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REGIONAL FISHERIES MANAGEMENT INVESTIGATIONS

PANHANDLE REGION (Subprojects I-A, II-A, III-A, IV-A)

PROJECT I.	SURVEYS AND INVENTORIES
Job a.	Panhandle Region Mountain Lakes Investigations
Job b[1].	Panhandle Region Lowland Lakes Investigations
Job b[2].	Panhandle Region Coeur d'Alene Lake Investigations
Job c.	Panhandle Region Rivers and Streams Investigations
PROJECT II.	TECHNICAL GUIDANCE
PROJECT III.	HABITAT MANAGEMENT
PROJECT IV.	POPULATION MANAGEMENT

By

Lance Nelson, Regional Fishery Biologist
Jim Davis, Regional Fishery Biologist
Ned Horner, Regional Fishery Manager

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1993 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management F-71-R-18

Project I: Surveys and Inventories

Subproject I-A: Panhandle Region

Job: a

Title: Mountain Lakes Investigations

Contract Period: July 1. 1993 to June 30, 1994

ABSTRACT

Bull trout *Salvelinus confluentus* were stocked in Upper Glidden, Revett, Roman Nose #1, and Roman Nose #2 mountain lakes to control stunted brook trout *S. fontinalis* populations. Stocking rates ranged from 40 fish/ha to 70 fish/ha.

Hatchery personnel and volunteers stocked 45 mountain lakes in the Panhandle Region. Species stocked included westslope cutthroat trout *Oncorhynchus clarki lewisi*, domestic Kamloops and Hayspur stock rainbow trout O. *Mykiss*, brook trout, bull trout, splake *S. fontinalis x S. namaycush*, and Arctic grayling *Thymallus arcticus.*

Authors:

Lance Nelson
Regional Fishery Biologist

Jim Davis
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

OBJECTIVES

1. To control stunted brook trout *Salvelinus fontinalis* populations in four mountain lakes with the introduction of bull trout *S. confluentus.*

2. To develop improved management plans for fish populations in mountain lakes in the Panhandle Region.

3. To provide diversity of angling opportunity by maintaining a stocking program with different species of salmonids in Panhandle Region mountain lakes.

INTRODUCTION

Biologists surveyed three mountain lakes in the South Fork Coeur d'Alene River drainage and two mountain lakes in the Kootenai River drainage in 1992 (Horner et. al. 1996). These lakes contained populations of stunted brook trout. Fish predators were decided upon as a means of reducing the number of brook trout in the lakes and thus improving the condition of the remaining brook trout. Bull trout was the predator species selected for this control.

METHODS

The four mountain lakes which received bull trout as a predator control on stunted brook trout populations were each stocked at a different density (Table 1). A Hughes 500 helicopter equipped with a fire bucket was used to transport the fish to the lakes.

Table 1. Bull trout stocking densities in four mountain lakes in Idaho, August 1993.

Lake	Surface area (ha)	Number of fish stocked	Density (fish/ha)
Upper Glidden	4.50	180	40
Revett	4.50	315	70
Roman Nose #1	6.50	390	60
Roman Nose #2	3.24	162	50

RESULTS AND DISCUSSION

Four of the five mountain lakes surveyed in 1992, Upper Glidden, Revett, Roman Nose #1, and Roman Nose #2, were stocked with bull trout in August 1993. The bull trout ranged in length from 200 mm to 350 mm. These fish were F1 progeny from adults captured in Gold Creek, Lake Pend Oreille, Idaho, and reared to age 1+ at the Sandpoint Fish Hatchery. The fifth lake, Upper Stevens, was not stocked because of insufficient numbers of bull trout available.

The standard stocking program for Panhandle Region mountain lakes was completed with minimal changes in 1993. The majority of lakes (21 in 1993) were stocked with westslope cutthroat trout *Oncorhynchus clarki lewisi.* All lakes scheduled for rainbow trout O. *mykiss* fry were stocked with either domestic Kamloops or Hayspur stock rainbow trout. All lakes scheduled for Arctic grayling *Thymallus arcticus* or golden trout *O. aguabonita* were stocked with Arctic grayling, as no golden trout were available in 1993.

Bloom Lake continued to be stocked with brook trout and received its third stocking of splake *S. fontinalis x S. namaycush* in 1993. Bull trout were stocked in four mountain lakes to test their effectiveness in reducing overabundant brook trout.

