Fisheries Division
Federal Aid Job Progress Report

Montana Statewide Fisheries Management

Federal Aid Project Number:	F-113-R1 (work completed July 1, 2000 – June 30, 2001) F-113-R2 (work completed July 1, 2001 – June 30, 2002) F-113-R3 (work completed July 1, 2002 – June 30, 2003)
Project Title:	Statewide Fisheries Management
Job Title:	Kootenai River Drainage Fisheries Management Project 3140
Project Period:	July 1, 1999 Through June 30, 2003

EXECUTIVE SUMMARY

We collected fish population data for 17 lakes in the Kootenai River drainage between June 1995 and December 1999. The lakes ranged in size from 9 surface acres to 46,500 surface acres. These surveys are part of a continuing effort to monitor wild populations, stocking success and illegal introductions.

In an effort to create a more successful rainbow trout (*Oncorhynchus mykiss irideus*) fishery at McGregor Lake, which has a high density of lake trout (*Salvelinus namaycush*), MFWP began boating the 2 to 4 inch fingerlings to sites throughout the lake. The technique looked promising so in 1997 we formed a "regatta" of boats to distribute stocked trout more evenly throughout the lake. In 1998 we requested that rainbow trout destined for McGregor Lake be held until at least early June. The combination of "regatta stocking" and later stocking date and a second stocking in September appears to have produced a successful spring/fall rainbow trout fishery.

There is evidence (both historic reports and genetic testing) to suggest that Kilbrennan Lake historically contained native Columbia Basin redband trout (*Oncorhynchus mykiss gairdneri*). Montana Fish, Wildlife and Parks (MFWP) personnel initiated discussion about chemical rehabilitation and re-stocking of Kilbrennan Lake with redband trout in 1984 as part of a basin-wide management effort. The most prevalent comment gotten from public scooping was that MFWP should poison the lake but re-stock with brook trout and redband

trout. The project is at an impasse until agreement can be made and meanwhile the fishery declines as a result of illegal introductions of black bullheads and yellow perch.

Since 1997 MFWP has partnered with Bonneville Power Administration to rehabilitate four lakes since 1995 that were illegally stocked with non-game species. To date all projects are non-game fish clean and growing healthy catchable westslope cutthroat trout and rainbow trout.

In an effort to help improve recreation and education opportunities in the Montana portion of the Kootenai River sub-basin, MFWP has worked in conjunction with BPA and local communities to create community fish ponds. To date we have completed the Troy project, nearly finished the Eureka project and are planning for a community pond in Libby hopefully by 2005.

We documented changes in the assemblage of fish species sampled in Lake Koocanusa since impoundment. Kokanee salmon, Kamloops rainbow trout and yellow perch did not occur in the Kootenai River prior to impoundment but are now present. Kokanee were released into the reservoir from the Kootenay Trout Hatchery in British Columbia, yellow perch may have dispersed into the reservoir from Murphy Lake.

Peamouth and northern pikeminnow were rare in the Kootenai River before impoundment, but have increased in abundance in the reservoir. Fluctuations in catch of kokanee in Lake Koocanusa have corresponded to the strength of various year classes and have varied by year. There is no apparent trend in abundance. Rainbow trout and westslope cutthroat trout were common in the Kootenai River before impoundment, but have decreased in abundance since impoundment.

British Columbia Ministry of Environment (BCMOE) first introduced Gerrard (Kamloops) rainbow trout in Lake Koocanusa in 1985. Montana FWP has stocked Duncan strain Kamloops rainbow trout annually since 1988 and since 2001, all stocked Kamloops have been triploid fish. The catch of Kamloops in fall floating gillnets (fish per net) was correlated with the number of hatchery Kamloops stocked in the reservoir the previous year for 1988 through 1999. Catch rates for Kamloops rainbow trout in fall gillnets has been low since 1996. We initiated a creel program in 2002. Responses have shown catch rates of 32 hours per fish. This is similar to other “Kamloops” lakes.

Kokanee lakes are monitored yearly to help identify potential management strategies; data are presented. Additionally, there is evidence from historic stocking records and personal observations that the kokanee lakes in the Kootenai drainage support at least some natural reproduction. Beginning in 1994, MFWP fed kokanee tetracycline laced feed to lay a mark in bony structures. Unfortunately, we have had no success with identifying the tetracycline marks from kokanee captured at any of the lakes. We are working with the hatchery system to treat eyed eggs with alternating cold and warm water to create unique daily growth rings on the otoliths since 2001. After several less than successful attempts, we believe we have a useable marking pattern.

BACKGROUND

The project area is located in northwest Montana and includes all Lincoln County and portions of Flathead County that include the Thompson Chain of Lakes Management area (Hensler and Vashro 1997). This portion of Region One encompasses all of the Montana portions of the Kootenai River drainage and portions of the lower Clark Fork of the Columbia River drainage (upper Thompson River drainage).

There are approximately 150 mountain and valley lakes and reservoirs in the project area that consistently provide more than 100,000 angler days of fishing for trout, salmon and other species of fish. Common introduced game fish are coastal rainbow trout (*Oncorhynchus mykiss irideus*), Columbia River basin redband trout (*Oncorhynchus mykiss gairdneri*) that include Duncan Gerrard strains (commonly referred to as Kamloops) brown trout (*Salmo trutta*), kokanee salmon (*Oncorhynchus nerka*), arctic grayling (*Thymallus arcticus*), brook trout (*Salvelinus fontinalis*), lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*) and yellow perch (*Perca flavescens*). Native gamefish include Columbia River basin redband trout (*Oncorhynchus mykiss gairdneri*), westslope cutthroat trout (*Oncorhynchus clarki lewisi*), mountain whitefish (*Prosopium williamsoni*), and bull trout (*Salvelinus confluentus*). Redband trout, westslope cutthroat trout and bull trout are species of special concern in Montana because of their limited distribution. The U.S. Fish and Wildlife Service (USFWS) received petitions to list redband trout and westslope cutthroat trout; neither was listed. They listed bull trout as threatened in 1998.

Habitat loss is a primary concern in the Kootenai River portion of Region One. A large portion of the workload and monitoring is aimed at addressing the impacts of development of resources such as timber and minerals, poorly planned lakeshore development, reservoir fluctuations and declines in water quality with special attention to excess nutrient and sediment loading. Declines in species of special concern have been caused in some cases by hybridization or competition with non-native species, angling harvest and habitat losses due to development of other resources.

Angling use on mountain and valley lakes and reservoirs in the Kootenai River portion of Region One increases every year, putting additional pressure on some waters that already show the effects of over-use and over harvest. Natural reproduction is not sufficient to meet all angling demands in many waters or is non-existent. The angling public wants a variety of new species or strains of trout and salmon introduced, but these fish may compete with existing fish species and threaten species of special concern. In many cases illegal introductions have completely changed existing fisheries constituencies, often to the detriment of angling. The establishment of *Mysis* relicta is some waters caused changes in salmonids populations. Anglers also want increased opportunities to catch large trout and salmon. This requires changes in stocking and management strategies. More complex regulations are required to maintain or improve existing fisheries and provide diversity of fishing experiences. Additionally MFWP will have to increase coordination efforts with other agencies, local governments and the public to create increased opportunities for Family oriented fisheries.

OBJECTIVES

1) To survey and monitor the characteristics and trends of fish populations, angler harvest and preferences, and to assess habitat conditions on selected waters.

2) To implement fish stocking programs and/or fish eradication actions to maintain fish populations at levels consistent with habitat conditions and other limiting factors.

3) To review projects by government agencies and private parties that have the potential to affect fisheries resources, provide technical advice or decisions to mitigate effects on these resources, and provide landowners and other private parties with technical advice and information to sustain and enhance fisheries resources.

4) To enhance the public's understanding, awareness and support of the state's fishery and aquatic resources and to assist young people to develop angling skills and to appreciate the aquatic environment.

5) To work with local entities to help provide and promote family oriented fishing ponds.

PROCEDURES

We accomplished general lakes surveys using standard experimental floating and sinking gill nets set overnight. Experimental nets are constructed of nylon, measure 6 feet by 125 feet and consist of five 25 feet panels measuring ¾ inch to 2-inch bar mesh. Additionally, we surveyed several lakes by hook and line. We identified fish caught to species, recorded length and weights when appropriate and gathered scales from gamefish when appropriate for age-growth determination. We captured kokanee with standard gill net. We measured mature male and female kokanee separately and collected otoliths when appropriate for aging. In some lakes we removed vertebrae from a sample of kokanee to assess tetracycline-marking techniques.

There were additional procedures for special projects. When that was the case, we added a procedures section or methods section.

FINDINGS

We collected fish population information for lakes in the Kootenai River drainage and portions of Flathead County that include the Thompson Chain of Lakes Management area (Hensler and Vashro 1997). This portion of Region One encompasses all of the Montana portions of the Kootenai River drainage and the lower portion of the Clark Fork of the Columbia River drainage (upper Thompson River drainage). The lakes data were separated by major drainage, by lake type (mountain lake, valley lake) and by special projects. The lakes ranged in size from 9 surface acres to approximately 46,500 surface acres.

Valley Lakes Monitoring

We collected fish population data for 17 lakes in the Kootenai River drainage between June 1999 and December 2003. The lakes ranged in size from 9 surface acres to 46,500 surface acres. These surveys are part of a continuing effort to monitor stocking success and illegal introductions. Results of gillnetting surveys are presented in Table 1.

Table 1. Summary of gill nets set for Valley Lakes in the Kootenai River drainage between July, 1999 and June 2003.

Lake (water code)	Date	Species	Number per net	Mean Length (mm)	Range (mm)	Mean Weight (gms)	Range (gms)	Other Species (number per net)
Topless Lake (11-9830)	5/30/00	WCT	21	309	236-352	303	162-556	
	6/14/01	RBT	5	303	294-315	322	308-360	
Banana Lake (11-7852)	5/30/00	FSU	17					
		YP	7					
		PS	62					
	6/13/02	No Fish						
	11/3/03	No Fish						
Cibid Lake (11-8130)	5/30/00	WCT	5	305	272-325	308	216-394	
		RBT	2	332	330-333	427	398-456	
	6/14/01	WCT	2	361	358-364	574	550-598	
Boot Jack Lake (11-7980)	5/30/00	WCT	4	286	102-498	301	102-498	
		RBT	1	385				
	6/14/01	RBT	9	299	255-440	309	192-844	
Sophie Lake (11-9620)	10/11/01	NP	2.17	551	288-680	1254	106-2472	NSQ(28.3) CSU(0.33) Blue Gill(0.33)
		KAM	0.5	507	490-532	1141	1026-1210	
		DV	0.17	600	600	2000	2000	
Carpenter Lake (Tetrault) (11-8060)	6/22/00	WCT	5	308	250-355	332	170-452	CRF(24)
		RBT	11	288	140-420	289	84-770	
		LMB	0.5	255	278	278	287	
Loon Lake (11-8940)	5/30/00	RBT	5.25	266	162-350	201	162-350	MWF(1.25) NSQ(1.75) CSU(11.25) CRC(10.5) PS(1.0) LMB(0.25) YP(20)
Grouse Lake (11-8440)	6/20/01	EBT	1.0	419				
McGregor Lake (05-9216)	05/21/02	LT	3.75	446	375-620	780	462-1850	FSU(3.5) MWF(1.25) RSS(1.5) CRF(2.0)
		RBT	0.25	531	531	1484	1484	

