CHENIK LAKE SOCKEYE SALMON ESCAPEMENT OBSERVATIONS 1989-90

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KEY WORDS: Salmon, *Oncorhynchus*, escapement projection, weir

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INTRODUCTION

Chenik Lake, located approximately 80 miles southwest of Homer on the west side of Cook Inlet, is a 290 acre lake which supports a sockeye run with both natural and enhanced components. Natural spawning, fry stocking and lake fertilization all contribute to returns which in the last three out of five years have exceeded 100,000 fish.

In 1989 the southern portion of the Kamishak District, including Chenik Lagoon, was closed to commercial fishing due to the presence of oil resulting from the grounding of the EXXON VALDEZ. Emergency arrangements were made with Cook Inlet Aquaculture Association (CIAA) extending the Paint River Special Harvest Area to include the Chenik Lake return. Oil spill funding was made available for a weir at the outlet of Chenik Lake to: 1) enumerate adult escapement, and 2) guard against potential over-escapement in the event the single vessel contracted by CIAA proved inadequate to harvest all fish surplus to escapement needs. During the period of weir operations from 28 June to 31 July, 38,900 sockeye were harvested from the Chenik Lagoon portion of the special harvest area and 12,000 additional fish were counted past the weir into Chenik lake. The peak daily passage rate past the weir (2,991 fish) occurred on July 21.

During the 1990 season no adult salmon weir was operated at the outlet of Chenik Lake. The return was managed to allow fishing five days per week up to the stream mouth with an 8 day mid-run fishery closure for passage of sufficient escapement (10-12,000 fish) into the lake. For a three day period during that fishery closure, Fish and Game personnel monitored the lake's outlet stream and documented passage of a projected 7,384 sockeye into Chenik Lake. Combined with the pre-closure aerial estimate of 4,700 fish in the lake and an additional 5,000 fish estimated to have moved into the lake after July 22, the total 1990 escapement to Chenik Lake is estimated at approximately 17,000 sockeye.

METHODS

1989:

For the adult enumeration project, one Fisheries Technician already stationed at Chenik Lake for a Fisheries Rehabilitation and Enhancement Division (FRED) smolt project, and one emergency non-

permanent employee, were hired to operate and maintain an aluminum picket weir located at the lake's outlet. Two additional Commercial Fisheries personnel and all necessary materials were transported from Homer to Chenik Lake via float plane on June 27 to assist with weir assembly and construction of a 16' high counting tower. While the counting tower was not considered absolutely necessary, as the outlet stream is small and clear, it was considered desirable to: 1) provide technicians limited protection should bears accumulate at the weir, and 2) potentially enhance night viewing. Flood lights powered by a small portable generator were attached to the counting tower to further enhance night counting.

Weir operation began on June 28 and continued through 30 July. The weir was checked a minimum of every six hours around-the-clock. When fish were present counts were conducted as often as necessary to prevent large numbers of fish accumulating behind the weir and thus becoming an attractant to bears. Fish passage was regulated by a small removable section of the weir which, by a line and series of pulleys, could be opened and closed from the counting tower. Fish passing through the weir were counted on a hand tally counter and recorded in a daily weir log. Counting times, total daily counts and other pertinent information including numbers of bears, condition of fish, weather etc. were also recorded. This information was relayed daily to the ADF&G office in Homer via marine VHF radio.

1990:

A commercial fisheries closure of the Chenik Subdistrict, designed to allow escapement into the Chenik Lake system, took effect at 06:00 hours 16 July, 1990. This closure was timed to coincided with a series of high tides believed necessary for fish to successfully reach the lowest of a series of holding pools at the stream's outlet. Department of Fish and Game personnel were flown to Chenik Lake on 20 July, during the latter portion of the tide series, to monitor fish passage from the outlet stream into the lake. Fish moving up the small clear outlet stream from the falls to the lake were easily counted without the aid of a tower. A Fish and Game cabin at the lake outlet provided ideally located housing.

