most complex, this will result in some geographic leap frog that I hope won't cause any confusion.

The management strategy in District 2, the middle Kuskokwim River is the simplest. The Board has established a guideline harvest range of 2,000 to 4,000 coho salmon to be taken between August 1 and August 31. District 2 has a quality problem due to its distance upstream and the fishery has been managed to remain static. We open District 2 about one week after District 1 to insure the majority of fish available are coho salmon. We then continue with simultaneous openings with District 1 to prevent massive effort shifts between the adjacent districts until the harvest guideline is reached, usually two to four 6-hour fishing periods. It is then closed.

District 4, Quinhagak and District 5, Goodnews Bay are managed with the fishing schedule strategy. In the past, 1985 was the first exception, these two districts have had low enough effort levels and large enough chum and sockeye salmon returns that the fishery was usually on a schedule of three 12-hour periods per week. This was allowed to continue through the decline of the chum salmon return and through the entire coho salmon return. The last open period normally had no effort due to processors pulling out and often in the past, the entire last week is missed for this reason. The fishing fleet is comprised of small, open, outboard powered skiffs. The average length is about 22 feet. The storms of August normally result in several no effort or extremely low effort periods. We only have aerial survey escapement data and that is very limited (Table 3). The fishery is managed by comparing commercial catch and CPUE to the prior years. If, as in 1984 extremely large catches are being made, we conduct early aerial surveys. In 1984, weather allowed and surveys confirmed that record escapements were also occurring and the fishery was allowed to continue undisturbed. This resulted in a record harvest. Sustained effort

by the commercial fishermen and processors is clearly the trend in these fisheries and the more recent years' catches are defining the expected harvest ranges of 30,000 to 50,000 coho salmon in District 4 and 20,000 to 40,000 in District 5. The previous 5 year average for District 4 is 70,000 and 40,000 for District 5 (Table 4). These high averages are primarily due to the record catches in 1982 and 1984, which may be unusual. The trend of sustained effort clearly points out the need for coho salmon escapement projects to allow the full utilization of the resource without damaging the coho salmon production.

The basic management strategy for District 1 in the Kuskokwim River is to harvest 150,000 to 250,000 coho salmon. Harvests in this range in the past have allowed adequate subsistence harvests and adequate escapements since harvests in this range have not resulted in serious declines in the stock. This fishery is opened when the test fishing catches indicate that coho salmon are the predominate species available. This usually occurs around the first of August. An analysis of the migratory run timing done by Helen Hamner, still in draft, showed a surprising consistency in run timing. Th mean peak of the run was 13 August with the earliest peak on 10 August and the latest on 16 August which may be a product of calendar variation rather than run timing variation.

The fishery is then managed to spread the harvest guideline over as much of the run as possible which normally means two 6 hour periods a week until the regulatory closure on 1 September. The primary technique used until recently was determining return magnitude from commercial catch data and

aiming for the low, midpoint or high end of the harvest range based on if the return seemed small, average or large.

As mentioned earlier, a provisional escapement goal was established at the Kogrukluk weir in 1984. By using the migratory run timing analysis, we began forecasting the final escapement. Combining this with the traditional analysis of the catch data and the apparent passage of coho salmon from the test fishery, we have for the last two years successfully maximized the harvest while achieving our single escapement goal. We are obviously at some risk of over utilizing a limited data base. The estimated exploitation rates of 54 and 49 percent would seem to indicate that the technique has not resulted in an overharvest and was confirmed by aerial surveys in 1984. It has also allowed the 1984 record harvest and the third highest harvest in 1985. Time and an increased data base will show us our errors and we hope allow even more refined management in the future.

Table 1. Kuskokwim Area commercial effort by district, 1970-1985[1]

YEAR	CHINOOK SEASON	CHUM SEASON	COHO SEASON	TOTAL
DISTRICT 1				
1970	361	[2]	266	387
1971	418	216	83	422
1972	405	176	245	425
1973	456	341	411	530
1974	606	467	516	666
1975	472	540	533	737
1976	561	517	516	674
1977	563	522	572	653
1978	615	61	597	723
1979	591	617	613	685
1980	553	579	586	663
1981	589	613	586	679
1982	610	576	596	686
1983	544	619	577	679
1984	520	586	619	654
1985	—[3]	598	627	654
Previous 5 Year Average (1980-1984)	563	595	593	672

Table 1. Kuskokwim Area, commercial effort by district, 1970-1985[1] (continued).