Six drive-to lakes were stocked with put-and-take rainbow trout. Solomon Lake was added to this list in 1993. Continued low water levels (about 50% of full pool) resulted in a winter kill during the winter of 1993, precluding the option of managing Solomon Lake for a quality cutthroat trout fishery. Stocking histories for mountain lakes in the Panhandle Region during the past 12 years are summarized in Appendix A.

Insufficient creel census data were available in 1993 to evaluate program goals.

The stocking schedule for Panhandle Region mountain lakes attempts to balance the number of species of fish and the number of lakes to be stocked each year (Appendices B and C). Deviations from the schedule have most often been caused by lack of fish, access problems, and conflicts with other programs. Lakes in the Little North Fork Clearwater River drainage were stocked by plane from McCall Hatchery in 1993.

Species diversity will be maintained by utilizing westslope cutthroat and domestic Kamloops rainbow trout for most lakes, golden trout and Arctic grayling (when available) for specialty lakes, and brown trout *Salmo trutta* for attempted control of stunted brook trout in 1993.

The lack of suitable sized domestic Kamloops rainbow trout has forced us to utilize different stocks of rainbow trout in order to maintain some species diversity in mountain lakes. Rainbow trout will not be stocked in mountain lakes in the Pend Oreille drainage to avoid

diluting the wild Gerrard rainbow trout gene pool in Lake Pend Oreille, and we will stock only westslope cutthroat trout in lakes specified for cutthroat trout.

RECOMMENDATIONS

1. Develop a mountain lake management plan that addresses management objectives, standardized survey techniques, and evaluation procedures for both short- and long-term goals.

2. Verify lake acreage estimates from aerial photos so that stocking density recommendations are accurate.

3. Evaluate trout growth relative to stocking density and frequency to determine if existing stocking recommendations are resulting in desirable fisheries.

4. Utilize the voluntary angler diary program to evaluate fish population characteristics and angler satisfaction.

5. Work with the Forest Service and Boundary County Backpackers to create a trail into Smith Lake to provide improved angling opportunity for Arctic grayling.

6. Consider stocking Arctic grayling or golden trout into a more accessible lake to provide increased angling opportunity for specialty stocks. Consult Department personnel and interested anglers to determine suitable waters. Survey lakes and consider a restoration project to eliminate competition from non-specialty stocks.