Lake (water code)	Date	Species	Number per net	Mean Length (mm)	Range (mm)	Mean Weight (gms)	Range (gms)	Other Species (number per net)
Glen Lake (11-8380)	10/3/00	WCT	3.25	283	255-318			YP(0.75) MWF(1.0) FSU (23.25)
		DV	2.5	468.5	288-645			
		EBT	0.25	194	194			
		KOK	17	286	230-332			
	10/1/01	WCT	0.5	343	318-368	459	380-538	YP(8.75) MWF(3.0) PS(1.25) FSU (31.75) CRF(5)
		DV	6.5	459	290-715	1001	218-3068	
		EBT	0.5	328	310-345	425	316-534	
		KOK	2.5	324	307-348	330	292-384	
	10/10/02	HYB	0.5	439	400-477	1106	831-1381	YP(2.5) MWF(1.75) PS(2.5) FSU (26.75) CRF(18.5)
		DV	4.25	510	435-648	1301	606-3545	
		KOK	16.25	324	300-357	312	245-381	
	10/15/03	WCT	0.25	450	450	1038	1038	YP(3.25) MWF(1.0) PS(0.75) FSU (26.75) CRF(20.75)
		DV	2.0	576	545-630	1719	1432-1926	
		KOK	10.25	316	155-365	316	33-440	
Dickey Lake (11-8220)	10/3/00	KAM	0.25	503	503			CSU(1.5) MWF(25.25)
		KOK	29.5	257	235-277			
	10/1/01	RBT	2.7	304	240-365	319	140-524	MWF(19.0) CRF(7.7)
		EBT	1.0	321	309-340	349	274-454	
		KOK	16.7	237	220-260	111	88-138	
	10/10/02	RBT	2.75	311	230-445	350	116-1039	MWF(27.0) CSU(0.25) FSU(4.75) CRF(4.5)
		KOK	18.75	213	180-265	85	49-130	
	10/15/03	KOK	10.75	205	170-227	71	44-95	MWF(12.75) CSU(0.25) FSU(1.0) CRF(2.25)
Crystal Lake (11-8180)	10/11/00	RBT	1.0	406	406			YP(4.0) PS(0.25)
		KOK	35.0	311	150-430	308	38-1000	
	9/26/01	RBT	2.7	287	250-395	297	158-774	YP(8.0) PS(1.0) CRF(6.3)
		KOK	28.7	311	245-377	298	158-452	
	9/30/02	RBT	2.0	392	350-440	646	372-972	YP(3.0) PS(0.25) CRF(9.5)
		KOK	78.5	319	287-421	320	219-758	
	10/1/03	RBT	0.75	307	225-460	417	131-986	YP(2.25) PS(0.25) CRF(12.0)
		KOK	34.0	327	275-375	321	180-458	
Middle Thompson Lake (05-9232)	10/11/00	NP	1.0	705	692-718	3093	2667-3519	MWF(0.33) PS(1.33) CSU(1.33) NSQ(4.33) YP(1.33) FSU(0.33)
		RBT	0.33					
		KOK	30.7	422	370-487	756	584-1166	
	9/26/01	NP	1.8	592	465-750	1392	896-2240	MWF(0.2) PS(0.2) CSU(0.2) NSQ(3.2) YP(26) CRF(3.0)
		RBT	0.4	489	323-655	444	372-3802	
		EBT	0.2	205	205	75	75	
		KOK	12.4	327	167-520	381	40-1172	
	5/22/02	NP	5.0	632	340-910	2319	278-6448	MWF(0.25) PS(0.5) NSQ(0.5) YP(44.25) FSU(0.5)
		KOK	0.75	192	187-194	57	49-64	
	9/30/02	NP	2.17	539	280-780	1527	150-4260	PS(0.17) CSU(0.33) NSQ(1.0) YP(19.83) CRF(1.67)
		LL	0.17	570	570	2478	2478	
		KOK	15.8	347	210-405	403	89-675	
	10/1/03	NP	2.83	533	495-562	1033	682-1245	PS(0.33) FSU(0.17) NSQ(0.83) YP(13.33) CRF(2.83)
		LL	0.17	560	560	2643	2643	
		RBT	0.17	632	632	2384	2384	
		KOK	22.67	358	220-422	454	92-695	
Spar Lake (11-9640)	10/10/00	LT	6.0	381	305-465	490	228-892	RSS(4.6)
		EBT	2.2	272	231-415	291	148-956	
	11/9/01	LT	10.33	409	255-515	624	162-1088	RSS(0.17)
		EBT	1.33	327	296-411	462	302-870	
		KOK	0.17	392	392	590	590	
	10/4/02	LT	5.0	412	330-465	576	302-855	RSS(2.0)
		EBT	1.5	333	220-378	493	124-645	
Bull Lake (07-5540)	10/10/00	DV	0.75	665	645-700	2690	2404-2900	NSQ(9.5) CRC(5.0) CSU(0.5) YP(2.75) MWF(0.75)
		KOK	11.25	314	170-410	328	44-586	
	10/3/01	DV	1.0	563	461-635	1791	872-2560	NSQ(11.0) CRC(4.75) CSU(1.25) YP(7.25) MWF(2.5)
		KOK	8.75	291	171-346	230	44-384	
	10/4/02	DV	3.0	600	520-750	2049	1130-3590	NSQ(12.25) CRC(11.5) YP(4.25) MWF(1.5)
		KOK	17.75	308	184-355	256	51-352	
	10/21/03	DV	2.75	663	587-730	2626	1640-3149	NSQ(6.75) CRC(6.25) CSU(0.75) YP(02.75) MWF(1.5) FSU(0.25) LMB(0.25) PWF(0.75)
		KOK	52	311	175-360	275	44-353	

Special Projects

McGregor Lake

McGregor Lake is a large, deep lake 35 miles west of Kalispell, Montana. The lake has small inlets and one small outlet (McGregor Creek) that connect it to the Clark Fork River through the Thompson River. The maximum depth is 220 feet and approximately 80 percent of the depth of the lake is greater than 100 feet. McGregor Lake has a surface area of 1328 acres. A small impoundment structure at the west end of the lake controls the upper three feet of the lake.

The historic species constituency of McGregor Lake included native westslope cutthroat trout, mountain whitefish, longnose suckers, northern pike minnows and redside shiners. Various species of fish including cutthroat trout, arctic grayling, coho salmon were stocked in the lake with poor results. Brook trout did manage to establish a small, self-reproducing population from a single plant of 4,000 fish in 1947. Yellow perch were also established through illegal introductions in the 1960's.

In 1942, the initial stocking of lake trout occurred and subsequent stocking from 1948 through 1953 established a self-reproducing population. Beginning in 1965, FWP began stocking kokanee salmon in McGregor Lake to produce a fishery similar to the very popular Flathead Lake and Whitefish Lake fisheries. FWP also continued to stock rainbow trout to produce a "three-tiered" effect that included a consumptive kokanee/rainbow trout fishery and a trophy lake trout fishery. McGregor Lake produced relatively good numbers and sizes of rainbow trout (14 inches and occasionally up to 10 pounds), kokanee (11 inches to 20 inches) and lake trout (18 inches to 25 pounds).

In 1968, FWP introduced the opossum shrimp (*Mysis relicta*) in McGregor Lake. The desired effect was to create a large kokanee (up to 5 pounds) similar to those being captured in Kootenai Lake, British Columbia. The result was not expected. We found that in deep lakes like McGregor Lake, *Mysis* tended to live near the lake bottom during the daylight hours and rise to the surface to feed at night. Two major outcomes resulted from the *Mysis* introduction.

Because the kokanee fed mainly near the thermocline (15 to 45 feet) during daylight hours, they rarely got the opportunity to feed on *Mysis*. Additionally, Mysis tended to feed on the same prey (*Daphnia pulex*) that kokanee and rainbow trout preferred. Second, and probably most important was the effect of *Mysis* on lake trout. Prior to Mysis introduction, juvenile lake trout had to survive on relatively small numbers of aquatic invertebrates and zooplankton to get to the size where they could effectively capture the other fish species in the lake. The introduction of Mysis removed this "bottleneck" and the juvenile lake trout population increased dramatically.

Lake trout population increased to high enough numbers to create a predator trap that kokanee could not escape. Angling success for small (12 inches) to medium (28 inches) sized lake trout was excellent but angling success for kokanee was reduced to such low levels that by 1985, FWP discontinued stocking kokanee in McGregor Lake.

The rainbow trout fishery also suffered. Since 1982 MFWP stocked between 50,000 and 95,000 rainbow trout annually with virtually no success. Interviews with anglers indicated that rainbow trout were caught only rarely. When we analyzed stomach contents of lake trout caught in gillnets set 1 to 2 days after stocking we found between one and 30 rainbow trout fingerlings in individual lake trout stomachs and rainbows were found in in 80 percent of the lake trout stomachs.

In an effort to create a more successful rainbow trout fishery MFWP discontinued the typical stocking at boat ramps and began boating the 2 inch to 4 inch fingerlings to sites throughout the 1328 acre lake. In subsequent gillnet sets we found no newly stocked rainbow trout in stomachs of lake trout. The technique looked promising so we contacted local anglers and in 1997 formed a "regatta" of 8 boats to distribute stocked trout more evenly throughout the lake. Additionally, from historic plankton we determined that the highest densities of Daphnia occurred in mid-June. In 1998 we requested that rainbow trout destined for McGregor Lake be held until at least early June.

One of the difficulties of holding fish for later stocking is space limitation. In this case we determined that we did not need a larger fish for stocking, just a later stocking date. The lot of rainbow trout destined for McGregor Lake are given reduced feed and/or removed from feed for the extra time they are held at the hatchery so they don't grow any further. We felt that this strategy helped to reduce the stress on the hatchery system and on trout destined for other systems caused by the special request.

The combination of "regatta stocking" and later stocking date appears to have produced a successful spring/fall rainbow trout fishery. Between 1998 and 2001, anglers commented that rainbow trout fishing like they have now has not been enjoyed since the 1960's. The limit on rainbow trout in McGregor Lake was reduced from 10 daily to 5 daily with only one greater than 22 inches. The limit (now the standard limit in Western Montana) was created because of the large number of comments from anglers that expressed their willingness to reduce their take of trout to help maintain this fishery.

A shift in hatcheries responsibilities much of which occurred from severe drought space limitation led to stocking of what we considered to be a smaller and less fit trout between 2000 and 2003. Anglers were not as successful for trout during that time. We have made adjustments to keep higher quality trout stocked in mid June and in 2003 we included stocking of 10,000 trout in September. These fish were adipose clipped and we will track them to assess success of the program. Local anglers said they saw more small trout (8 – 12 inches) in the winter creel than in the past two years.

MFWP used spot creel surveys during a local ice fishing derby to further monitor the success of this stocking strategy and catch of lake trout in McGregor Lake. We did not expand total catch because our surveys consisted of unfinished trips. Rainbow trout catch rates increased between the surveys and many of the trout were 9 to 13 inches, likely those from the previous summer's stocking (Table 2).

Table 2. McGregor Lake ice fishing derby results 2001 and 2004

Year	Anglers Surveyed	Total Anglers	Surveyed Hours Fished	Expanded Hours Fished	Lake Trout Caught	Lake Trout Per Hour	Rainbow Trout Caught	Rainbow Trout Per Hour
2001	226	1404	1230	7640	86	0.07	35	0.03
2004	80	1580	381	7525	30	0.08	42	0.11

Kilbrennan Lake

Kilbrennan Lake is a medium sized lake 25 miles northwest of Libby, Montana. The lake has a small inlet (Feeder Creek) and one outlet (Kilbrennan Creek) that connects it to the Kootenai River through the Yaak River. The maximum depth is approximately 25 feet and the surface area 57 acres. Beaver periodically dam the outlet of Kilbrennan Lake and cause flooding on Kootenai National Forest Road 2394 along the eastern shore of the lake.

There is evidence (both historic reports and genetic testing) to suggest that Kilbrennan Lake historically contained native Columbia Basin redband trout (MFWP, unpublished report). From the 1930's to the 1960's MFWP and private hatchery personnel took eggs from trout, although mostly brook trout. Between 1934 and 1954 MFWP stocked nearly 700,000 brook trout in Kilbrennan Lake. Brook trout established a self-reproducing population and stocking was halted. Kilbrennan Lake became an exceptional brook trout fishery. It was considered to be the most popular small lake fishery in northwestern Montana. As many as 357 anglers were creeled on opening day on this 57 acre lake (Figure 1.)

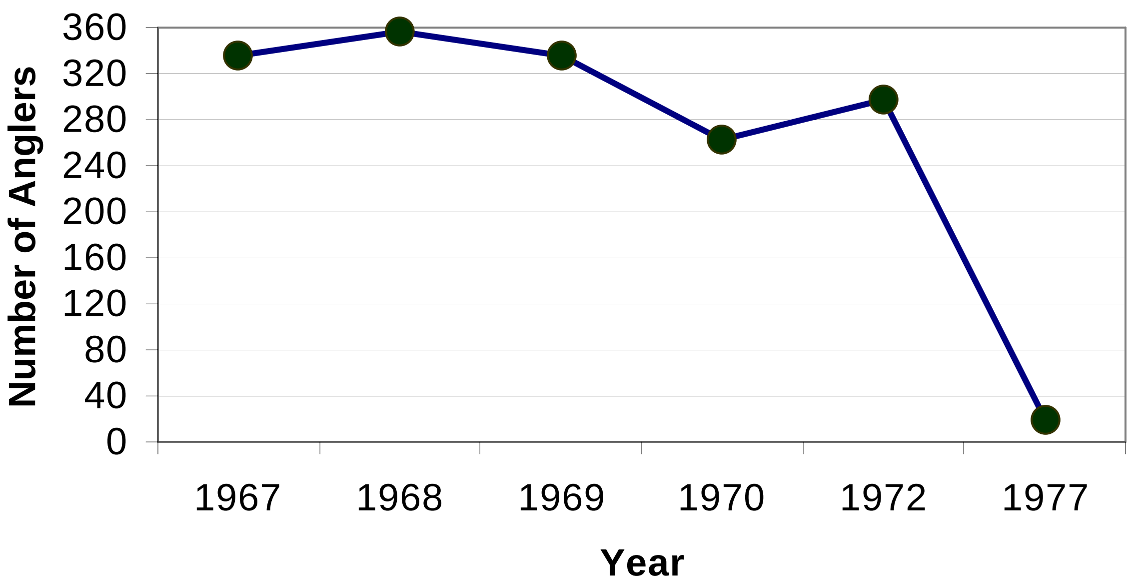

Figure 1. Number of anglers creeled on opening day at Kilbrennan Lake, Montana 1967 – 1977.