YEAR	CHINOOK SEASON	CHUM SEASON	COHO SEASON	TOTAL
DISTRICT 2				
1970	10	2/	11	18
1971	22	2/	2/	22
1972	12	2/	2/	12
1973	28	2/	2/	28
1974	36	2/	16	37
1975	38	2/	2/	38
1976	55	2/	11	57
1977	83	54	24	105
1978	28	2/	16	43
1979	41	2/	20	43
1980	37	21	12	43
1981	153	11	16	153
1982	38	50	25	60
1983	14	42	9	43
1984	15	49	32	49
1985	-	17	16	23
Previous 5 Year Average (1970-1984)	51	35	19	70

Table 1. Kuskokwim Area, commercial effort by district, 1970-1985 [1] (continued).

District 4		District 5	
YEAR	TOTAL	YEAR	TOTAL
1970	88	1970	35
1971	61	1971	16
1972	107	1972	14
1973	109	1973	21
1974	196	1974	49
1975	197	1975	50
1976	181	1976	40
1977	258	1977	34
1978	200	1978	35
1979	206	1979	30
1980	169	1980	48
1981	186	1981	48
1982	177	1982	48
1983	226	1983	79
1984	260	1984	77
1985	300	1985	69
Previous Five Year Average	192		60

1. Number of actual fishing vessels
2. No commercial fishing allowed.
3. Chinook salmon season (unrestricted mesh) estimated by regulation.

Table 2. Kuskokwim Area aerial survey results for coho salmon in Area Escapement index streams.

RIVER	DATE	NUMBER OF COHO
KUSKOKWIM DRAINAGE		
Kwethluk	9/08/83	809
	8/30/84	6,114
Kisaralik River	9/12/59	100
	10/01/76	1
	9/29/77	80
	9/08/83	406
	8/27/84	3,523
Tuluksak River	9/20/78	64
	9/09/83	373
	8/30/84	657
Aniak	9/19/78	140
	9/08/80	7,035
	9/15/83	765
	8/27/84	5,204
KUSKOKWIM BAY		
Kanektok River	8/19/60	420
	8/25/68	4,765
	8/22/80	69,325
	8/06/82	9,700
	8/26/84	46,830
Goodnews River		
Main Fork	9/12/59	4,100
	8/25/68	6,280
	8/21/80	23,671
	8/26/84	43,925
Middle Fork	9/09/68	1,980
	8/21/80	2,865

1. Excludes many reconnaissance surveys.

Table 3. Kogrukluk River Weir coho slmon data, 1981-1985.

YEAR	Operational Period	ACTUAL COUNTS Coho	EXPANDED COUNTS Coho
1981 1/	6/27-10/05	11,532	11,532
1982	7/09-9/14	35,581	38,961
1983	6/24-7/02;7/06-11 8/13-9/27	8,327	8,327
1984 1/	6/19-8/20 7/24-9/15	25,359	29,824 2/
1985	7/01-8/16 8/25-9/22	13,900	15,985 3/

1/ Not expanded due to completeness of actual counts.
2/ Actual 7/24-9/15 count was wxpanded to cover the period through 9/30.
3/ Preliminary figures.

Table 4. Kuskokwim area commercial catches by drainage, 1960-1985.