Counts were conducted for 20 minutes out of the hour and expanded by three to project the hourly passage rate. Counts were not always conducted during the same 20 minutes of each hour, and in some hours no counts were made. Average hourly passage rates for

each day were determined by dividing total number of fish observed for the day by the number of counts conducted on that day. Total daily escapement was calculated by multiplying the average hourly passage rate by the number of hours fish were observed to be moving into the lake. Fish were considered to have begun moving at the start of a counting day when counts exceeded 100 fish per hour. Darkness prevented counts beyond 23:00 hours. Formulas used to calculate escapement during the 20-22 July 1990 period are presented in Table 1.

Escapement to Chenik Lake during the period 23-30 July, 1990 was estimated by comparing 1989 and 1990 total harvest and these two years daily escapement rates for the period 20-22 July. These relationships along with the 1989 weir escapement data for 23-30 July were used to calculate the remaining 1990 escapement as presented in Table 2. This method assumes a similar run timing and simular harvesting effency in 1989 and 1990. Numbers of fish entering the lake after 30 July were assumed to be insignificant based on historic run timming.

RESULTS

1989:
During the 33 days of weir operation a total of 12,007 sockeye were counted into the lake for a mean passage rate of 364 fish per day. The largest daily escapement of 2991 fish occurred on 21 July. The lowest daily escapement of 0 fish occurred on 5,6,7 and 12 July. The special harvest area including Chenik Lagoon was opened by emergency order at 6:00 a.m. on 02 July until 6:00 a.m. 30 August. Escapement totaled only 7 fish in the 5 days following the opening of the special harvest area to fishing. On 17 July the first 'colored-up' fish were observed at the weir, and by 21 July an estimated 20% of the fish passing through weir were beginning to 'color-up'. Sockeye weir counts by date and time are presented in Table 3.

1990:
On the first of three consecutive counting days (20 July), observations were conducted from 16:45 hours until 23:00 hours. Hourly projections ranged from a low of 156 fish per hour at 18:45 hours to a high of 522 fish per hour at 19:40 hours. The last count of the day was made at 22:50 hours and was the third highest of the day at a projected 258 fish per hour. A total of six 20 minute counts were made on 20 July. Average passage rate for 20

July was 276 fish per hour over a 14 hour period for a total projected escapement of 3,864 fish. On 22 July counts were made from 06:50 hours to 17:00 hours. One additional count was made at 22:00 hours. A total of 9 counts were made on 22 July. Hourly passage rates ranged from 0 fish at 06:50 hours to a high of 354 fish per hour at 16:50 hours. The average passage rate was 139 fish per hour. Fish began moving in excess of 100 fish per hour by 09:00 hours. A 14 hour period of movement (from 09:00 hours to 22:00 hours) produced a projected daily escapement of 1,946 fish. On 23 July counts were made from 06:50 to 12:20 hours for a total of 5 counts. Counts ranged from 0 fish per hour at 07:50 to 333 fish per hour at 09:50 hours. Fish movement was projected to have occurred during a 13 hour period from approximately 10:00 hours to 23:00 hours. Average hourly passage rate was 119 fish and the daily projected escapement was 1,547 fish. Total projected escapement for the three day period was 7,384 fish. Hourly and daily escapement projections are presented in Table 4. Counting periods and numbers of fish observed are presented in Table 5.

During the three day observation period, fish appeared to began moving at 09:00-10:00 hours and continued to run after 23:00 hours, when poor light prevented any additional counting. Fish movement declined dramatically sometime during the night as passage rates by 06:00 hours were at or near zero.

In addition to monitoring escapement into the lake, fish movement through the falls was observed at approximately 19:30 hours on 21 July. At that time, approximately 5 hours after the high tide, a small number of fish were still moving from the intertidal lagoon area into the lowest of the holding pools. The tide at 19:30 hours was ebbing at the 5 + foot level.

Adequate escapement was confirmed by Sunday 22 July and the Chenik Subdistrict was reopened to commercial fishing on a five day per week basis at 6:00 a.m. Tuesday, 24 July, 1990.

Results of aerial estimates conducted on July 18 indicate 4,700 fish were present in Chenik Lake at that time. Calibration counts indicate 7,384 fish moved into Chenik Lake during 20-22 July. Escapement estimates for the period 23-30 July 1990 total 5,000 fish (Table 2). The sum of these escapement components indicate the total number of fish returning to the Chenik Lake system in 1990 was just over 17,000 fish.