Black bullheads (*Ameiurus melas*) were illegally introduced in Kilbrennan Lake in the late 1960's or early 1970's. By 1977 black bullheads dominated the gill net catches (Figure 2). The number and size of trout in Kilbrennan Lake declined (Table 3) and recreational angling declined dramatically as seen by opening day creel surveys (Figure 1). Catch rates decreased so dramatically that the angling public no longer requested a winter closure.

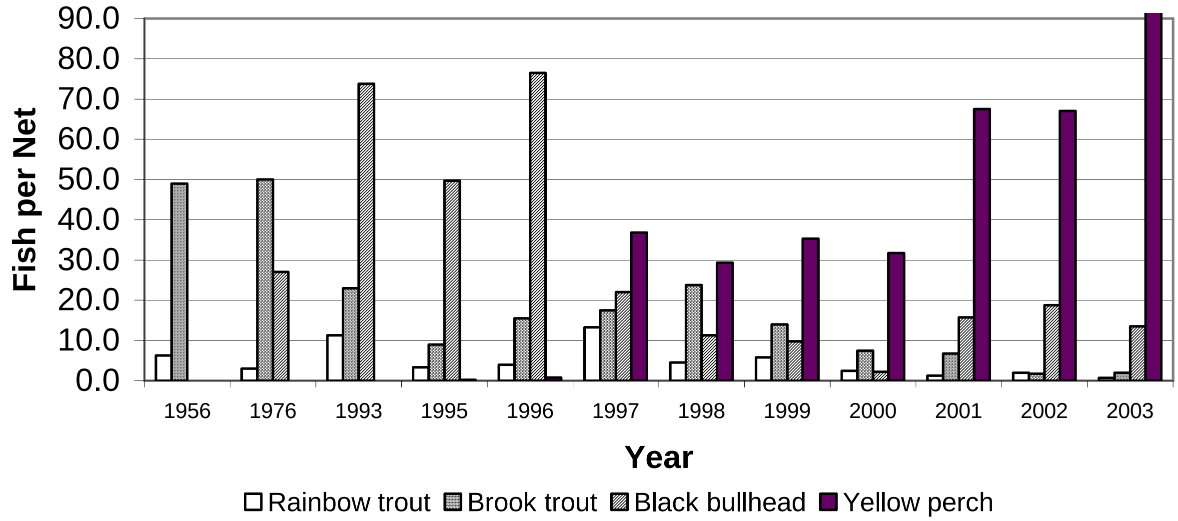

Figure 2. Number fish per net in gill net sets for Kilbrennan Lake, Montana 1956 through 2003.

We re-initiated gill net sampling at Kilbrennan Lake in 1993 to get baseline information for a potential rehabilitation project (Table 3). To add to the problem yellow perch were illegally introduced probably in 1994 and by 1999 they dominated the net catch.

A common phenomenon in northwest Montana lakes is that as illegally introduced yellow perch populations initially expand, larger individuals (>200 mm) many times represent a sufficient enough portion of the population (25 percent or more) to support a limited fishery. In other lakes we have seen this happen in around 5 years. In almost all cases the perch population stunts as population density rises. As the number of adult yellow perch greater than 200 mm declines, the angling declines. Lakes that have gill net catches where 200 mm perch represent less than 5 percent of the population get little to no angling pressure (MFWP, unpublished data). By 1993, MFWP estimated that the total yearly pressure for Kilbrennan Lake was 482 angler-days. When compared to 1968 (357 anglers on opening day), this series of events shows the unfortunate results of illegal introductions.

In addition to negatively affecting recreational angling, high-density yellow perch populations make it extremely difficult for trout species to exist, especially in a lake supported completely by natural reproduction. We have also found that stocking rainbow trout in smaller lakes (less than 100 acres) dominated by pan fish (including pumpkinseeds and yellow perch) is generally unsuccessful due to extreme competition for zooplankton and predation on smaller trout.

Table 3. Results from gill net surveys on Kilbrennan Lake, Montana 1995 – 2003.

Date	Species	Number per net	Mean Length (mm)	Range (mm)	Mean Weight (gms)	Range (gms)
5/23/95	RBT	3.3	304	161-362	281	38-468
	EBT	9.0	265	146-380	189	32-488
	BBH	49.7	182	131-220	81	26-178
	YP	0.2	260			
6/18/96	RBT	4	239	160-290	152	45-250
	EBT	15.5	235	153-320	147	39-332
	BBH	76.5	170	132-184	60	32-88
	YP	0.75	195	140-251	121	32-210
6/24/97	RBT	13.25	271	205-338	191	74-332
	EBT	17.5	229	168-305	122	46-268
	BBH	22	170	130-191	74	34-94
	YP	36.75	163	150-204	50	36-98
6/9/98	RBT	4.5	282	155-342	250	40-386
	EBT	23.8	221	150-283	129	42-238
	BBH	11.3				
	YP	29.3		All <200		
6-9-99	RBT	5.75	270	185-328	178	58-310
	EBT	14	220	157-290	97	36-204
	BBH	9.75	185	149-214	92	52-154
	YP	35.25	200	130-229	90	26-124
6-5-00	RBT	2.5	258	212-300	155	106-228
	EBT	7.5	212	146-266	91	28-144
	BBH	2.25	158	130-188	54	24-89
	YP	31.75	<200			
6-20-01	RBT	1.25	243	201-260	134	76-184
	EBT	6.75	203	155-257	85	44-144
	BBH	15.75	139	128-181	37	28-92
	YP	67.5	<200			
6-17-02	RBT	2.0	214	173-251	84	46-122
	EBT	1.75	200	175-242	71	45-116
	BBH	18.75	159	131-192	53	27-86
	YP	67.0	<200			
6-27-03	RBT	0.75	225	212-234	106	95-115
	EBT	2.0	204	174-241	86	50-147
	BBH	13.5	173	162-186	79	58-94
	YP	93.5	<200			

We sampled zooplankton in Kilbrennan Lake beginning in 1996. During that time we saw a dramatic shift in the zooplankton populations. Prior to the illegal introduction of yellow perch, larger zooplankton that are typically preyed on by trout, (*Daphnia*, *Epischura* and *Diaptomus* species) dominated the samples (Figure 3). As the yellow perch increased, the smaller, less utilized zooplankton (*Cyclops*, *Bosmina*, *Ceriodaphnia*, *chydorus* species) also increased and the larger zooplankton decreased dramatically.

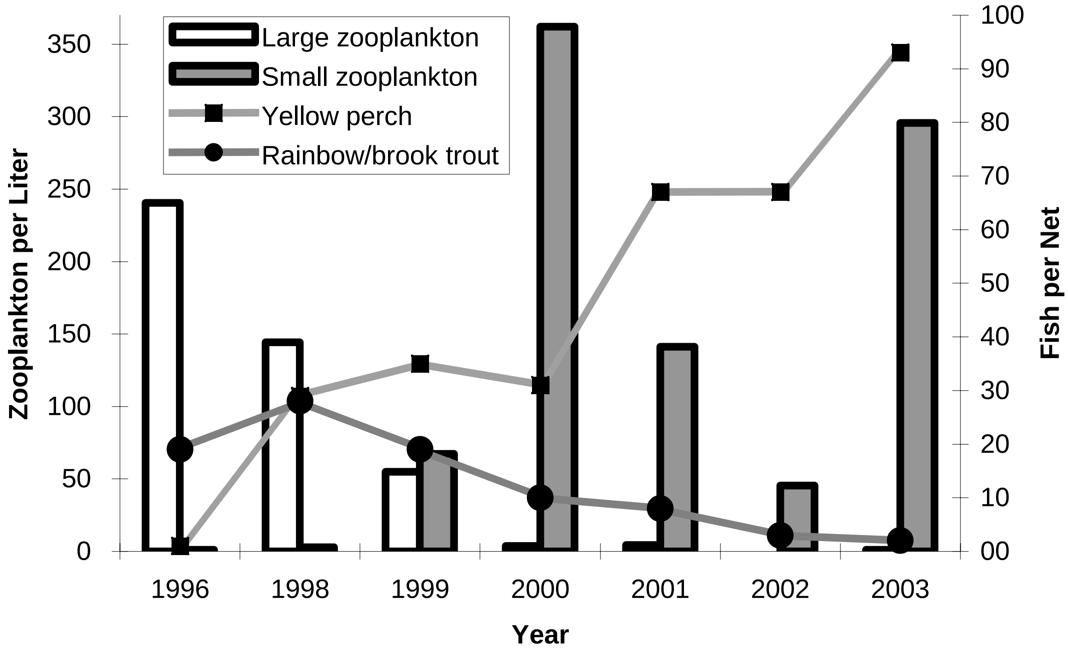

Figure 3. Trends in large zooplankton (*Daphnia*, *Epischura*, *Diaptomus*) and small zooplankton (*Bosmina*, *Cyclops*, *Chydorus*) densities and fish species (trout and yellow perch) per net from Kilbrennan Lake, MT 1996 – 2003.

Montana Fish, Wildlife and Parks personnel initiated discussion about chemical rehabilitation and re-stocking of Kilbrennan Lake with redband trout in 1994. Because Kilbrennan Lake used to support redband trout we believe it would make an ideal brood lake as part of a basin-wide recovery effort. The most prevalent comment we received from public scooping was that MFWP should poison the lake but re-stock with brook trout and redband trout.

Anglers felt that Kilbrennan could support both fish and even suggested a catch and release for redband trout along with the standard 20 brook trout limit. Coincidently in 1994, MFWP established a no-stock policy for brook trout in western Montana, especially where bull trout (*Salvelinus confluentus*) are present. The policy was created to help prevent the potential for hybridization between brook trout and bull trout

Bull trout are not present in Kilbrennan Creek or the Yaak River drainage, although, they are present in the Kootenai River and tributaries above and below the confluence with Yaak River. Until a stocking agreement can be reached, recreational angling will continue to suffer due to the current species constituency. Additionally, MFWP will have to search for different brood lake candidates. MFWP will monitor the species constituency and zooplankton populations until a decision is reached.

Bootjack Lake/Topless Lake/Cibid Lake

Since 1997 MFWP has partnered with Bonneville Power Administration to mitigate for the construction and operation or Libby Dam. As part of that mitigation MFWP personnel have identified through public and internal scooping and management plans, several lakes for rehabilitation. Montana Fish, Wildlife & Parks with the help of BPA special projects rehabilitated 5 lakes between 1997 and 2001. Four of the lakes (Bootjack, Topless, Cibid and Banana) are in the Thompson Chain of Lakes between Libby and Kalispell.

Bootjack, Topless and Cibid Lakes are small, closed-basin lakes, 45 miles south of Libby, MT. The maximum depth of Bootjack Lake is 41 feet and surface area is 10 acres. Topless lake is 24 feet deep and has a surface area of 15 acres of which 8 acres are suitable for trout. Cibid Lake is largest (11 acres) and deepest (60) of the three lakes. Historic game warden creel surveys indicate that all three lakes produced quality summer/winter put-grow-and-take trout fisheries with catch rates greater than 1.0 per hour and sizes ranging from 12 inches to 20 inches. Since 1970, all three lakes had been stocked with Arlee rainbow trout or westslope cutthroat trout depending on availability at approximately 200 fish per acre. We stocked the lakes on a two-year rotation to maximize growth.

By 1980 all three lakes had been illegally stocked with non-game fish (Table 4). By 1995 angling success in the lakes had declined dramatically. Public sentiment as expressed through the Thompson Chain of Lakes Fisheries Management Plan (MFWP, 1997) was to re-gain the trout fishing in the lakes. By 1997 MFWP planned to chemically rehabilitated all three lakes with rotenone.

We treated Bootjack and Cibid Lakes with rotenone during November 1997, to remove stunted populations of illegally introduced yellow perch and pumpkinseed sunfish. We treated Topless Lake during April 1998, to remove black bullheads, yellow perch, and pumpkinseed sunfish. Subsequent netting in 1998 indicated that the rehabilitation was successful (Table 3).

MFWP stocked the lakes with westslope cutthroat trout and rainbow trout following a detoxification period. Natural reproduction of trout is not possible in the closed-basin lakes and the fisheries will be managed as put-grow-take. Based on gillnet data (Table 4) and reports from anglers, the treatments were a success.

We stock the lakes with Arlee rainbow trout and westslope cutthroat trout rotated yearly to provide increased and diverse fishing opportunity throughout the year (Table 5). Anecdotal creel surveys and angler reports indicate that fishing at the lakes is exceptional and anglers are catching 14 inch to 16 inch trout. We will continue to monitor the effectiveness of this stocking scenario.

Table 4. Summary of catch in gillnets set to monitor lakes pre- and post-treatment with rotenone.