7. Evaluate bull trout stocking in 1995 or 1996.

8. Evaluate return to the creel for put-and-take rainbow trout in Dismal and Antelope lakes.

APPENDICES

Appendix A. Number and species of fish (fry except where noted) stocked into mountain lakes in Region 1 from 1981-1993.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Kootenai	Hidden (1-103)	50	1981	15,922	318	Westslope cutthroat	
			1982	15,656	313	Kamloops rainbow	
			1983	12,107	242	Henrys Lake cutthroat	
			1984	12,768	255	Kamloops rainbow	
			1985	12,512	250	Westslope cutthroat	
			1986	6,000	120	Westslope cutthroat	
			1987	12,500	250	Westslope cutthroat	
			1988	12,096	242	Kamloops rainbow	
			1989	3,082	62	Kamloops rainbow	
			1989	12,495	250	Westslope cutthroat	
			1990	12,928	258	Kamloops rainbow	
			1991	12,500	250	Westslope cutthroat	
			1992	8,440	169	Kamloops rainbow	
			1993	12,000	242	Westslope cutthroat	
	Lake Mountain (Cuttoff) (1-104)	7	1983	1,723	246	Henrys Lake cutthroat	
			1985	1,748	250	Westslope cutthroat	
			1987	1,750	250	Westslope cutthroat	
			1989	1,750	250	Westslope cutthroat	
			1991	1,750	250	Westslope cutthroat	
	West Fork (1-109)	12	1981	6,704	559	Westslope cutthroat	
			1982	3,648	304	Kamloops rainbow	
			1983	3,016	251	Henrys Lake cutthroat	
			1984	3,010	251	Kamloops rainbow	
			1985	2,990	250	Westslope cutthroat	
			1986	4,495	375	Westslope cutthroat	
			1987	3,000	250	Westslope cutthroat	
			1988	3,007	250	Westslope cutthroat	
			1989	3,087	257	Kamloops rainbow	
			1990	3,000	250	Westslope cutthroat	
			1991	3,000	250	Kamloops rainbow	
			1992	3,000	250	Westslope cutthroat	
			1993	3,006	250	Kamloops rainbow	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Kootenai	Long Mountain (1-112)	3	1987	1,000	333	Grayling	
			1990	1,500	500	Grayling	
			1991	1,500	500	Grayling	
			1992	664	331	Grayling	
			1993	1,500	500	Grayling	
	Parker (1-113)	3	1986	1,225	408	Golden trout	
			1988	1,002	334	Grayling	
			1990	1,410	470	Golden trout	
			1991	1,500	500	Grayling	
			1992	265	122	Grayling	
			1993	1,042	347	Grayling	
	Smith (Long Canyon) (1-115)	6	1987	2,000	333	Grayling	
			1988	3,000	500	Grayling	
			1990	3,000	500	Grayling	
			1991	1,000	167	Grayling	
			1993	704	117	Grayling	
	Big Fisher (1-117)	10	1981	3,352	335	Westslope cutthroat	
			1983	2,486	248	Henrys Lake cutthroat	
			1985	2,530	253	Westslope cutthroat	
			1987	2,500	250	Westslope cutthroat	
			1990	2,500	250	Westslope cutthroat	
			1992	2,500	250	Westslope cutthroat	
	Myrtle (1-122)	20	1983	5,189	259	Westslope cutthroat	
			1985	5,100	255	Westslope cutthroat	
			1987	5,000	250	Westslope cutthroat	
			1989	5,000	250	Westslope cutthroat	
			1991	4,953	248	Westslope cutthroat	
			1993	5,075	254	Westslope cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Kootenai	Trout (1-124)	7	1981	2,514	359	Westslope cutthroat	
			1982	3,296	471	Kamloops rainbow	
			1983	1,720	247	Henry's Lake cutthroat	
			1984	1,733	248	Kamloops rainbow	
			1985	1,748	250	Westslope cutthroat	
			1986	1,721	246	Westslope cutthroat	
			1987	1,751	250	Westslope cutthroat	
			1988	1,743	250	Westslope cutthroat	
			1990	1,750	250	Westslope cutthroat	
			1992	1,750	250	Kamloop rainbow	
	Pyramid (1-125)	11	1981	4,190	381	Westslope cutthroat	
			1982	3,296	300	Kamloops rainbow	
			1983	2,702	246	Henrys Lake cutthroat	
			1984	2,736	249	Kamloops rainbow	
			1985	2,760	251	Westslope cutthroat	
			1986	2,741	249	Westslope cutthroat	
			1987	2,750	250	Westslope cutthroat	
			1988	2,752	250	Westslope cutthroat	
			1989	2,750	250	Kamloops rainbow	
			1990	2,765	251	Westslope cutthroat	
			1991	2,750	250	Kamloops rainbow	
			1992	2,750	250	Westslope cutthroat	
			1993	2,805	255	Kamloops rainbow	
	Ball Creek (1-126)	6	1983	1,513	255	Henrys Lake cutthroat	
			1984	1,000	167	Westslope cutthroat	
			1986	1,498	250	Westslope cutthroat	
			1988	1,500	250	Westslope cutthroat	
			1990	1,500	250	Westslope cutthroat	
			1992	1,500	250	Westslope cutthroat	