Table 1. Formulas used to calculate hourly and daily escapement, Chenik Lake 20-22 July, 1990.

Hourly projection = 20 Minute calibration value X 3
Average hourly projection = $\sum$ Hourly projections ÷ Number of counts
Daily escapement projection = Ave. hourly projection X hours of fish movement
Fish movement (period) = First daily count when passage rate ≥ 100 Fish/hour to 23:00 hours

Table 2. Formula and calculations of escapement[1], Chenik Lake, 23-30 July, 1990.

Escapement to Chenik Lake from July 23 to 30 1990, (E^{90}), is calculated by:

$$\frac{E^{90}}{E^{89}} = \frac{\frac{e^{90}}{e^{89}} + \frac{H^{90}}{H^{89}}}{2} \text{ or; } \qquad E^{90} = (E^{89}) \times \left(\frac{\frac{e^{90}}{e^{89}} + \frac{H^{90}}{H^{89}}}{2} \right)$$

where: E^{90} = escapement 23-30 July 1990
E^{89} = escapement 23-30 July 1989
e^{89} = escapement 20-22 July 1989
e^{90} = escapement 20-22 July 1990
H^{89} = total 1989 harvest
H^{90} = total 1990 harvest

therefore:

$$E^{90} = (2{,}989) \times \left(\frac{\frac{7{,}384}{4{,}231} + \frac{69{,}189}{40{,}625}}{2} \right) = 2{,}989 \times 1.7 \text{ or } \underline{E^{90} = 5{,}081}$$

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[1]Assumes similar run timing and harvesting capicity in 1989 and 1990.

Table 3. Sockeye salmon weir counts, by date and time period, Chenik Lake, 1989.

DATE	START TIME	END TIME		No. FISH
6-28-89			DAILY TOTAL =	44
6-29-89	07:30	08:30		229
	10:50	11:00		21
	13:30	13:55		41
	18:00	18:00		5
	21:30	21:30		10
			DAILY TOTAL =	306
6-30-89	07:30	07:30		16
	19:94	19:45		4
			DAILY TOTAL =	20
7-01-89	09:50	09:50		7
	15:40	15:40		6
	20:45	20:45		2
			DAILY TOTAL =	15
7-02-89	08:00	11:00		373
	11:40	12:50		102
	14:15	14:15		37
	19:10	19:10		5
	23:00	24:00		65
			DAILY TOTAL =	582
7-03-89	01:00	02:00		323
	05:00	05:30		141
	07:00	11:00		39
	14:00	17:30		7
			DAILY TOTAL =	510
7-04-89	13:15	13:15		3
			DAILY TOTAL =	3
7-05-89			DAILY TOTAL =	0
7-06-89			DAILY TOTAL =	0
7-07-89			DAILY TOTAL =	0

continued

Table 3. (cont).

DATE	START TIME	END TIME		No. FISH
7-08-89	12:00	12:00		3
	19:40	19:40		1
			DAILY TOTAL =	4
7-09-89	08:00	09:00		32
	14:30	16:00		9
	19:00	23:00		7
			DAILY TOTAL =	48
7-10-89	04:10	05:10		182
	08:00	08:30		28
	15:00	18:50		40
			DAILY TOTAL =	250
7-11-89	15:30	16:30		16
	19:00	19:00		11
			DAILY TOTAL =	27
7-12-89			DAILY TOTAL =	0
7-13-89	19:30	24:00		163
			DAILY TOTAL =	163
7-14-89	04:45	05:10		47
	12:30	15:45		113
	19:15	19:30		31
	21:15	23:05		66
			DAILY TOTAL =	257
7-15-89	06:05	06:35		21
	21:30	24:00		51
			DAILY TOTAL =	72
7-16-89	09:30	11:40		18
	19:00	19:15		9
	21:40	23:45		370
			DAILY TOTAL =	397

continued

Table 3. (cont).