KUSKOKWIM RIVER [1]	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL
1960	5,969	0	2,498	0	0	8,467
1961	18,918	0	5,044	0	0	23,962
1962	15,341	0	12,432	0	0	27,773
1963	12,016	0	15,660	0	0	27,676
1964	17,149	0	28,613	0	0	45,762
1965	21,989	0	12,191	0	0	34,180
1966	25,545	0	22,985	0	0	34,180
1967	29,986	0	56,313	0	148	86,447
1968	34,278	0	127,306	0	187	161,771
1969	43,997	322	83,765	0	7,165	135,249
1970	39,290	117	38,601	44	1,664	79,716
1971	40,274	2,606	5,253	0	68,914	117,047
1972	39,454	102	22,579	8	78,619	140,762
1973	32,838	369	130,876	33	148,746	312,862
1974	18,664	136	147,269	84	171,887	337,984
1975	21,720	23	81,945	10	181,840	285,538
1976	30,735	2,971	88,501	133	177,864	300,204
1977	35,830	9,379	241,364	203	248,721	535,451
1978	45,641	733	213,393	5,832	248,656	514,255
1979	38,966	1,054	219,060	78	261,874	521,032
1980	35,881	360	222,012	803	483,211	742,297
1981	47,663	48,375	211,251	292	418,677	726,258
1982	48,234	33,154	447,117	1,748	278,306	808,559
1983	33,174	68,855	196,287	211	267,698	575,225
1984	31,742	48,575	623,447	2,942	423,718	1,130,424
1985	37,889	106,647	335,606	75	199,478	679,695
5 year average (1980-1984)	39,339	39,864	340,023	1,199	376,122	796,547

1. District 1 and District 2 combined.

Table 4. Kuskokwim area commercial catches by drainage, 1960-1985, (continued).

QUINHAGAK	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL
1960	0	5,649	3,000	0	0	8,649
1961	4,328	2,308	46	90	18,854	25,636
1962	5,526	10,313	0	4,340	45,707	65,886
1963	6,555	0	0	0	0	6,555
1964	4,081	13,422	379	939	707	19,528
1965	2,976	1,886	0	0	4,242	9,104
1966	278	1,030	0	268	2,610	4,186
1967	0	652	1,926	0	8,087	10,665
1968	8,879	5,884	21,511	75,818	19,497	131,589
1969	16,802	3,784	15,077	953	38,206	74,822
1970	18,269	5,393	16,850	15,195	46,556	102,623
1971	4,185	3,118	2,982	12	30,203	40,506
1972	15,880	3,286	376	1,878	17,247	38,667
1973	14,993	2,783	16,515	277	19,680	54,248
1974	8,704	19,510	10,979	43,642	15,928	98,133
1975	3,928	8,584	10,742	486	35,233	58,973
1976	14,110	6,090	13,777	31,412	43,659	109,048
1977	19,090	5,519	9,028	202	43,707	77,546
1978	12,335	7,589	20,114	47,033	24,798	111,869
1979	11,144	18,828	47,525	295	25,995	103,787
1980	10,387	13,221	62,610	21,671	65,984	173,873
1981	24,525	17,292	47,587	160	53,316	142,880
1982	22,106	25,685	73,651	11,838	33,336	166,616
1983	46,385	10,263	32,442	168	23,090	112,348
1984	33,652	17,258	135,342	16,249	50,424	252,925
1985	30,401	7,876	29,992	28	20,418	88,715
5 Year Average (1980-1984)	27,411	16,744	70,326	10,017	45,230	169,728

Table 4. Kuskokwim area commercial catches by drainage, 1960-1985, (continued).

GOODNEWS BAY	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL
1968	0	0	5,485	0	0	5,485
1969 [1]	3,987	6,256	11,631	298	5,006	27,169
1970	7,163	7,144	6,974	12,183	12,346	45,630
1971	477	330	1,771	0	301	2,879
1972	264	924	925	66	1,331	3,510
1973	3,543	2,072	5,017	324	15,781	26,737
1974	3,302	9,357	21,340	16,373	8,942	59,314
1975	2,156	9,098	17,889	419	5,904	35,466
1976	4,417	5,575	9,852	8,453	10,354	38,651
1977	3,336	3,723	13,335	29	6,531	26,954
1978	5,218	5,412	13,764	9,103	8,590	42,087
1979	3,204	19,581	42,098	201	9,298	74,382
1980	2,331	28,632	43,256	7,832	11,748	93,799
1981	7,190	40,273	19,749	11	13,642	80,865
1982	9,476	38,877	46,683	4,673	13,829	113,538
1983	14,117	11,716	19,660	0	6,766	52,259
1984	8,612	15,474	71,176	4,711	14,340	114,313
1985	5,793	6,698	16,498	8	4,784	33,781
5 Year Average (1980-1984)	8,345	26,994	40,105	3,445	12,065	90,955