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Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Kootenai	Little Ball Creek (1-127)	4	1984	1,500	375	Westslope cutthroat	
			1986	956	239	Westslope cutthroat	
			1988	1,000	250	Westslope cutthroat	
			1990	1,000	250	Westslope cutthroat	
			1992	1,000	250	Westslope cutthroat	
	Snow (1-134)	10	1982	3,008	301	Westslope cutthroat	
			1983	2,872	287	Henrys Lake cutthroat	
			1987	2,500	250	Westslope cutthroat	
			1989	2,400	240	Westslope cutthroat	
			1991	2,500	250	Westslope cutthroat	
			1993	2,500	250	Westslope cutthroat	
	Roman Nose #1	16	1993	390	24	Bull trout	(brook trout control)
	Roman Nose #2	7.9	1993	162	21	Bull trout	(brook trout control)
	Roman Nose #3 (1-137)	12	1983	2,320	193	Domestic Kamloops	(size 2)
			1985	3,000	50	Westslope cutthroat	
			1986	3,000	250	Westslope cutthroat	
			1987	3,000	250	Westslope cutthroat	
			1988	3,000	250	Westslope cutthroat	
			1989	3,000	250	Kamloops rainbow	
			1990	1,000	83	Westslope cutthroat	(size 2)
			1991	3,150	262	Kamloops rainbow	
			1992	1,305	109	Westslope cutthroat	(size 2)
			1993	3,000	250	Kamloops rainbow	
	Solomon (1-146)	9	1982	3,040	338	Kamloops rainbow	
			1983	2,162	240	Henrys Lake cutthroat	
			1984	2,268	252	Kamloops rainbow	
			1985	2,250	250	Westslope cutthroat	
			1986	2,500	278	Westslope cutthroat	
			1987	2,250	250	Westslope cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Kootenai	Solomon		1988	2,250	250	Westslope cutthroat	
			1989	712	29	Westslope cutthroat	(Broodstock)
			1990	2,250	250	Westslope cutthroat	
			1991	1,024	114	Westslope cutthroat	(size 2)
			1991	480	53	Westslope cutthroat	(Broodstock)
			1992	1,045	116	Westslope cutthroat	(size 2)
			1993	500	56	Kamloops rainbow	Winter killed, shift mgmt to put-and-take rainbow (size 3)
	Spruce (1-147)	5	1982	2,432	486	Kamloops rainbow	
			1983	1,297	259	Henrys Lake cutthroat	
			1984	2,520	504	Kamloops rainbow	
			1985	1,250	250	Westslope cutthroat	
			1986	1,250	250	Westslope cutthroat	
			1987	1,250	250	Westslope cutthroat	
			1988	1,250	250	Westslope cutthroat	
			1989	1,265	253	Westslope cutthroat	
			1990	1,250	250	Westslope cutthroat	
			1991	1,247	250	Kamloops rainbow	
			1992	1,250	250	Westslope cutthroat	
			1993	1,250	250	Kamloops rainbow	
	Queen (1-148)	5	1983	1,296	259	Henrys Lake cutthroat	
			1986	1,250	250	Westslope cutthroat	
			1988	1,250	250	Westslope cutthroat	
			1990	1,250	250	Westslope cutthroat	
			1992	1,250	250	Westslope cutthroat	
	Debt (1-150)	5	1985	1,250	250	Westslope cutthroat	
			1989	1,250	250	Westslope cutthroat	
			1991	1,250	250	Westslope cutthroat	
			1993	1,250	250	Westslope cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Kootenai	Copper (1-154)	5	1983	1,297	259	Henrys Lake cutthroat	
			1984	1,390	278	Westslope cutthroat	
			1986	1,250	250	Westslope cutthroat	
			1988	1,247	250	Westslope cutthroat	
			1990	1,250	250	Westslope cutthroat	
			1992	1,250	250	Westslope cutthroat	
	Callahan (Smith) (1-160)	10	1984	2,500	250	Westslope cutthroat	
			1987	2,522	252	Westslope cutthroat	
			1988	2,500	250	Westslope cutthroat	
			1992	2,563	251	Westslope cutthroat	
			1993	2,514	250	Westslope cutthroat	
	Estelle (1-167)	5	1988	1,075	"215	Brown trout	Test control
			1990	500	100	Brown trout (size 3)	of stunted
			1992	150	30	Brown trout (size 2)	brook trout
Pend Oreille	Hunt (2-101)	12	1982	3,648	304	Kamloops rainbow	
			1985	3,000	250	Westslope cutthroat	
			1986	3,000	250	Westslope cutthroat	
			1987	3,033	253	Westslope cutthroat	
			1988	3,000	250	Westslope cutthroat	
			1989	5,000	417	Westslope cutthroat	
			1990	3,000	250	Westslope cutthroat	
			1991	3,000	250	Westslope cutthroat	
			1992	3,023	250	Westslope cutthroat	