Lake	Date	Species*	Number per net	Mean Length (mm)	Range (mm)	Mean Weight (g)	Range (g)
PRE-TREATMENT							
Bootjack	10-02-96	RBT	7.0	227	205-346	127	90-426
		YEP	2.0	254	243-271	237	210-296
		PKS	3.5	116	100-166	35	18-98
Topless	10-02-96	RBT	8.0	199	156-342	100	36-428
		PKS	8.0	122	96-139	37	14-50
Cibid	09-10-97	RBT	6.7	236	166-415	158	50-820
		YEP	8.7	212	143-320	182	32-452
		PKS	3.7	102	95-112	18	14-22
Carpenter	05-28-97	RBT	0.5	415	394-428	783	602-904
		WCT	0.2	426		808	
		NOP	0.5	735	574-1,054	4,201	1,392-9,525
		BLG	1.7	133	127-187	63	26-146
POST-TREATMENT							
Bootjack	06-07-99	RBT	10.0	316	165-347	433	38-532
		WCT	2.0	313	312-313	387	386-388
Topless	06-07-99	No Fish					
Cibid	06-08-99	WCT	8.0	244	200-285	153	58-284
Carpenter	06-22-00	RBT	11.0	290	174-420	276	60-770
		WCT	5.0	308	250-355	332	170-452
		LMB	0.5	255		278	
Bootjack	05-30-00	RBT	1.0	385		578	
		WCT	4.0	286	218-356	301	102-498
Topless	05-30-00	WCT	10.5	309	236-352	373	162-556
Cibid	05-30-00	RBT	2.0	332	330-333	427	398-456
		WCT	5.0	305	272-325	308	216-394

- Species abbreviations: RBT = rainbow trout, WCT = westslope cutthroat trout, PKS = pumpkinseed, YEP= yellow perch, NOP = northern pike, LMB = largemouth bass, BLG = bluegill.

Table 5. Stocking schedule for Bootjack Lake, Topless Lake and Cibid Lake, Montana for 2000 – 2005.

Lake	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Bootjack Lake	A001[a] (227/acre)	M012 (91/acre)	A001 (227/acre)	M012 (91/acre)	A001 (227/acre)	M012 (91/acre)
Topless Lake	M012 [b] (182/acre)	A001 (182/acre)	M012 (182/acre)	A001 (182/acre)	M012 (182/acre)	A001 (182/acre)
Cibid lake	A001 (125/acre)	M012 (63/acre)	A001 (125/acre)	M012 (63/acre)	A001 (125/acre)	M012 (63/acre)

[a] A001 = Arlee rainbow trout [b] M012 = westslope cutthroat trout

We also collected zooplankton samples from lakes that had been treated with rotenone in the recent past to remove illegally introduced fish species. We collected 3 samples from each lake prior to treatment in June using a 0.3 m diameter 153 μ Wisconsin net taken as deep as possible (up to 20 m and no shallower than 5 m). We sampled the treated lakes for 3 years after rehabilitation to document zooplankton recovery. In all the lakes, zooplankton numbers returned to pre-treatment densities or greater (Figures 4 - 6).

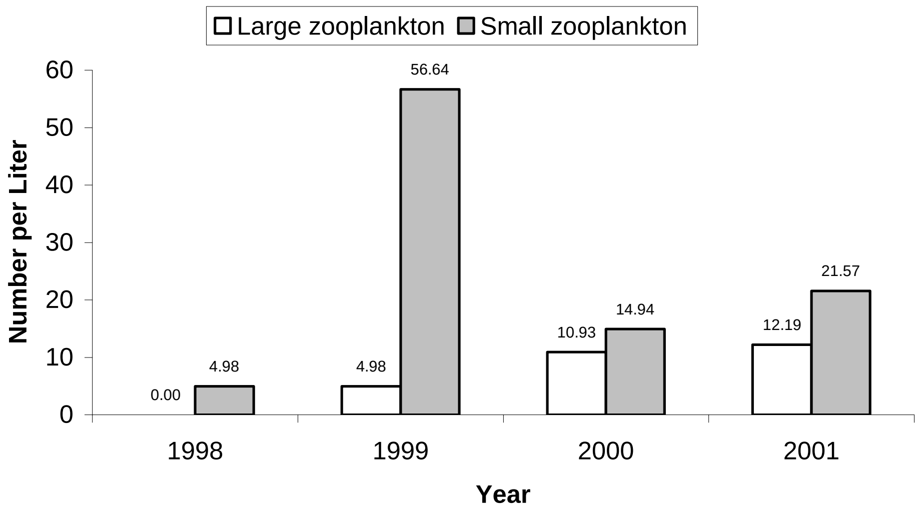

Figure 4. Large zooplankton (*Daphnia*, *Epischura*, *Diaptomus*) and small zooplankton (*Bosmina, Cyclops, Chydorus*) densities in Bootjack Lake, Montana, before and after treatment with rotenone (November 1997).

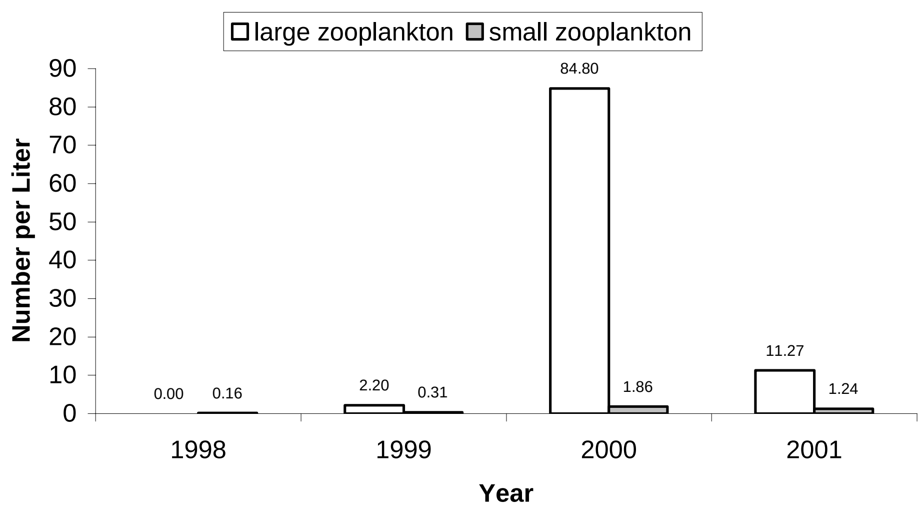

Figure 5. Large zooplankton (*Daphnia, Epischura, Diaptomus*) and small zooplankton (*Bosmina, Cyclops, Chydorus*) densities in Topless Lake, Montana, before and after treatment with rotenone (April, 1998).

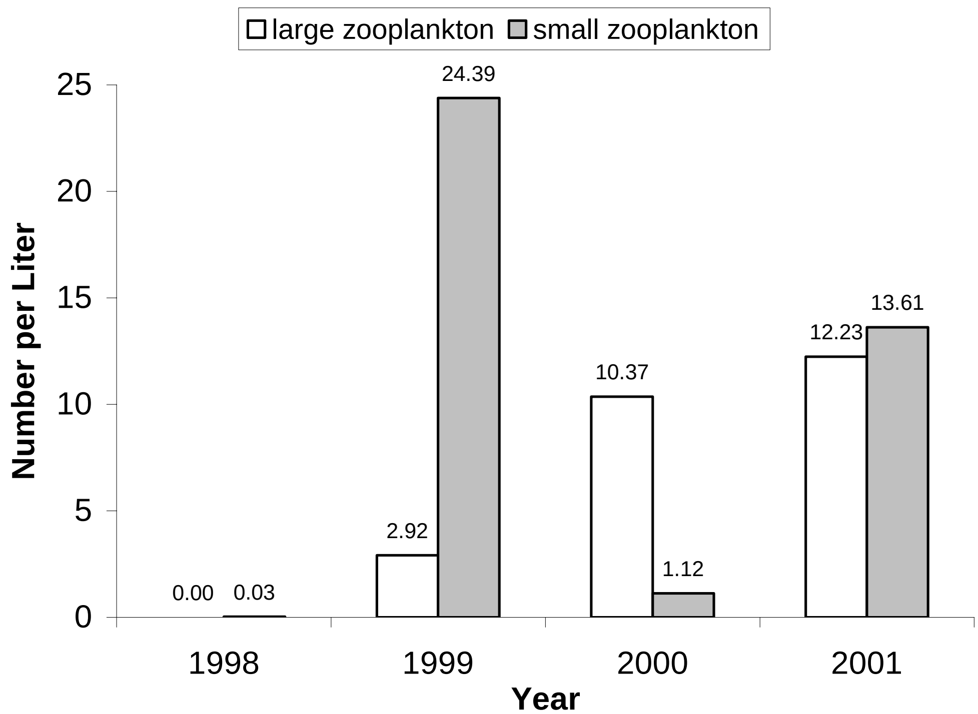

Figure 6. Large zooplankton (*Daphnia*, *Epischura*, *Diaptomus*) and small zooplankton (*Bosmina, Cyclops, Chydorus*) densities in Cibid Lake, Montana, before and after treatment with rotenone (November 1997).

Community Fish Pond Management

In an effort to help improve recreation and education opportunities in the Montana portion of the Kootenai River sub-basin, MFWP has worked in conjunction with BPA and local communities to create community fish ponds. To date we have completed the Troy project, nearly finished the Eureka project and are planning for a community pond in Libby hopefully by 2005.

Troy Fishing Pond

The Troy fishing pond was a cooperative effort with Montana FWP, the city of Troy, MT, Lincoln County and Bonneville Power Administration. This project was initiated in 1998 and was completed in 2002. We created the pond from an existing abandoned saw millpond that for many years was the site used to dump excess fill accumulated from city of Troy and Lincoln County projects (Figure 6).

Figure 6. Photographs of the excavation of Troy Fish Pond and removal of fill material. Weeded area shows level of fill.

We considered the abandoned millpond to be an excellent site because the water source, the city of Troy's old water supply system from O'Brien Creek that currently serves as a backup water system, is adequate and controllable, and portions of the original pond still had a clay layer that would keep water in the pond. Additionally, the city of Troy had acquired the property and was in the process of creating a recreation complex that would include baseball, soccer and the family fishing pond.

The site was cleared, shaped and excavated to a depth of 17 feet maximum depth, and lined with a mixture of silt and granular bentonite to minimize leaking (Figure 7). The pond has an area of approximately 2 acres. Water exits the pond via a screened outlet pipe into the Kootenai River. The fishing pond is permanently scheduled for stocking of both rainbow trout and westslope cutthroat trout Remote site incubators could be used to stock the pond and provide an educational opportunity in future years. To date the Troy pond has been very successful and has gotten considerable use (Figure 8).

Figure 7. Photographs of the Troy fishing pond during bentonite application and shortly after construction during the 2002 summer.

Figure 8. Photographs of anglers at the Troy fishing pond during the 2003 summer.

Eureka Pond

In 1999 MFWP staff began working with the Lincoln County Fairgrounds board of directors and Lincoln County Road Department along with Bonneville Power Administration to construct a fishing pond on the fairgrounds property in Eureka in 2000.

Design work and discussions about liability issues delayed construction until the summer of 2002. The pond was excavated and lined with a mixture of silt and granular bentonite to minimize leaking (Figure 9). The maximum depth of the pond is 8 feet and has a surface area of 0.4 acres. The water source for the Eureka pond is out of Mill Spring. Lincoln County Fair Board has a water reservation of 50 gallons per minute. Part of the pond project included reconstruction of a portion of Mill Spring to a proper pattern, profile and dimension that would efficiently pass fine sediments (Figure 9).

Figure 9. Photographs of the Eureka fishing pond taken shortly after construction.

The gravel/cobble substrate beneath the pond has proven difficult to seal. Leaks in the pond bottom have prevented complete filling. During the fall of 2003 we added a plastic pond liner to the bottom ½ of the project area. We will add sedge mats in 2004. The pond has been added to the permanent stocking schedule and will receive rainbow and westslope cutthroat trout in 2004.

Lake Koocanusa Gillnet Monitoring

We documented changes in the assemblage of fish species sampled in Lake Koocanusa since impoundment in 1972. Kokanee salmon, Kamloops rainbow trout and yellow perch did not occur in the Kootenai River prior to impoundment but are now present. Kokanee were released into the reservoir from the Kootenay Trout Hatchery in British Columbia (Huston et al. 1984). Yellow perch may have dispersed into the reservoir from Murphy Lake (Huston et al. 1984).

British Columbia Ministry of Environment (BCMOE) first introduced Gerrard (Kamloops) rainbow trout in Lake Koocanusa in 1985. Peamouth and northern pikeminnow were rare in the Kootenai River before impoundment, but have increased in abundance in the reservoir. Mountain whitefish, rainbow trout, westslope cutthroat trout and redside shiner were common in the Kootenai River before impoundment, but have decreased in abundance since impoundment.

Total Fish Abundance

The long-term trends in total fish abundance in the reservoir reflect the changes that have occurred in the reservoir since impoundment. Total catch (fish per net) for spring gillnets has significantly increased since impoundment (Figure 10; $r^2 = 0.31$; $p = 0.003$; Table 6). This is typical of species that prefer reservoir habitats: peamouth chub, suckers, and northern pikeminnow. However, there is no significant trend in total catch (fish per net) for fall gillnets (Figure 10; $r^2 = 0.07$; $p = 0.202$; Table 7). Species composition for the catch of fall and spring gillnets has remained relatively stable since 1988 (Table 8).

