MONITORING KOKANEE SALMON ESCAPEMENT AND SPAWNING IN THE FLATHEAD RIVER SYSTEM

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INTRODUCTION

This report describes the results of the 1984-85 kokanee spawning, incubation and emergence monitoring efforts in the Flathead River System (Fraley and McMullin, 1984).

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 heavy 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 (NWPPC 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 continued in 1982 under Bonneville Power Administration funding with the purpose of evaluating and fine tuning the flow recommendations. This report summarizes kokanee escapement and spawning in the Flathead River system during 1984-85. The report is organized by activity. Priority one activities include: 1) kokanee redd counts, 2) snorkel counts of spawners, and 3) fish samples for age and length data.

Priority one 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. Priority one activities are designed as the minimum monitoring program, while priority two and three activities would be desirable if time and resources permit.

This monitoring program was initiated during the 1984-85 season and will be continued through 1987, at least partly under Bonneville Power Administration funding.

RESULTS

PRIORITY ONE ACTIVITIES

Kokanee Redd Counts

Numbers of spawning kokanee and redds were greater in all but one major river system spawning areas compared to the previous year (Table 1). The 12 major monitoring areas contained 60 percent (4,496) of the total 7,440 main stem redds (Table 2, Figure 1). Several areas not previously used for spawning were found in 1984. These areas contained 135 redds. Surveys in the South Fork of the Flathead revealed 3,129 redds, the highest count since the study began. The count of 999 redds in the Whitefish River was higher than in any previous year of study. For the second consecutive year no spawning occurred in Beaver and Deerlick Creeks.

The first schools of migrating kokanee in 1984 were observed in the Salmon Hole on September 3, and the peak count occurred on September 28 when fish were present in all river sections.

The improved flow conditions in the main stem may draw fish from other areas such as McDonald Creek where crowding can occur. It is possible in the early years of the recovery that cohorts affected by the present flow regime will show much greater increases than projected. Once the main stem population recovery is well underway, straying may occur from it back into areas such as the Middle Fork and Whitefish River.

Snorkel Counts

Snorkel trend counts in McDonald Creek estimated 86,700 spawners during peak abundance (Table 3). This is the second highest estimate for McDonald Creek since the beginning of the study. An estimated 114,837 kokanee spawned in the Flathead River System in 1984. Only in 1981 were there more spawners in the river system.

Table 1. Estimated numbers of post harvest kokanee spawners in the Flathead River system, 1979-1984. Figures represent minimum trend counts. The percent contribution for each area is in parentheses.

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

a/ Live peak snorkel count plus dead fish.
b/ Estimated by multiplying redd counts by 2.4.
c/ No count.

Table 2. Redd counts for the 12 main stem Flathead River spawning areas proposed for monitoring, 1979-1984.

Area description	Area number	Number of Redds						
		1979	1980	1981	1982	1983	1984	Total
Brenneman's Slough	1	425	136	341	180	278	155	1,515
Fairview	17	359	0	118	0	0	550	1,027
Pressentine Side Channel	20-21	55	13	830	0	154	660	1,712
Bucks	25	290	5	363	0	124	22	804
Hoerner	27	150	0	494	0	368	140	1,152
Kokanee Bend	29-30	275	0	469	22	300	99	1,165
Columbia Falls Bridge	32	---[a]	---[a]	735	0	199	137	1,071
Spring above Taylors	34	20	0	160	67	123	115	485
Columbia Falls Slough	36	330	231	0	0	0	0	561
Mouth of Slough and upstream bank	35-37	150	0	641	0	1,327	510	2,628
Anaconda Bar Spring	38	100	0	288	0	260	890	1,538
House of Mystery	39	---[a]	---[a]	1,083	560	1,852	1,218	4,713
TOTAL, 12 areas		2,154	385	5,522	829	4,985	4,496	18,371
TOTAL, 45 areas		2,802	467	7,853	1,528	6,680	7,440	26,635
% TOTAL		77	82	70	54	73	60	69

[a] Area not checked.

