MONITORING KOKANEE SALMON ESCAPEMENT AND SPAWNING IN THE FLATHEAD RIVER SYSTEM

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INTRODUCTION

This report describes the results of monitoring during the 1985-86 kokanee spawning, incubation and emergence periods in the Flathead River System. This monitoring program was initiated during the 1984-85 season and will be continued through 1987, at least partly under Bonneville Power Administration funding.

Studies of kokanee salmon in the Flathead River system were conducted by the Montana Department of Fish, Wildlife and Parks (MDFWP) from 1979-1982 with funding provided by the Bureau of Reclamation (Graham et al. 1980, McMullin and Graham 1981, Fraley and Graham 1982). These studies resulted in flow recommendations in the Flathead River of 3,500-4,500 cfs, measured at Columbia Falls, during the kokanee spawning period (15 October - 15 December). A minimum flow of 3,500 cfs was recommended during the incubation period (15 December - 30 April). These flows were designed to eliminate the high incubation mortality which had occurred in kokanee redds dewatered by past Hungry Horse Dam operations. These flows were recommended through the Northwest Power Planning Council (NPPC 1982) and have been provided by the Bureau of Reclamation since 1982. Preliminary study flows were provided by the Bureau of Reclamation during 1980-81 and 1981-82. The study has continued since 1982 under Bonneville Power Administration funding with the purpose of evaluating and fine tuning the flow recommendations.

This monitoring program was developed and implemented to evaluate the effectiveness of the Departments recommendations for recovery of the kokanee population (Fraley and McMullin 1984, Clancey and Fraley 1985). Monitoring activities include kokanee

redd counts, snorkel counts of spawners, and fish samples for age and length data, a fall creel census, wintertime egg and alevin survival estimates, and springtime fry emigration sampling. These activities are considered essential for a clear, long-term picture of kokanee escapement and population trends in the river system. Continued monitoring of kokanee escapement will allow generation of a stock-recruitment curve for the river system. These activities are designed as the minimum monitoring program.

RESULTS

The first schools of migrating kokanee in 1985 were seen in the main stem Flathead River on September 4 near Therriault Access 3-4 miles upstream of the Sportsman Bridge. The peak count occurred on October 2 and was nearly achieved again on October 9 and 22 (Figure 1). Flights were cancelled after October 22 due to unusually high fall runoff and poor visibility. Nearly twice as many kokanee were present in the Flathead River in late October 1985 than at that time in any previous year.

A creel survey conducted from August 25 through October 22 estimated a total river harvest of 13,796 kokanee (Table 1). Nearly 70 percent of the kokanee harvested in the river were caught in river section 1 in the Salmon Hole and Foys Bend, where spawners stage before continuing their upstream migration.

Kokanee redd counts were difficult to complete due to fall river flows 300 percent above normal and ice formation in almost all areas before the completion of spawning. Ice scour obliterated many redds. Based on aerial kokanee counts and incomplete redd counts, an estimated minimum of 20,000 kokanee spawned in the main