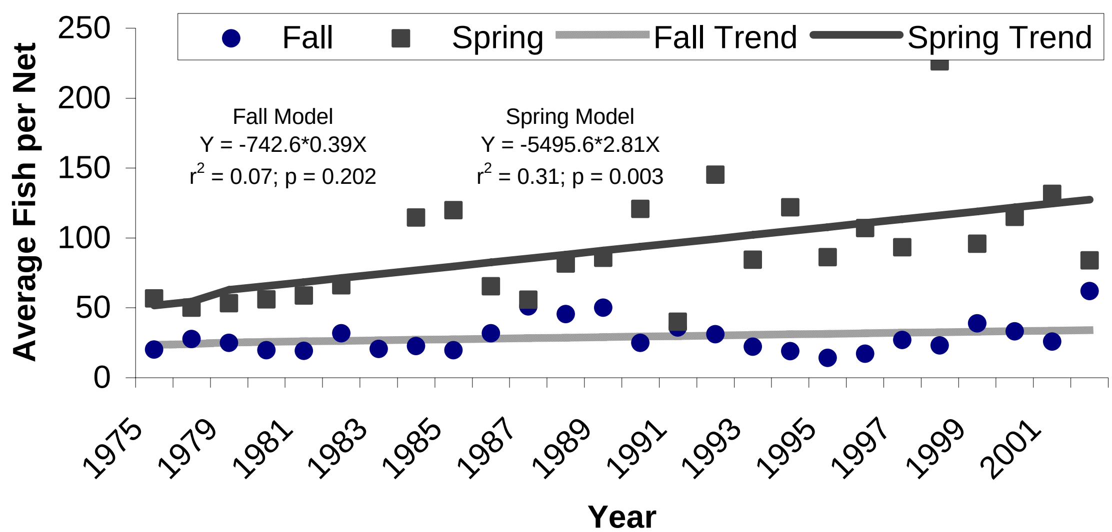

Figure 10. Catch per net (all species combined) in fall floating and spring sinking gillnets and associated trend lines in Lake Koocanusa, 1975 through 2002.

Table 6. Average catch per net for nine different fish species* captured in floating gillnets set during the fall in the Tenmile and Rexford areas of Lake Koocanusa, 1990 through 2002.

	YEAR												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	**2002**
Surface Temperature	16	15	13.8	13.8	16.6	15.8	15.5	17.2				19	
Date	9/25	10/2	9/25	10/5	9/27	10/10	9/23	9/22	9/21	9/14	9/12	9/20	9/10
Number of Floating Nets	54	28	28	28	28	28	28	28	28	28	28	14	14
Reservoir Elevation	2456	2448	2421	2441	2446	2454	2450	2448	2439	2453	2434	2433	2441
Average number of fish caught per net for individual fish species													
RBT	0.2	0.4	0.1	0.4	0.2	0.6	0.3	0.3	0.2	0.2	0.6	0.3	0.5
WCT	0.2	0.4	0.5	0.9	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1
RB X WCT∠	0.3	0.2	0.2	0	0	0	0	0	<0.1	0	0	0	0
SUB-TOTAL	0.7	1	0.8	1.3	0.3	0.7	0.5	0.4	0.3	0.3	0.7	0.4	0.6
MWF	0.2	0.5	0.2	0.3	0.4	0.3	0.3	0.5	0.4	0.1	0.1	0.2	0.4
CRC	18.2	18.4	23.3	17.1	10.4	1.2	11.7	17.8	14.4	24.3	12.9	5.6	21.4
NPM	1.8	2.1	1.8	2.2	3.4	2.7	1.8	4.0	4.9	6.4	3.9	3.9	8.1
RSS	0	0.1	0	0	0.3	0.2	0.1	1.0	0.3	0.3	<0.1	0	0.3
BT	0	0	0.1	0.3	0	1.2	<0.1	0	<0.1	<0.1	0.2	0	0.1
CSU	0.1	0.1	0	0.1	0.1	0	0.4	0.1	0.1	0.1	0.1	0.3	0.1
KOK	3.9	13.7	5	1	4	7.9	2.3	3.1	2.7	7.3	8.0	2.1	14.2
TOTAL	24.9	35.9	31.2	22.3	18.9	14.2	17.1	26.9	23.1	38.8	25.9	12.5	45.1

*Species Codes (RBT = rainbow trout, WCT = westslope cutthroat trout, RBXWCT = rainbow and cutthroat trout hybrid, MWF = mountain whitefish, CRC = Columbia River chub, NPM = northern pikeminnow, RSS = redside shiner, BT = bull trout, CSU = coarse scale sucker, and KOK = kokanee.

Table 7. Average catch per net for 12 different fish species* captured in sinking gillnets set during spring in the Rexford area of Lake Koocanusa, 1990 through 2002.

	YEAR												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Surface Temperature	11.7	9.8	16.7	14.4	13.3	13.5	8.9						
Date	5/10	5/16	5/5	5/17	5/16	5/8	5/12	5/12	5/11	5/17	5/14	5/15	5/13
Number of Sinking Nets	27	28	28	28	28	28	28	28	27	28	14	14	14
Reservoir Elevation	2358	2330	2333	2352	2405	2386	2365	2350	2417	2352	2371	2392	2384
Average number of fish caught per net for individual fish species													
RBT	0.1	0.1	0.1	0.3	0.2	0.2	0.7	0.1	<0.1	1.1	0.3	0.2	0.4
WCT	<0.1	0.0	0.1	0.0	<0.1	0.1	0.1	0.2	0.0	0.3	0.1	0	0
RB x WCT	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0	0.2
SUB-TOTAL	0.1	0.2	0.2	0.3	0.2	0.3	0.9	0.3	0.0	1.4	0.4	0.2	0.6
MWF	0.2	0.3	0.9	0.1	0.3	1.5	1.6	1.3	1.2	0.7	0.8	0.4	1.2
CRC	104.8	31	119	63.3	94.2	54.1	60.9	51.1	171.7	54.4	76.4	25	24.1
NPM	6.0	2.0	4.2	3.8	7.6	8.0	10.0	13.1	15.1	14	12.6	11	9.9
RSS	<0.1	0.0	0.5	0.0	0.0	0.0	0.0	0.1	1.0	0.1	0.4	0	0
BT	1.2	0.5	2.3	1.2	3.0	2.3	3.5	3.1	2.5	3.6	6.7	5.4	4.9
LING	0.2	0.4	0.6	0.3	0.1	0.1	0.5	0.4	0.4	0.4	0.3	0.1	0.1
CSU	5.8	2.4	12.9	9.8	9.0	12.0	19.9	14.3	21.1	8.3	10.6	14.2	9.9
FSU	1.8	1.1	2.9	4.1	6.5	3.0	4.8	4.7	9.5	5.9	5.1	1.1	2.9
YP	4.7	2.1	1.8	1.1	0.7	2.5	3.7	4.75	2.4	1.8	1.3	1.6	0.6
KOK	2.0	1.0	0.4	3.5	0.3	2.1	2.0	1.4	1.3	5.3	1.0	0.2	1.0
TOTAL	120.7	40.0	145.3	84.3	121.9	86.3	107.1	93.25	226.2	95.9	115.1	59.2	55.2

*Species Codes (RBT = rainbow trout, WCT = westslope cutthroat trout, RBXWCT = rainbow and cutthroat trout hybrid, MWF = mountain whitefish, CRC = Columbia River chub, NPM = northern pikeminnow, RSS = redside shiner, BT = bull trout, LING = burbot, CSU = coarse scale sucker, FSU = fine scale sucker, YP = yellow perch, and KOK = kokanee.

Table 8. Percent composition of major fish species* caught in fall floating and spring inking gillnets in Lake Koocanusa, 1988 through 2002. Blank entries in table indicate either no fish were captured or that they occurred in very small proportions.

	1988		1989		1990		1991		1992		1993		1994		1995		1996	
	Fall	Spr.	Fall	Spr.	Fall	Spr.	Fall	Spr.	Fall	Spr.	Fall	Spr.	Fall	Spr.	Fall	Spr.	Fall	Spr.
RB	3.0		0.1		0.7		1.0		0.3		1.8		0.9		4.4		1.4	
WCT	0.5		0.3		0.7		1.0		1.7		3.8		0.7		0.8		1.2	
HB	1.0		0.3		1.1		0.5		0.7		0.2		0.0		0.3		0.2	
ONC	4.5	0.7	0.7	0.4	2.4	0.1	2.4	0.4	2.7	0.1	5.8	0.3	1.7	0.2	5.5	0.4	2.8	1.0
MWF	0.5	1.6	0.2	0.8	0.9	0.2	1.4	0.7	0.7	0.6	1.4	0.2	2.2	0.3	2.1	1.7	1.4	1.5
CRC	39.4	63.8	70.5	66.0	71.4	82.6	50.0	76.5	72.6	81.7	72.8	73.9	54.3	77.0	8.6	62.9	66.5	56.9
NPM	2.9	7.7	4.1	7.4	7.2	4.8	5.8	5.0	5.6	2.9	9.3	5.0	17.5	6.2	19.6	9.3	10.2	8.7
RSS	0.8	0.2	0.2	0.1	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	1.5	0.0	1.3	0.0	0.6	0.0
FSU	0.0	2.3	0.0	1.6	0.0	1.5	0.0	2.6	0.1	2.0	0.0	5.2	0.0	5.3	0.0	3.5	0.0	4.4
CSU	0.0	12.7	0.2	10.3	0.2	4.5	0.3	5.9	0.0	8.8	0.6	9.7	0.6	7.3	0.0	13.9	2.4	18.6
KOK	47.3	1.7	23.4	2.1	15.5	1.5	37.3	1.6	15.7	0.3	4.4	3.4	20.6	0.2	57.4	2.4	13.2	1.8
YP		5.5		9.4		3.7		5.2		1.2		1.1		0.9		2.9		3.4
BT		2.4		1.4		1.0		1.1		1.7		1.1		2.5		2.8		3.3

	1997		1998		1999		2000		2001		2002		Average	
	Fall	Spr.	Fall	Spr.	Fall	Spr.	Fall	Spr.	Fall	Spr.	Fall	Spr.	Fall	Spr.
RB	1.7	0.2	1.5	0.1	0.6	0.9	1.1	0.2	1.4	0.4	0.4	0.4	1.4	0.4
WCT	0.6	0.4	0.5	0.1	0.3	0.2	0.8	0.1	1.7	0	0.1	0	1.0	0.1
HB	0	0	2.3	0	0	0	0	0	0	0	0	0	0.4	0.0
ONC	2.3	0	4.2	0.4	0.9	1.3	1.9	0.3	3.1	0.4	0.5	0.4	2.8	0.5
MWF	2.4	1.9	1.2	2.5	0.6	1.1	0.5	0.7	2.5	0.6	0.3	1.5	1.2	1.1
CRC	56.0	33.8	50.2	33.0	44.6	38.3	46.4	66.0	49.3	42.2	41.5	62.4	52.9	58.6
NPM	18.0	20.0	21.1	17.6	22.5	20.8	18.1	10.8	22.5	18.6	14.4	11.8	13.3	11.3
RSS	3.5	0.2	0.8	1.4	0.7	0.1	0.1	0.4	1.4	0	0.9	0	0.8	0.2
FSU	0	7.2	0.3	12.1	0.1	8.7	0.1	4.0	0	1.9	0	3.4	0.0	4.3
CSU	3.38	20.8	4.6	24.1	3.3	13.7	4.0	9.1	3.4	24.0	0.6	12.3	1.6	13.7
KOK	14.4	2.2	17.3	1.8	27.1	8.1	28.6	0.9	17.5	0.4	41.6	1.2	25.4	2.0
YP	0	7.4	0	3.2	0.1	2.8	0.3	1.1	0	2.7	0.1	0.8	0.1	3.6
BT	0.1	5.1	0.3	3.3	0.1	2.6	0	5.8	0.3	9.2	0	5.9	0.1	3.6

*Species Codes = RB = Rainbow trout, WCT = westslope cutthroat trout, HB = hybrid rainbow trout X cutthroat trout, ONC= Combined Rainbow, westslope cutthroat and hybrid trout, MWF = mountain whitefish, CRC = Columbia River chub (peamouth), NPM = northern pikeminnow, RSS = red side shiner, FSU = fine scale sucker, CSU = course scale sucker, KOK = kokanee, YP = yellow perch, BT = bull trout.

Kokanee

Since the introduction of fry from the Kootenay Trout Hatchery at Wardner, British Columbia into Lake Koocanusa in 1980 and quite likely other inadvertent introductions of presumed moribund fish, kokanee have become the second most abundant fish captured during fall gillnetting. Fluctuations in catch have corresponded to the strength of various year classes (Hoffman et al. 2002), and have varied by year, with no apparent trend in abundance (Figure 11).