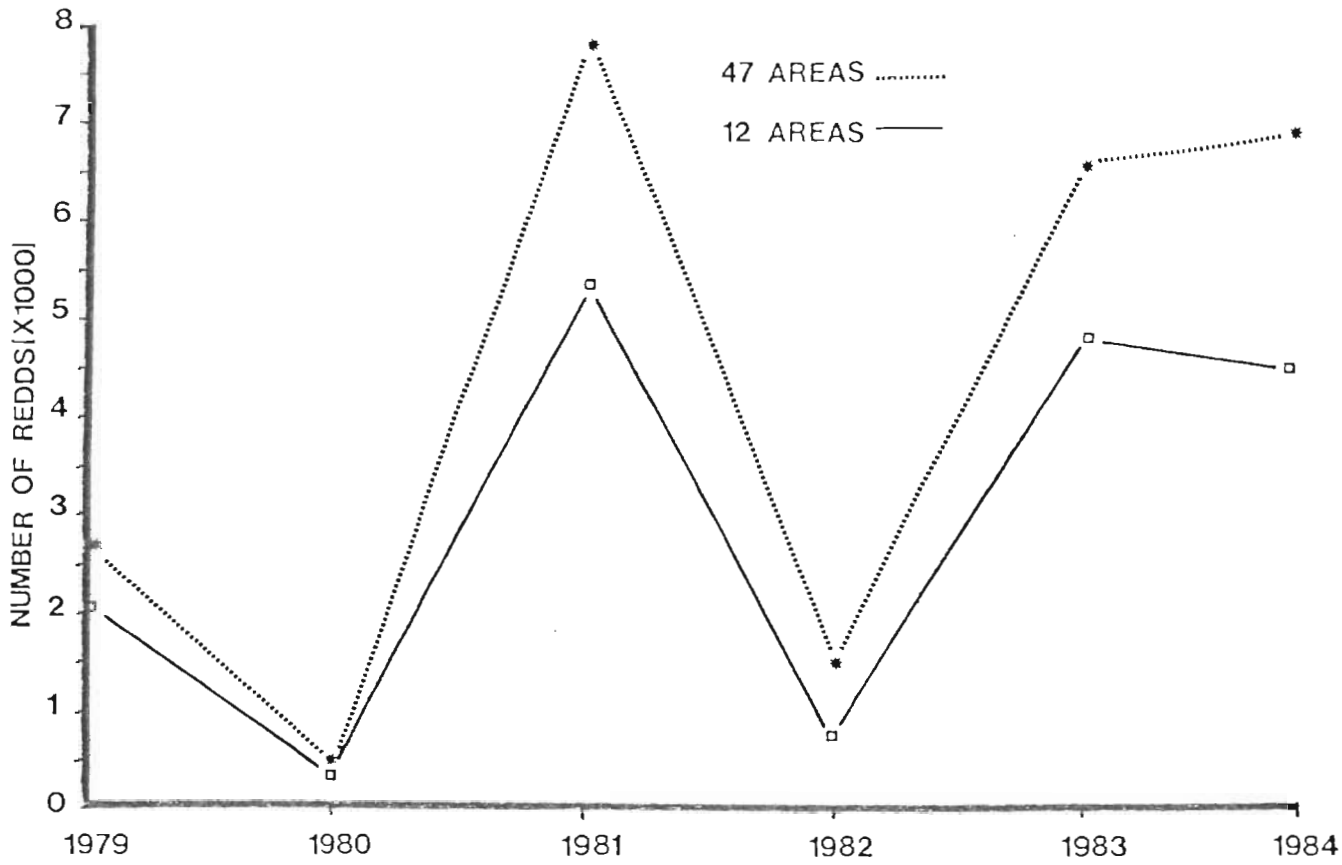

Figure 1. Yearly trends in kokanee spawner abundance in the main stem Flathead River as indicated by total redd counts in 45 areas (dotted line) and redd counts in 12 proposed monitoring areas (solid line).

Table 3. Snorkel counts of kokanee in McDonald Creek during 1984.