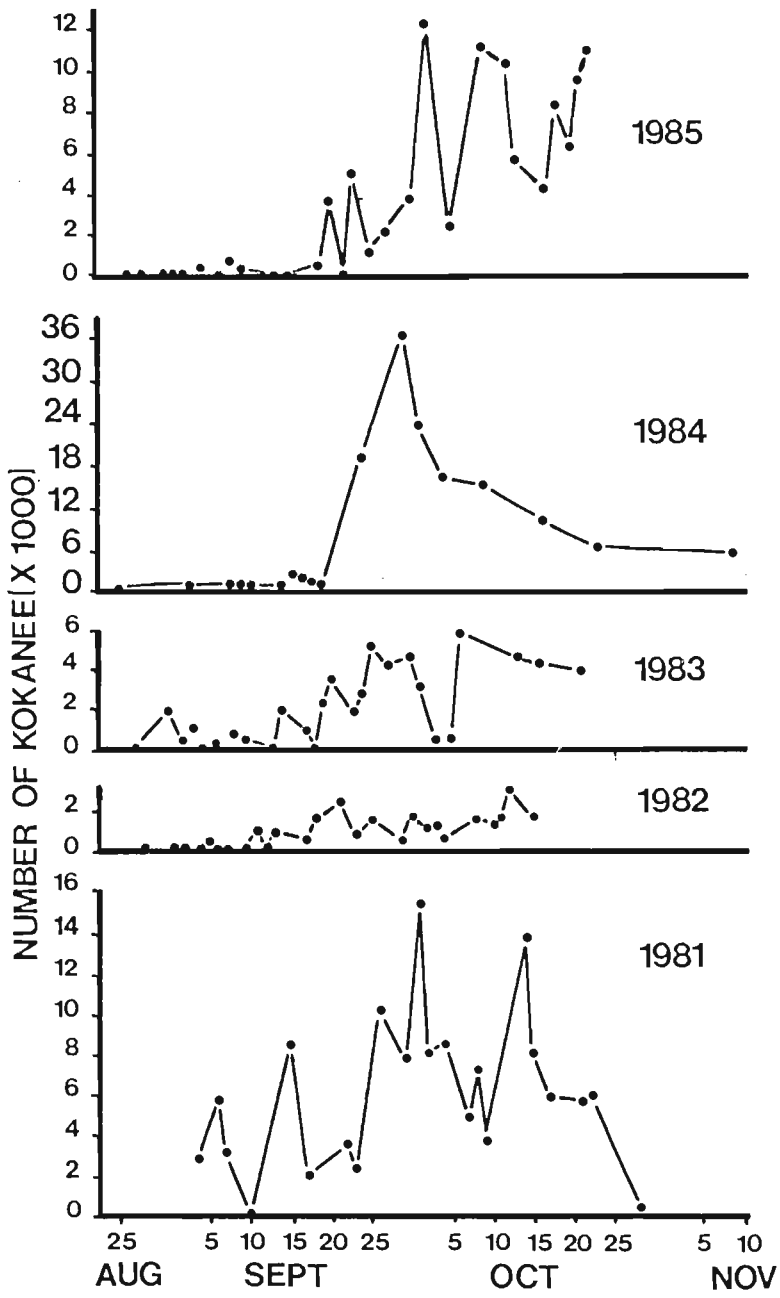

Figure 1. Aerial spawner counts and migration timing in the Flathead River, 1981-1985.

Table 1. Estimated kokanee harvest from the Flathead River, 1985. Estimated pressure (in hours) is in parenthesis.

Survey Strata		River Section*				
		4.1	4.2	4.3	4.4	2.1
1	Aug. 25 - Sept. 7	4526 (3324)	0 (0)	0 (0)	0 (0)	0 (0)
2	Sept. 8 - Sept. 21	4481 (4144)	9 (835)	947 (676)	975 (553)	0 (0)
3	Sept. 22 - Oct. 5	318 (1023)	105 (621)	430 (639)	1428 (570)	172 (120)
4	Oct. 6 - Oct. 19	0 (0)	39 (228)	300 (222)	66 (108)	0 (0)
5	Oct. 20 -	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Totals		9325 (8491)	153 (1684)	1677 (1537)	2469 (1231)	172 (120)
Percent of total		67.6 (65.0)	1.1 (12.9)	12.2 (11.8)	17.9 (9.4)	1.2 (0.9)

* River Sections
- 4.1 Flathead Lake to the mouth of the Stillwater River.
- 4.2 Mouth of the Stillwater to Pressentine Fishing Access.
- 4.3 Pressentine Fishing Access to Highway 2 bridge in Columbia Falls
- 4.4 Highway 2 bridge at Columbia Falls to confluence of North and Middle Forks
- 2.1 Middle Fork Flathead River confluence with North Fork, to McDonald Creek.

stem Flathead River (Table 2). Redds built by early spawning fish were exposed to desiccation and freezing after fall flows receded. The South Fork of the Flathead River contained 863 redds, nearly three times as many as in 1981, but less than 1/3 the number counted in 1984. Beaver and Deerlick Creeks held 761 redds, more than any previous year on record. Forty-two redds were counted in the Middle Fork of the Flathead near Beaver Creek. Only a small portion of the Middle Fork was surveyed because of the ice cover. A count could not be obtained for the Whitefish River.

Snorkel trend counts in McDonald Creek peaked at 122,875 kokanee on October 29. This is the greatest number of spawners ever counted in McDonald Creek. An estimated total of 146,870 kokanee spawned in the Flathead River System in 1985, more than in any other year of study.

Average length of spawners in the river system in 1985 was 365 mm, an increase of 20 mm over the 1984 average length (Appendix Tables 1 and 2). In 1984, a significant portion of the spawners were age II+, but in 1985, no II+ spawners were sampled.

Egg and alevin sampling was completed in McDonald Creek, Beaver Creek, the South Fork of the Flathead and three areas of the main stem Flathead River. Other areas were not sampled because redds were unrecognizable due to high flows and ice scour. Instantaneous survival in the main stem areas averaged 77.9%. No hatching had occurred in the river by mid February. Survival in McDonald Creek was 83.8%. Only 8.6% of the embryos sampled in McDonald Creek had hatched by mid February. Sampling in McDonald Creek in 1984 showed 29 percent hatch by mid-January, and

Table 2. Estimated numbers of post harvest kokanee spawners in the Flathead River system, 1979-1985. Figures represent minimum trend counts. The percent contribution for each area is in parentheses.