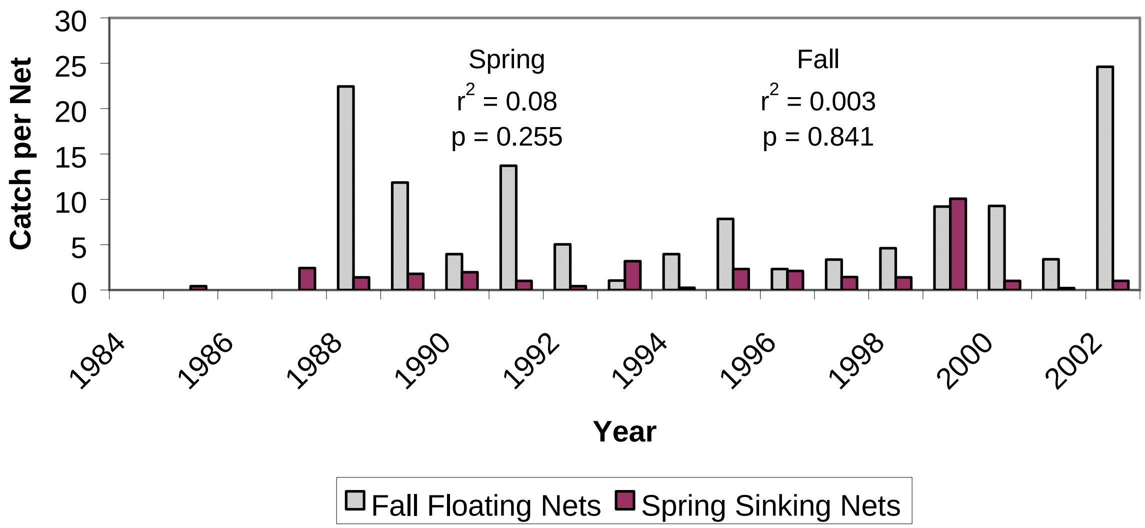

Figure 11. Average catch per net of kokanee for fall floating (1988-2002) and spring sinking (1984-2002) gill nets in Koocanusa Reservoir.

Average length of kokanee varied among years. Average length and weight between 1988 and 2002 was 292.0 mm and 239.2 g respectively (Table 9), while maximum average size occurred in 1992 (350 mm, 411 g). However, the minimum mean length was observed in 2002 (Table 9). Adult escapement to surveyed tributaries has increased substantially since 1997. It appears as though increasing numbers of bull trout; Kamloops trout and other predators have not negatively impacted kokanee populations in Lake Koocanusa.

Table 9. Average length and weight of kokanee salmon captured in fall floating gillnets (Tenmile and Rexford) in Lake Koocanusa, 1988 through 2002.

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	AVG.
Sample size (n)	2150	1259	517	624	250	111	291	380	132	88	76	200	342	120	357	
Length (mm)	315.5	275	257.3	315.8	350	262.7	270.2	300.2	293.7	329.6	333.9	291.6	271.3	261.6	251.3	292.0
Weight (gm)	289.1	137.2	158.4	327.3	411.3	162.3	191.7	261.6	234.5	363.2	322.0	229.6	185.6	161.6	152.2	239.2
Adult Escapement*									397,697	116,317	147,026	258,817	328,747	351,653	452,740	

*Escapement count from Westover (2002)

Rainbow and Westslope Cutthroat Trout

Rainbow trout and westslope cutthroat trout catch both have significantly declined since the impoundment of Lake Koocanusa (Figures 12 and 13). Rainbow trout catch per net since 1975 has declined more precipitously than cutthroat trout catch per net. However, catch statistics for both species exhibit similar trends.

Rainbow trout have exhibited two general trends since impoundment. The first trend was the initial decline in abundance from 1975 to 1989, which is characterized by significant decline (Figure 12), followed by a period of relative stability from 1990 to 2002, where the average catch per net during this period (mean fish per net = 0.313) was not significantly different than a stable population (zero slope; Figure 12).

Gill net catch of cutthroat trout in Lake Koocanusa exhibit a similar pattern, with the exception that that cutthroat trout catch rates exhibit 3 general trends. A significant decline occurred during the early years of impoundment from 1975 to 1986 (Figure 13), where mean catch rates averaged 1.37 fish per net. The second general trend reduced abundance (0.38 fish per net), but at a level of stability from 1987 to 1993 ($r^2 = 0.337$; $p = 0.172$).

The third general trend occurred from 1994 to 2002, and was characterized by a significantly lower level of abundance (0.13 fish per net; $p = 0.001$), and a somewhat stable level ($r^2 = 0.013$; $p = 0.768$). The general trend of cutthroat trout relative abundance observed between 1987 and 1993 was probably an artifact of the of hatchery cutthroat trout stocked in the reservoir during this period (Table 10). Hatchery cutthroat trout were last stocked in the reservoir in 1994.

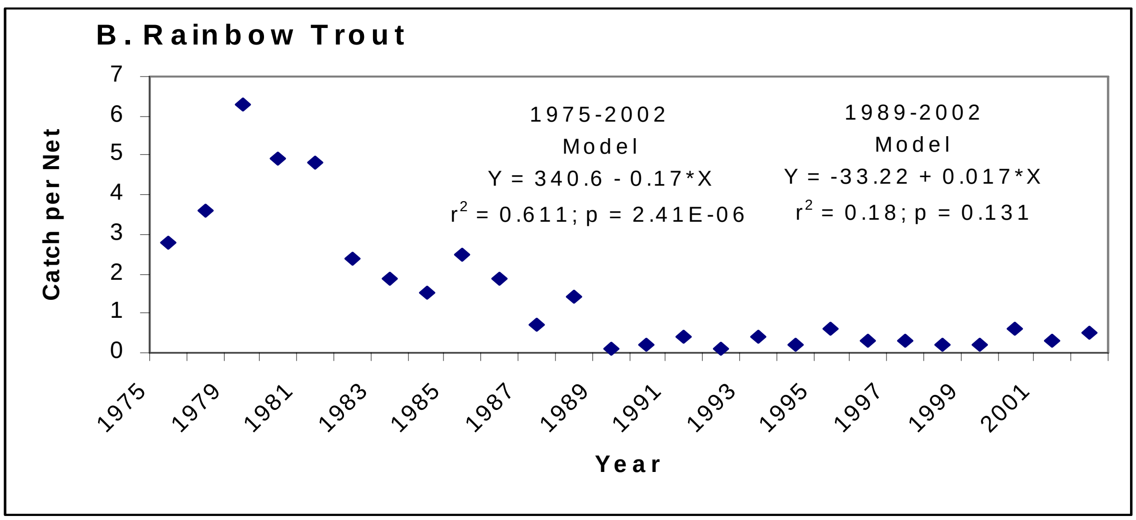

Figure 12. Mean catch rates (fish per net) of rainbow trout in floating gillnets from Tenmile and Rexford areas in Lake Koocanusa, 1975 - 2002. The Tenmile area was not sampled during the fall in 2001 or 2002.

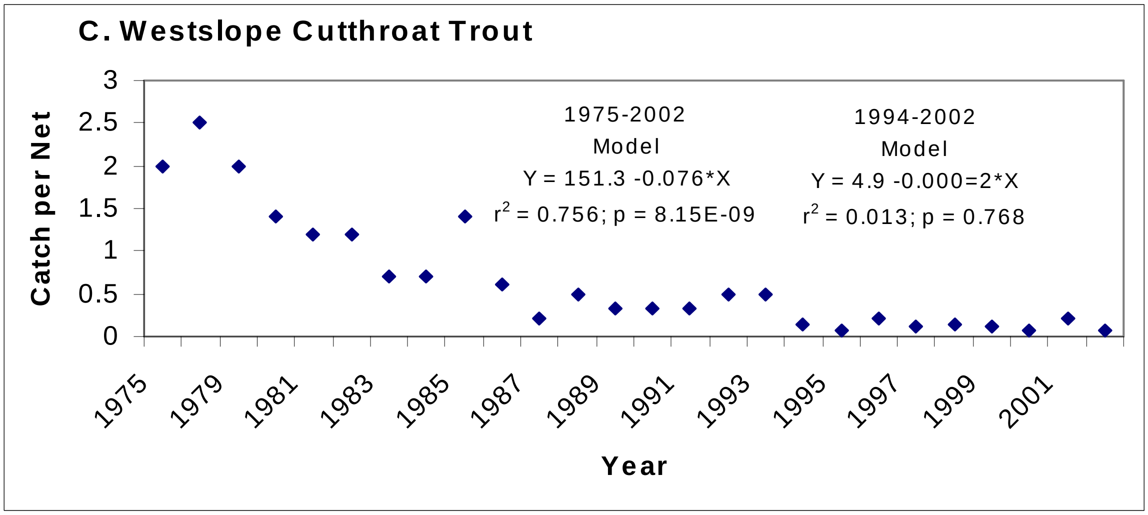

Figure 13. Mean catch rates (fish per net) of westslope cutthroat trout in floating gillnets from Tenmile and Rexford areas in Lake Koocanusa, 1975- 2002. The Tenmile area was not sampled during the fall in 2001or 2002.

Table 10. Number and lengths of westslope cutthroat trout in Lake Koocanusa, MT 1972– 994.

Date	Species	Number	Length (in)
4/10/72 - 4/25/72	WCT	177,756	3.0-4.0
7/27/1972	WCT	26,532	1.0
5/2/1973	WCT	38,425	5.0
7/11/1973	WCT	1965	5.0
7/11/1973 - 8/8/73	WCT	935,555	1.0-2.0
9/10/1973	WCT	24,856	2.0
10/16/1973	WCT	8901	3.0
4/16/1974	WCT	103,222	5.0
6/3/1974	WCT	33,500	4.0
9/6/1974	WCT	3234	4.0
9/9/74 - 10/29/74	WCT	400,720	2.0-3.0
8/19/1975	WCT	118,000	1.0
9/3/75 - 9/10/75	WCT	615,785	2.0
10/28/1975	WCT	24,560	3.0
8/5/1976 - 8/6/76	WCT	415,900	1.0-2.0
9/8/1976	WCT	94,250	3.0
9/13/76 - 10/11/76	WCT	101,632	2.0
5/14/81 - 5/22/81	WCT	200,000	4.0
4/29/1982 - 7/8/82	WCT	4789	13.0-14.0
5/3/82 - 6/11/82	WCT	316,191	4.0-5.0
7/14/82 - 7/20/82	WCT	9012	9.0
7/21/1982	WCT	604	11.0-12.0
9/23/1982	WCT	119,759	2.0
4/18/83 - 7/11/83	WCT	262,190	4.0-6.0
9/21/83 - 10/19/83	WCT	546,280	2.0-3.0
3/6/84 - 4/18/84	WCT	200,090	5.0
9/25/84 - 10/15/84	WCT	655,700	2.0
3/18/85 - 3/19/85	WCT	83,426	5.0
7/3/1985	WCT	16,570	6.0
9/18/85 - 9/26/85	WCT	556,850	2.0-3.0
9/15/86 - 9/17/86	WCT	495,356	1.0-2.0
8/17/1990	WCT	5779	1.3
6/26/1991	WCT	40,376	4.1
5/11/92 - 6/26/92	WCT	72,211	8.5-9.1
5/25/93 - 6/24/93	WCT	72,367	7.2-7.7
10/11/94 - 10/18/94	WCT	1360	11.3

Kamloops Rainbow Trout (Gerrard and Duncan Strain)

The name “Kamloops” is a popular catchall given to rainbow trout that originated in British Columbia lakes. These trout were known to prey on kokanee and reach large size (up to 40 lbs.). The rainbow trout utilized in Lake Koocanusa actually originated from two strains of trout. Gerrard strain trout are F2 progeny of wild trout taken from Kootenay Lake British Columbia. This particular strain spawns in the Lardeau River, B.C. Hatchery personnel take eggs on alternate years, grow the fish to adult and spawn these trout for the hatchery stock (Andrusak and Brown 1989). Duncan strain (Tributary to Kootenay Lake) originated from a sample of adults taken in 1988 and then domesticated by USFWS at Ennis National Fish Hatchery and now Murray Springs State Fish Hatchery. The Gerrards were first introduced to Lake Koocanusa in 1985 by BCMOE. The BCMOE stocked approximately 5,000 fingerling Kamloops (Gerrard strain) annually into Kikomun Creek (a tributary to the Kootenai River) between 1985-1998 (L. Siemens, BCMOE, personal communication).

Montana FWP has stocked approximately 11,000 to 73,000 Duncan strain rainbow trout annually since 1988 and since 2001, all stocked Kamloops have been triploid fish.(Table 8). The catch of Kamloops in fall floating gillnets (fish per net) was significantly and positively correlated with the number of hatchery Kamloops stocked in the reservoir the previous year ($P=0.002$; $r^2 = 0.63$; Table 11) for 1988 through 1999. However, the catch rate of Kamloops rainbow trout in fall floating gillnets shows no significant trend (Figure 14; $r^2 = 0.136$; $p = 0.177$). Catch rates for Kamloops rainbow trout in fall gillnets has been low since 1996.

Table 11. Kamloops rainbow trout captured in fall floating gillnets in the Rexford and Tenmile areas of Lake Koocanusa, 1988 through 2002. The Tenmile site was not sampled in 2001 or 2002.