DATE	START TIME	END TIME	No. FISH
7-17-89	00:10	00:20	16
	05:20	06:05	193
	06:05	08:20	*
	12:00	12:40	27
	14:55	15:05	11
	20:40	23:00	18
		DAILY TOTAL =	265
7-18-89	00:05	01:10	156
	04:10	05:15	215
	14:10	18:30	37
	20:30	24:00	557
		DAILY TOTAL =	965
7-19-89	00:30	00:50	22
	03:35	03:50	123
	06:00	06:20	178
	09:15	09:25	127
	11:25	14:50	59
	18:00	22:50	50
	23:30	24:00	150
		DAILY TOTAL =	709
7-20-89	00:30	03:15	365
	04:40	07:45	94
	13:10	13:15	4
	21:50	23:00	22
		DAILY TOTAL =	485
7-21-89	00:01	06:10	1504
	08:50	13:55	809
	14:20	15:35	89
	16:15	19:15	462
	20:15	24:00	127
		DAILY TOTAL =	2991
7-22-89	00:30	07:15	627
	10:00	11:30	115
	12:30	16:25	13
		DAILY TOTAL =	755

continued

Table 3. (cont).

DATE	START TIME	END TIME	No. FISH
7-23-89	04:55	05:05	62
	10:55	13:55	30
	17:25	19:55	129
	21:00	23:00	48
		DAILY TOTAL =	269
7-24-89	04:55	05:20	218
	09:10	12:50	204
	15:15	18:00	349
	20:10	22:35	404
	23:25	23:50	11
		DAILY TOTAL =	1186
7-25-89	06:10	06:30	117
	07:45	10:40	163
	21:20	22:45	49
		DAILY TOTAL =	329
7-26-89	07:55	08:10	43
	12:00	12:20	32
	15:00	15:15	28
	17:55	20:00	16
	22:40	22:40	5
		DAILY TOTAL =	124
7-27-89	08:05	08:10	25
	15:15	18:00	192
	19:05	23:45	236
		DAILY TOTAL =	453
7-28-89	10:00	10:15	25
	20:45	20:55	33
	22:15	22:30	22
		DAILY TOTAL =	80

continued

Table 3. (cont).

DATE	START TIME	END TIME	No. FISH
7-29-89	08:10	08:25	133
	09:40	09:50	49
	13:40	13:50	23
	18:30	23:30	292
		DAILY TOTAL =	497
7-30-89	08:05	09:35	102
	11:40	11:55	45
	12:55	13:40	54
		DAILY TOTAL =	201
TOTAL 1989 CUMULATIVE ESCAPEMENT = 12,007			

Table 4. Hourly and daily projections of sockeye escapement into Chenik Lake, 20-22 July, 1990.

20 July:
Fish Movement Period = 09:00-23:00 hours = 14 Hours
Average Hourly Projection = 276 Fish/Hour
Total Daily Escapement Projection = 3,864 Fish

21 July:
Fish Movement Period = 09:00-23:00 hours = 14 Hours
Average Hourly Projection = 139 Fish/Hour
Total Daily Escapement Projection = 1,946 Fish

22 July:
Fish Movement Period = 10:00-23:00 Hours = 13 Hours
Average Hourly Projection = 119 Fish/Hour
Total Daily Escapement Projection = 1,574 Fish

Projected Escapement July 20-22, 1990 = 7,384 Fish

TABLE 5. Numbers of sockeye observed and hourly escapement projections into Chenik Lake, by date and time period, 1990.

DATE	START TIME	END TIME	No. FISH	HOURLY PROJECTION
7-20-90				
	16:45	17:05	55	165
	17:45	18:05	77	231
	18:45	19:05	52	156
	19:40	20:00	174	522
	20:40	21:00	108	324
	22:50	23:1	86	258
			PROJECTED TOTAL =	1,656
7-21-90				
	06:50	07:10	0	0
	07:50	08:10	13	39
	08:45	09:05	56	168
	10:00	10:20	16	48
	10:50	11:10	7	21
	12:50	13:10	98	294
	15:20	15:40	95	285
	16:50	17:10	118	354
	18:00	WALKED TO FALLS*		
	22:00	22:20	98	294
			PROJECTED TOTAL =	1,248
7-22-90				
	06:50	07:10	4	12
	07:50	08:10	0	0
	08:50	09:10	7	21
	09:50	10:10	111	333
	12:20	12:40	77	231
			PROJECTED TOTAL =	597