	Estimated number of spawners						
	1979	1980	1981	1982	1983	1984	1985[d]
McDonald Creek[a]	65,000 (90)	49,500 (96)	103,500 (79)	30,965 (80)	34,306 (60)	86,729 (75.8)	122,875 (83.7)
Mainstem Flathead River[b]	6,785 (10)	1,121 (2)	19,073 (15)	3,720 (10)	16,279 (28)	17,839 (15.6)	20,000 (13.6)
Whitefish River[b]	---	1,022 (2)	998 (<1)	1,836 (5)	1,272 (2)	2,359 (2.1)	-----[c]
South Fork Flathead River[b]	---[c]	---[c]	720 (<1)	480 (1)	4,493 (8)	7,510 (6.5)	2,071 (1.4)
Beaver-Deerlick Creeks[b]	0	---[c]	1,723 (1)	101 (<1)	1 (<1)	0	1,826 (1.2)
Middle Fork Flathead River	---[c]	---[c]	5,520 (4)	1,802 (4)	1,330 (2)	400 (0.3)	100 (.1)
TOTAL	71,785	51,643	131,534	38,904	57,681	114,837	146,872

[a] Live peak snorkel count plus dead fish.
[b] Estimated by multiplying redd counts by 2.4.
[c] No count.
[d] Redd counting was difficult to accomplish due to fall flows 300% above normal and nearly complete ice formation in most areas before the completion of spawning. The count for the main stem is the estimated minimum number of spawners.

20 percent hatch by mid February 1985. The later development of the embryos in 1986 may have been caused by late spawning fish superimposing their redds over those of early spawning fish. In Beaver Creek and the South Fork of the Flathead, sampled in mid March, survival was 92 and 93 percent, respectively. Nineteen percent of the embryos in the South Fork and 92 percent of the embryos in Beaver Creek had hatched.

An estimated 9.9 million fry emigrated from McDonald Creek in 1986. Emigration in McDonald Creek began in early March, peaked in late May, and ended in early July. Fry emigration from Beaver Creek was well underway when netting began in mid March. The peak occurred in late March-early April and emigration ended in mid May. A minimum of 343,000 fry emigrated from Beaver Creek.

Kokanee fry were first captured in the Flathead River at the Sportsmans Bridge, two miles upstream upstream from Flathead Lake, in early April. The peak of fry movement past the Sportsmans Bridge was in early to mid June and no fry were captured after early July. An estimated 2.2 million fry passed the Sportsmans Bridge on their way to Flathead Lake. Netting was difficult in the river due to debris in the nets, high current velocities during spring runoff, and slack water conditions due to the increase in Flathead Lake water levels in the late spring. The estimate for the Flathead River at the Sportsmans Bridge is probably low due to these factors. Mortality in the river is probably not as high as the data may suggest.

Eyed egg plants were made in three river spawning areas and in Deerlick Creek. In late March, river spawning areas 13, 25, and 27 received 40,000 eggs each, due to the possibility of redd desiccation and freezing during the winter and 20,000 eggs were planted in Deerlick Creek to supplement the run there.

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APPENDIX

Appendix
Table 1. Summary data for length (mm) and age of kokanee salmon collected in the Flathead River system from 1970-1984. Data are from Hanzel and Rumsey, Progress Reports F-7-R-33, 1970-84.

Year	No. fish			Average length [a]			% Age II+ [b]			% Age III+			% Age IV+		
	Male	Female	Comb.	Male	Female	Comb.	Male	Female	Comb.	Male	Female	Comb.	Male	Female	Comb.
1985	96	96	192	371	358	365	0	0	0	95	95	95	5	5	5
1984	141	161	302	354	337	345	18	11	14	81	88	85	1	1	1
1983	116	140	256	376	361	369	3	1	2	88	96	92	9	3	6
1982	107	106	213	381	367	374	2	1	2	79	89	84	19	10	14
1981	85	120	205	373	356	364	0	0	0	82	95	89	18	5	11
1980	47	69	116	371	343	357	0	0	0	36	65	51	64	35	49
1979	92	102	194	345	328	336	0	0	0	85	98	92	15	2	8
1978	175	143	318	333	312	321	0	0	0	85	95	90	15	5	10
1977	321	309	630	323	310	316	4	1	2	89	94	92	7	5	6
1976	253	145	398	312	300	306	6	6	6	81	71	76	13	23	18
1975	114	123	237	315	302	308	0	0	0	56	69	63	44	31	37
1974	114	78	192	315	302	308	0	0	0	60	72	66	40	28	34
1973[c]	44	22	66	305	292	298	2	14	8	82	73	78	16	13	14
1972	49	27	76	333	318	325	0	0	0	32	37	34	68	63	66
1971	99	112	211	333	320	327	0	23	11	29	69	49	33	8	20
1970	74	83	157	325	310	318	0	0	0	34	31	33	66	69	67

[a] Combined length is an average of the mean male and mean female lengths.
[b] Combined age structure is an average of the mean male and mean female age structure.
[c] Figures from 1970-1973 are McDonald Creek fish only.