Date	Number of Kokanee				
	Low Count	High Count	Mean (live)	Dead	Total Mean
08/28/84	0	0	0	0	0
09/05/84	4	4	4	0	4
09/16/84	177	197	187	0	187
10/03/84	46,690	61,430	54,060	0	54,060
10/17/84	79,222	93,815	86,520	209	86,729
11/01/84	64,600	86,585	75,593	4,500	80,093
11/14/84	31,040	38,070	34,555	no count	---
11/28/84	5,933	6,748	6,340	no count	---

Fish Samples

Average length of spawners in the river system decreased by 24 mm from 1983, however the II+ age class made up a substantially larger portion of the spawning population in 1984 than in previous years (Tables 4 and 5).

PRIORITY TWO ACTIVITIES

Fry Sampling

Estimates of emigrating fry from various Flathead River System spawning areas varied greatly. An estimated 6,550,000 fry emigrated from McDonald Creek, the major kokanee spawning area in the Flathead drainage. This estimate is about half of the estimate of each of the previous three years. A possible explanation for the low estimate may be that high current velocities in McDonald Creek during the spring of 1985 caused the drift nets to rest at an angle in the water column, not faced fully into the current. Another factor may have been that mortality during late incubation was high due to the high density of eggs and alevins in the gravel and water temperatures just above freezing from late January to early March. Emigration from McDonald Creek began in February, peaked in mid-May, and ended in July.

Estimates of emigrating fry from the Whitefish River and main stem area 1 were 13,061 and 3,147 respectively. The 1985 estimate in the Whitefish River is similar to the 1982 estimate, but far short of the 1983 and 1984 estimates. Emigration began in February, peaked in early April and ended in May. Capture of emigrating fry may have been impaired due to ice conditions in the river and subsequent freezing of the net.

The 1985 fry emigration estimate in main stem area 1 is less than 10 percent of each of the 1982-84 estimates. Emigration began in February, peaked in mid March and ended in May. Netting did not begin until after fry

Table 4. 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.
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.

Table 5. 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)															
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 1981-1984, Kokanee Bend-1984)															
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

Table 5. 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															
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

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

emigration had began in area 1, so the estimate is low. Efficiency of the net is questionable due to clogging by aquatic vegetation. Other main stem areas are difficult to trap because they are not confined like area 1.

Timing of emigration in the Whitefish River and main stem area 1 was similar to previous years, except the peak of emigration varied by up to 3 weeks between years.

Creel Survey

A creel survey conducted during September 1984 resulted in closure of the kokanee fishery above Flathead Lake. Over 12,000 kokanee were harvested in 12 days from the Salmon Hole, where they held for an unusually long period of time. Daily catch rates (kokanee/hour) varied from 0.19 to 2.95 and averaged 1.63. Average catch rates and numbers of kokanee harvested in previous years in the Salmon Hole are shown in Table 6.

PRIORITY THREE ACTIVITIES

Egg and Alevin Sampling

Egg and alevin sampling was completed in five of the seven scheduled areas. The Whitefish River and the South Fork Flathead were not sampled due to ice cover and high flows, respectively. Survival in three main stem areas averaged 87.2 percent. During 1983-84 survival averaged 62 percent and during 1982-83 the average was 59 percent. Survival in McDonald Creek averaged 93.2 percent and ranged from 80.6 to 97.5 percent between sampling sites. These values may be artificially high due to the late sampling date at McDonald Creek and subsequent egg decomposition and consumption by predatory organisms. Spawning was about 1-1/2 to 2 weeks later than in most years and embryo development appears to have been slower in 1984-85 than in other years. By mid-February, 20 percent of the eggs in McDonald Creek had hatched, while in 1983-84 29 percent of all eggs had hatched by mid-January.

Table 6. Kokanee catch rates and harvest in the Salmon Hole Area of Flathead River.

Year	Catch rate (Kokanee/hour)	Number of Kokanee Harvested
1981	0.50	6,039
1982	0.22	1,120
1983	0.62	2,625
1984	1.63	12,063

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