	1988	1989	1990	1991	1992	1993	1994	1995
Number Caught	3	0	18	6	3	4	0	12
Avg. Length mm)	289	n/a	301	383	313	460	N/A	313
Avg. Weight (gm)	216	n/a	243	589	289	373	N/A	311
Number Stocked	20,546	73,386	36,983	15,004	12,918	10,831	16,364	15,844
Length (mm)	208-327	175-198	175-215	180-190	198-208	165-183	168-185	165-178
	1996	1997	1998	1999	2000	2001	2002	
Number Caught	2	1	2	3	3	0	0	
Avg. Length (mm)	460	395	376	378	395	N/A	N/A	
Avg. Weight (gm)	1192	518	450	504	555	N/A	N/A	
Number Stocked	12,561	22,610	16,368	13,123	None	None	29,546	
Length (mm)	170.5	152-178	127-152	255-280	N/A	N/A	80.3	

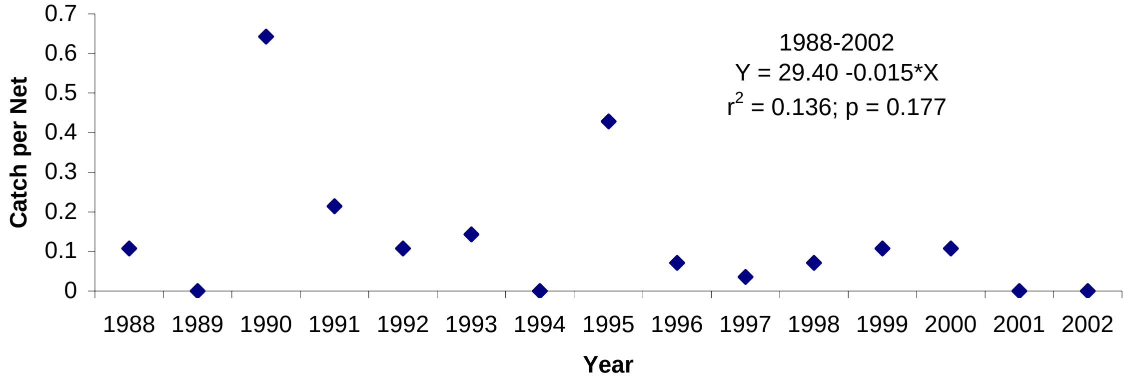

Figure 14. Average catch (fish per net) of Kamloops rainbow trout (Duncan strain) in fall floating gill nets in Lake Koocanusa at the Rexford and Tenmile sites 1988-2002. The Tenmile site was not sampled in 2001 or 2002.

In 2002, MFWP contacted 10 avid trout anglers that were targeting Kamloops that have been stocked into Lake Koocanusa since 1985. We requested they log fishing effort during the year. The creel book program was initiated in July 2002 because some anglers suggested that they were catching "too many" bull trout. Although these anglers were targeting the large Kamloops, the techniques used are also effective at capturing bull trout. MFWP also accomplished a creel survey during a Kamloops fishing derby between May 16 and 17, 2003. To date, we have information from 2385 hours of angling through nearly one year (Table 12). The average catch rates for Lake Koocanusa trout (32hrs/fish) are very similar to Idaho (over 30) and what Andrusak and Brown (1989) found for Kootenay Lake trout (35hrs/fish) We intend to continue to use and if possible expand this survey to aid in determining the success of triploidy as a management tool.

Table 12. Information on angler-use and catch for Kamloops trout from creel books for Lake Koocanusa July, 2002 through May, 2003.

Month	Number of Anglers	Total Hours Fished	Number Fish Caught[1]	Number Caught	Hours/fish Caught	Fish Caught/Hour
July	18	122	6	1	122	0.01
August	15	93	1	1	93	0.01
September	14	95	10	5	19	0.05
October	27	179	15	5	36	0.03
November	24	145	34	7	21	0.05
December	14	88	23	2	44	0.02
January	24	136	33	0	--	--
February	34	205	51	10	21	0.05
March	40	263	30	4	66	0.02
April	34	183	24	9	20	0.05
May	100	876[2]	100	30	29	0.03
Total	344	2385	327	74	32	0.03

1: Includes bull trout
2: Includes creel survey from two-day Kamloops derby.

Kokanee Lakes

Montana Fish, Wildlife and Parks personnel continued to monitor total length of mature spawning kokanee from lakes in the Kootenai drainage to assess stocking success. A summary of mean lengths for males and females is presented in Table 13. There is a loose correlation between date of stocking and length of spawning adults. We have worked with hatchery personnel at Somers Hatchery, Montana to stock the lakes after May 15, which is closer to historic timing.

Table 13. Mean length of spawning kokanee salmon collected from lakes in Region 1, 1995 – 2003.

			Males			**Females**			
Lake (water code)	**Date**	**Surface Area**	**N**	**Mean Length (mm)**	**Range (mm)**	**N**	**Mean Length (mm)**	**Range (mm)**	**Number kokanee stocked (date)**
Bull Lake (11-8040)	10/30/95	1250	12	399	376-426	6	377	367-386	92,000 (5/31)
	10/24/96		9	378	345-405	3	358	345-371	50,000 (5/21)
	9/30/98		25	350	331-396	25	334	315-368	100,000 (4/14)
	10/12/99		30	369	336-395	28	351	321-380	56,000 (6/16)
	10/10/00		22	373	335-410	8	346	306-380	214,000 (5/27)
	10/3/01		11	329	310-346	9	297	277-323	198,000 (3/28)
	10/4/02		30	326	310-355	28	306	268-325	170,000 (4/15)
	10/21/03		30	338	322-360	28	308	290-322	98,000 (5/2)
Crystal Lake (11-8180)	10/20/95	178	30	383	342-473	15	423	322-454	50,000 (5/26)
	10/1/96		25	403	383-423	25	383	349-475	50,000 (5/20)
	9/15/97		9	311	233-330	13	296	235-333	50,000 (4/29)
	9/28/98		32	334	305-367	30	323	290-352	50,000 (4/13)
	10/4/99		29	313	290-363	29	306	276-345	50,000 (4/20)
	10/11/00		26	329	290-362	30	307	285-350	52,000 (4/4)
	9/26/01		27	322	300-377	30	310	290-340	43,000 (4/30)
	9/30/02		28	325	297-370	30	310	287-349	51,000 (4/18)
	10/1/03		30	331	305-375	30	328	312-355	50,000 (5/9)
Dickey Lake (11-8220)	10/19/95	625	20	282	253-306	20	265	251-302	32,000 (6/1)
	10/4/96		25	254	231-266	18	249	238-260	30,000 (5/24)
	9/29/98		25	222	205-238	2	211	206-215	21,000 (4/28)
	10/3/00		30	262	235-277	30	253	235-265	15,000 (4/25)
	10/1/01		25	237	220-260	17	237	228-251	18,000 (5/1)
	10/10/02		30	220	200-265	24	206	182-225	15,000 (4/22)
	10/15/03		19	213	197-223	19	205	190-227	15,000 (4/26)
Glen Lake (11-8380)	10/19/95	340	10	326	320-332	6	316	305-327	54,000 (6/0)
	10/4/96		25	387	356-404	25	367	335-387	0
	9/29/98		9	349	269-479	2	359	263-455	51,000 (4/27)
	10/3/00		29	293	275-332	30	284	266-315	0
	10/1/01		4	336	323-348	6	317	307-322	47,000 (5/22)
	10/10/02		30	329	305-357	23	317	300-340	21,000 (4/22)
	10/15/02		27	326	290-365	12	320	290-360	29,000 (4/26)
Spar Lake (11-9640)	10/30/95	602	2	431	386-476				80,000 (5/31)
	11/28/96		17	403	340-440	1	399	282-399	98,000 (5/21)
	10/7/98		2	296	290-301	1	296		99,000 (5/15)
	10/13/99		0	None		0	None		56,000 (6/7)
	10/10/00		0	None		0	None		91,000 (5/24)
	11/9/01		1	392	392	0	None		130,000 (5/17)
	10/4/02		0	None		0	None		100,000 (5/29)
Middle Thompson Lake* (05-9232)	10/25/95	600	31	463	411-558	31	414	386-514	112,000 (5/26)
	10/1/96		19	470	420-530	13	450	411-495	96,000 (5/20)
	9/15/97		6	427	415-445	3	400	385-436	97,000 (4/18)
	9/28/98		32	388	260-465	15	387	340-435	101,000 (4/13)
	10/4/99		30	420	350-485	22	397	330-426	99,000 (4/20)
	10/11/00		30	431	405-487	27	412	370-480	101,000 (4/11)
	9/26/01		21	400	365-460	6	376	355-406	101,000 (4/22)
	9/30/02		30	365	340-405	18	337	315-365	110,000 (4/19)
	10/1/03		34	386	337-422	46	348	316-410	80,000 (5/10)

* No kokanee were stocked in Middle Thompson Lake, numbers are for those stocked in Lower Thompson Lake annually. Lower Thompson Lake is connected to Middle Thompson Lake via a shallow channel.

There is evidence from historic netting records and personal observations that all these lakes support at least some natural reproduction. Because kokanee populations tend to exhibit density dependent growth, it was to our advantage to identify the proportion of hatchery to wild contribution to the populations. Additionally, if we decide to use any of these lakes for future egg sources, we need to know what effect removal of spawning adults might have on the population structures of these lakes. All of these lakes have very popular summer and winter kokanee fisheries. We chose Crystal Lake and Middle Thompson Lake to assess a marking strategy.

Beginning in 1994, MFWP fed kokanee tetracycline laced feed to lay a mark in bony structures. We remove the atlas and several additional vertebrae from netted kokanee. The vertebra are cleaned and placed under ultra violet light to identify fluoresced bone. The purpose of this strategy was to assess the contribution of hatchery reared kokanee to the lakes.

Unfortunately, we had no success with identifying the tetracycline marks from kokanee captured at any of the lakes, even though the kokanee were checked periodically for marks at the hatchery prior to release. There are three possible reasons for this outcome: 1) the marks were not strong enough to be seen in adults three years after the marking; 2) kokanee were stocked into the lakes at a small enough size that there was not enough pigmentation in the skin to keep sunlight from destroying the mark; 3) we captured the progeny of kokanee that spawned in the lakes.

In 2001 we initiated a program with the hatchery personnel at Somers Hatchery, Montana to treat eyed eggs with alternating cold and warm water to create unique daily growth rings on the otoliths beginning in 2002.

We marked kokanee eggs at the Somers Fish Hatchery, Somers Montana, using egg chillers constructed by hatchery personnel. We collected eggs from spawning fish at Little Bitterroot Lake, Lake Mary Ronan and Swan Lake. After fertilization and treatment of the eggs was complete hatchery personnel transported the eggs from the source to the Somers Fish Hatchery, where they were placed in hatching jars at 50-52 F. The eggs were held at this temperature until eye up when the thermal marking was to commence. After eye-up the eggs were placed in egg chillers where we decreased water temperature from 50-52 F to 38-42 F. Eggs were to be subjected to these temperature fluctuations at regular intervals. This process was repeated several times to increase the number of visible marks (Table 14).

We varied the duration and temperatures through the study to find a desired marking technique to distinguish hatchery kokanee from the wild reproducing kokanee. After marking was complete the eggs hatched, we placed fry in troughs and collected a small sample of fish for analysis. The remaining fish were reared at Somers Hatchery until we stocked them.

Table 14. Temperature, duration and number of marks for kokanee thermal marking program at Somers Hatchery, MT 2002 through 2004

Year	Lot#	Temp. Variation	Duration	Number of Marks
2001-2002	DC	50 F - 38 F	144 hrs 1st mark 24 hrs 2nd mark	2
2002-2003	DA	52 F - 42 F	72 hrs	1
	DB	52 F - 42 F	48 hrs	1
2003-2004	RB	50 F - 40 F	48-72 hrs	3
	RC	50 F - 40 F	48-72 hrs	4
	RD	50 F - 40 F	48-72 hrs	4

We collected a sample of approximately ten kokanee fry from each lot of marked fish after they have absorbed yolk sacs. We also sampled from unmarked fish. We preserved the fry in ethanol and transported them to Libby Area Office for examination. We extracted the otoliths and immersed them in a clear fiberglass resin and placed them under a fume hood to be cured. After the resin cured, we used a rotating disk with 600 grit carborundum paper and water slurry to ground the otoliths the primordium. When the primordium and daily growth rings were visible under magnification. We then polished otoliths with one-micron alumina micro polish and finally buffed them to remove scratches. We captured the otoliths images and recorded the vital information to cross reference future samples collected from lakes containing thermally marked fish.

We have had varying success with this process. In the first year (2001-2002) we used two temperature changes leaving two distinct marks. This lot of fish was sampled and analyzed both as fry and as 1+ juvenile fish (Table 14, Figure 15). We included un-marked fish for comparison. The un-marked fish showed a single band in their growth called a stress check, which occurs at hatching. The hatching check on the marked fish is outside of the thermal marks.