1. Includes Chagvan Bay.

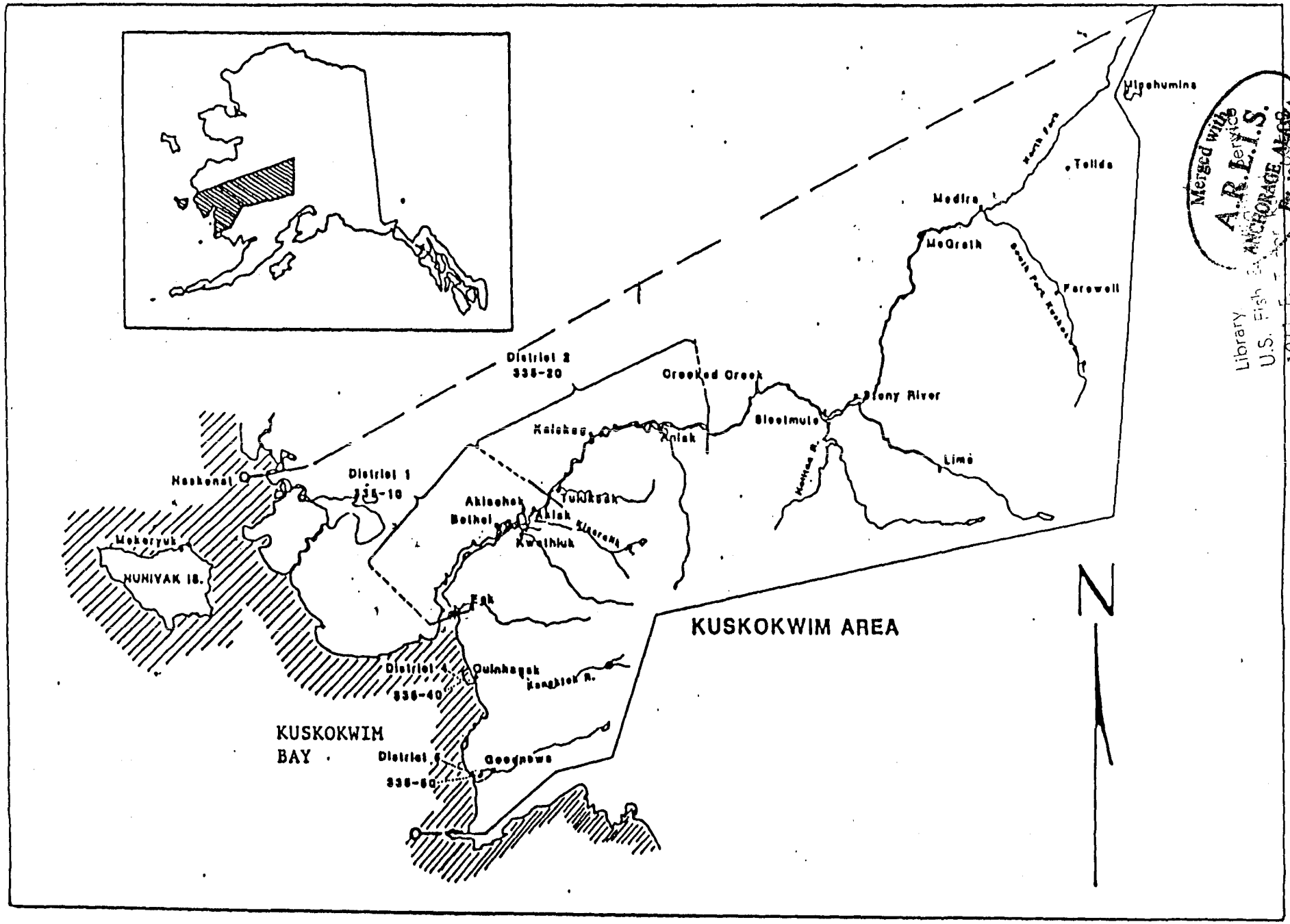

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Figure 1. Kuskokwim Area Map.