Appendix
Table 2. Length and age data for kokanee salmon collected in Flathead River system spawning areas from 1970-1984.

Year	No. fish			Average length			% Age II+			% Age III+			% Age IV+		
	Male	Female	Comb.	Male	Female	Comb.	Male	Female	Comb.	Male	Female	Comb.	Male	Female	Comb.
Flathead River, Spring (Brenneman's Slough)															
1985	22	12	34	372	351	362	0	0	0	95	92	94	5	8	6
1984[a]	123	138	261	354	345	350	14	13	14	71	87	82	14	0	4
1983	29	51	80	381	366	374	0	0	0	100	98	99	0	2	1
1982[b]	168	225	393	388	369	378	6	3	4	83	97	90	11	0	6
1981	29	29	58	384	361	372	0	0	0	64	93	79	36	7	21
1980	32	40	72	372	343	358	0	0	0	30	61	46	70	39	54
1979	51	48	99	345	329	337	0	0	0	81	96	88	19	4	12
1978	36	18	54	335	317	326	0	0	0	89	94	91	11	6	9
1977	53	49	102	323	315	319	8	0	4	77	96	87	15	4	9
1976	51	35	86	320	307	314	0	8	4	82	52	67	18	40	29
1975	27	25	52	323	310	316	0	0	0	59	83	71	41	17	29
1974	33	11	44	325	310	318	0	0	0	79	91	85	21	9	15
Flathead River, Non-spring (Eleanor Island 1974-1979, House of Mystery 1981-1985, Kokanee Bend-1984)															
1985	17	33	50	370	369	370	0	0	0	87	100	95	13	0	5
1984	55	74	129	351	336	343	17	13	14	83	86	85	0	1	1
1983	36	31	67	373	353	363	0	0	0	100	93	97	0	7	3
1982	31	24	55	377	362	369	0	0	0	89	96	93	11	4	7
1981	27	27	54	358	345	351	0	0	0	96	96	96	4	4	4
1980	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1979	15	21	36	348	323	336	0	0	0	79	100	90	21	0	10
1978	49	49	98	329	310	320	0	0	0	84	96	90	16	4	10
1977	35	41	76	318	302	310	3	3	3	91	91	91	6	6	6
1976	50	47	97	302	295	298	10	2	6	82	84	83	8	14	11
1975	50	50	100	310	302	306	0	0	0	48	62	55	52	38	45
1974	50	43	93	305	297	301	0	0	0	56	60	58	44	40	42

Continued

Appendix
Table 2. Continued

Year	No. fish			Average length			% Age II+			% Age III+			% Age IV+		
	Male	Female	Comb.	Male	Female	Comb.	Male	Female	Comb.	Male	Female	Comb.	Male	Female	Comb.
McDonald Creek															
1985	26	29	55	373	358	365	0	0	0	96	93	94	4	7	6
1984	109	77	186	356	340	348	25	14	20	73	86	78	2	0	2
1983	31	32	63	371	358	365	14	4	9	72	93	83	14	3	8
1982	26	24	50	389	369	379	0	0	0	54	76	65	46	24	35
1981	29	64	93	381	361	371	0	0	0	89	97	93	11	3	7
1980	11	24	35	368	345	357	0	0	0	40	71	56	60	29	44
1979	26	33	59	348	330	339	0	0	0	96	0	48	4	100	52
1978	20	17	37	328	318	323	0	0	0	84	94	89	16	6	11
1977	41	50	91	315	305	310	0	0	0	96	83	90	4	17	10
1976	152	63	215	315	300	308	4	12	8	76	64	70	20	24	22
1975	37	48	85	312	300	306	0	0	0	65	71	68	35	29	32
1974	32	26	58	318	305	311	0	0	0	53	81	67	47	19	33
1973	64	22	86	305	292	299	2	14	8	82	73	77	16	14	15
1972	49	27	76	333	318	325	0	0	0	32	37	34	68	63	66
1971	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1970	74	83	157	325	310	318	0	0	0	34	31	33	66	69	67
Whitefish River															
1984	24	40	64	354	336	345	4	3	3	96	94	95	0	3	2
1983	20	26	46	384	363	374	0	0	0	78	96	87	22	4	13
1982	12	17	29	383	362	373	0	0	0	100	77	88	0	23	12
1980	4	5	9	375	339	357	0	0	0	75	75	75	25	25	25
1974	3	3	6	315	300	307	0	0	0	67	100	84	33	0	16
1972	28	12	40	284	338	311	0	0	0	65	74	69	26	35	31
South Fork Flathead															
1985	31	22	53	368	353	361	0	0	0	100	95	98	0	5	2

a/ Aging based on 7 males, 14 females.
b/ Aging based on 36 males, 35 females.