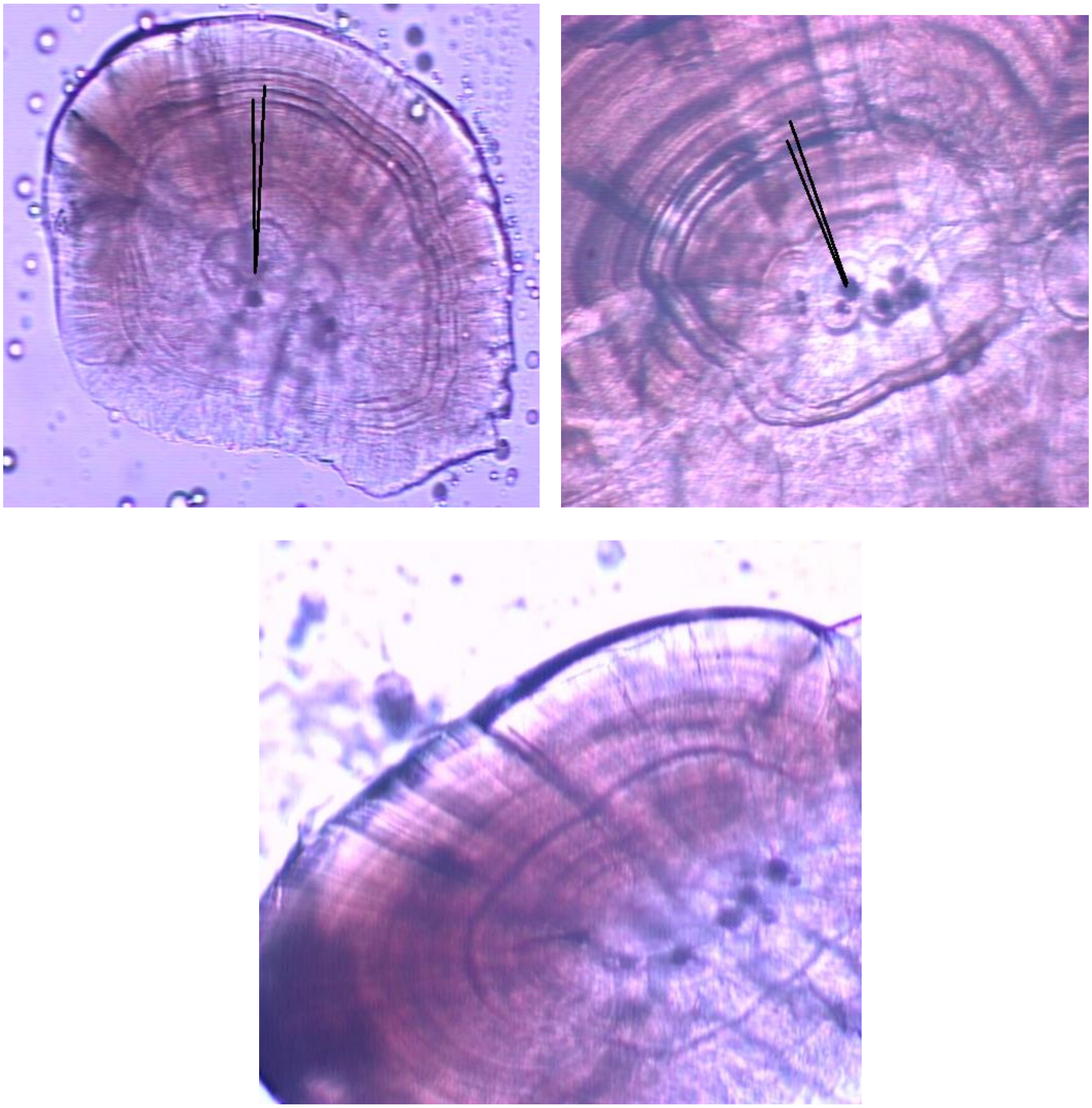

Figure 15. Examples of otoliths from one lot of kokanee fry exposed to two temperature marks in 2002. All otoliths are magnified to 400X. Otolith on the left is from a fry. Otolith on the right is from a 1+ kokanee. Otolith on bottom is from a kokanee fry subjected to standard hatchery conditions.

In year two, we expanded the thermal marking over two separate lots of eggs (Table 14). The first lot (DA) was marked using a single temperature change. This single event created a mark that was noticeable in the fry (Figure 17). The second lot (DB) was marked using the same temperature change, however, the exposure time was decreased to 48 hours. This also created a mark that was evident in the fry analyzed from this lot and wasn't seen in the un-marked fry of a different lot (Figure 17). We are concerned that the single thermal mark will be difficult to distinguish between the hatching mark of a wild kokanee.

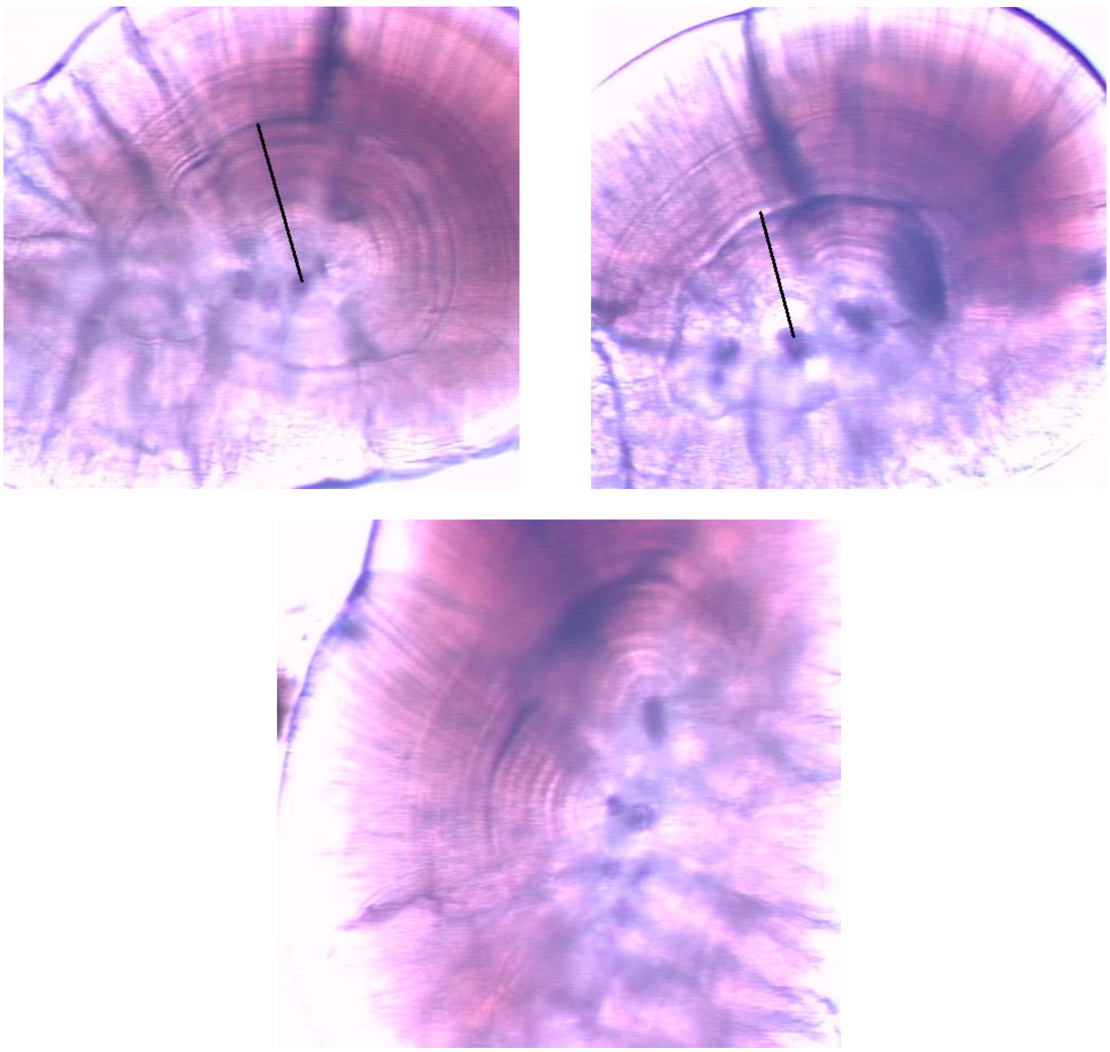

Figure 16. Examples of otoliths from kokanee fry exposed to one temperature mark in 2003. All otoliths are magnified 400X. Otolith on bottom is from a kokanee fry subjected to standard hatchery conditions.

In 2004 we exposed three lots of eggs to four thermal marks (Table 14). All lots of eggs marked this year have good marks that are easily separated from the un-marked fish (Figure 17).

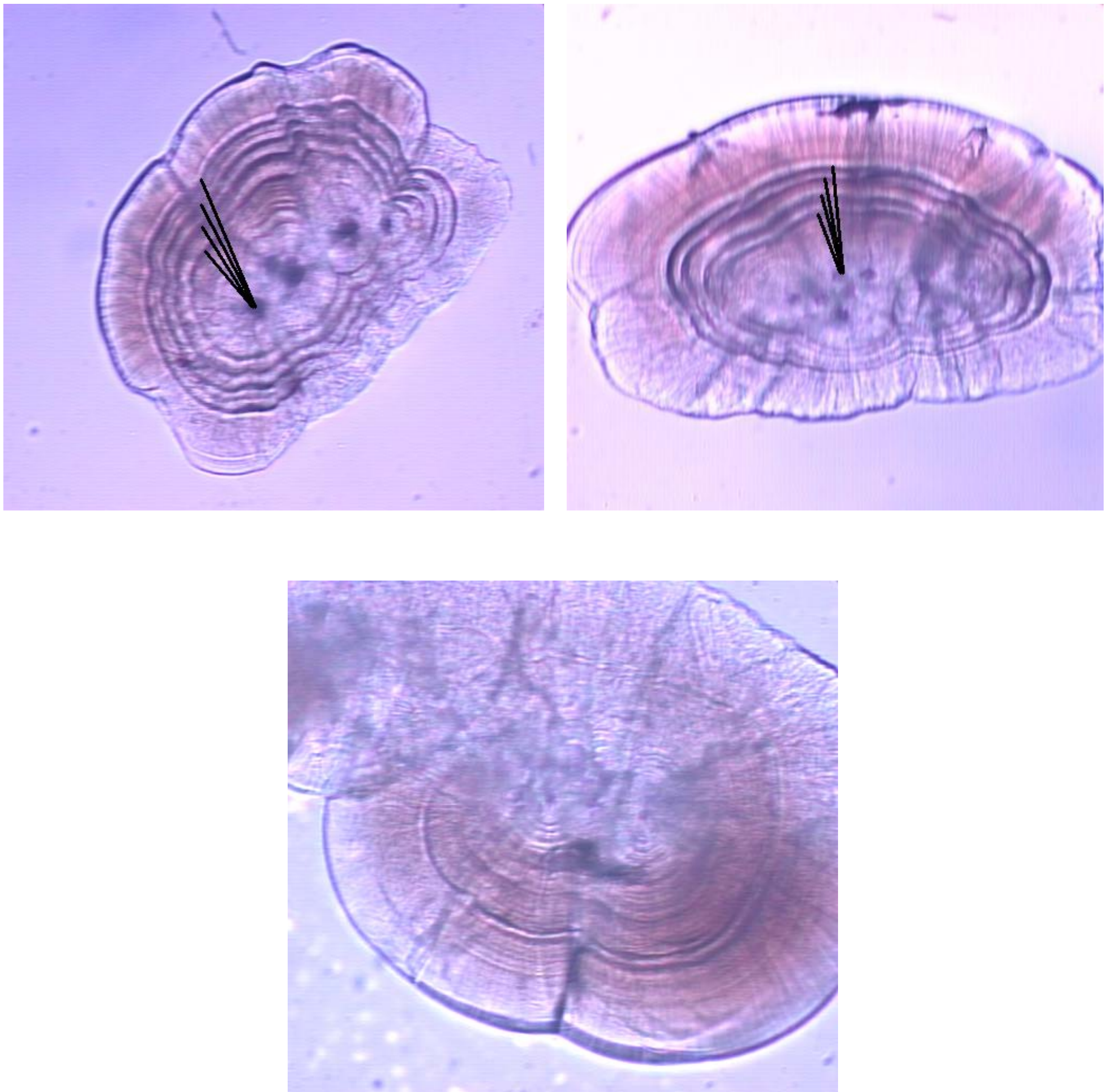

Figure 15. Examples of otoliths from one lot of kokanee fry exposed to two temperature marks in 2004. All otoliths are magnified to 400X. Otolith on bottom is from a kokanee fry subjected to standard hatchery conditions.

RECOMMENDATIONS

Recommendations for work items in fiscal year 2001 are listed below

1) Continue to survey lakes within Region one as the need and opportunity arises
2) Continue to monitor kokanee populations in Region one lakes every one to four years to detect population changes.

Submitted by: Mike Hensler Jim Dunnigan Neil Benson

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