			1993	3,000	250	Westslope cutthroat	
	Standard (2-103)	16	1983	4,021	251	Henrys Lake cutthroat	
			1985	4,000	250	Westslope cutthroat	
			1987	3,962	248	Westslope cutthroat	
			1989	4,000	250	Westslope cutthroat	
			1991	4,000	250	Westslope cutthroat	
			1993	4,020	251	Westslope cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Pend Oreille	Two Mouth #1 (2-106)	?	1981	2,258		Westslope cutthroat	Discontinue stocking due to winter kill
	Two Mouth #2 (2-107)	5	1981	2,258	452	Westslope cutthroat	
			1983	2,054	411	Henrys Lake cutthroat	
			1985	1,265	253	Westslope cutthroat	
			1987	1,269	254	Westslope cutthroat	
			1989	1,265	253	Westslope cutthroat	
			1991	1,250	250	Westslope cutthroat	
			1993	1,327	265	Westslope cutthroat	
	Two Mouth #3 (2-108)	20	1977	9,444	472	Henrys Lake cutthroat	
			1979	6,140	307	Henrys Lake cutthroat	
			1981	6,774	339	Westslope cutthroat	
			1983	4,973	249	Henrys Lake cutthroat	
			1984	5,280	264	Westslope cutthroat	
			1986	5,000	250	Westslope cutthroat	
			1988	5,000	250	Westslope cutthroat	
			1990	5,000	250	Westslope cutthroat	
			1992	5,000	250	Westslope cutthroat	
	Mollies (2-114)	2	1981	3,352	1,672	Westslope cutthroat	
			1983	648	324	Henrys Lake cutthroat	
			1985	506	253	Westslope cutthroat	
			1987	508	254	Westslope cutthroat	
			1989	500	250	Westslope cutthroat	
			1991	500	250	Westslope cutthroat	
			1993	503	251	Westslope cutthroat	
	Caribou (near West Fk Mtn) (2-116)	6.8	1984	1,752	258	Henrys Lake cutthroat	
			1986	1,750	257	Westslope cutthroat	
			1987	1,750	257	Westslope cutthroat	
			1988	1,750	257	Westslope cutthroat	
			1990	1,750	257	Westslope cutthroat	
			1992	1,750	257	Westslope cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Pend Oreille	Fault (Hunt Peak #1) (2-121)	6	1981	2,258	376	Westslope cutthroat	
			1983	2,872	478	Henrys Lake cutthroat	
			1985	1,500	250	Westslope cutthroat	
			1987	1,500	250	Westslope cutthroat	
			1989	1,553	259	Westslope cutthroat	
			1991	2,275	379	Westslope cutthroat	Received McCormick Lake fish as well
			1993	1,500	250	Westslope cutthroat	
	McCormick (Hunt Peak #2) (2-122)	3.1	1981	2,258	728	Westslope cutthroat	
			1985	780	252	Westslope cutthroat	
			1987	775	250	Westslope cutthroat	
			1989	805	260	Westslope cutthroat	
			1991	816	263	Westslope cutthroat	
			1993	775	250	Westslope cutthroat	
	Little Harrison (2-126)	6.5	1981	2,258	347	Westslope cutthroat	
			1983	1,651	254	Henrys Lake cutthroat	
			1987	1,625	250	Westslope cutthroat	
			1988	1,625	250	Westslope cutthroat	
			1990	1,625	250	Westslope cutthroat	
			1992	1,625	250	Westslope cutthroat	
	Beehive (2-128)	7	1981	2,258	323	Westslope cutthroat	
			1983	1,723	246	Henrys Lake cutthroat	
			1985	1,740	248	Westslope cutthroat	
			1986	1,803	258	Westslope cutthroat	
			1987	1,750	250	Westslope cutthroat	
			1989	2,164	309	Westslope cutthroat	
			1991	1,750	250	Westslope cutthroat	
			1993	1,750	250	Westslope cutthroat	
	Harrison (2-129)	29	1981	9,218	318	Westslope cutthroat	
			1982	6,972	240	Kamloops rainbow	
			1983	7,243	250	Henrys Lake cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Pend Oreille	Harrison		1984	7,296	250	Kamloops rainbow	
			1985	7,200	248	Westslope cutthroat	
			1986	6,870	237	Westslope cutthroat	
			1987	7,264	250	Westslope cutthroat	
			1988	7,250	250	Westslope cutthroat	
			1989	7,479	258	Westslope cutthroat	
			1990	7,250	250	Westslope cutthroat	
			1991	7,246	250	Westslope cutthroat	
			1992	7,250	250	Westslope cutthroat	
			1993	7,250	250	Westslope cutthroat	
	Beaver	5	1990	500	100	Brown trout (size 3)	Test control of
	(2-130)		1992	150	30	Brown trout (size 2)	stunted brook trout
	Dennick	8	1981	5,800	725	Westslope cutthroat	
	(2-171)		1983	1,939	242	Henrys Lake cutthroat	
			1984	2,060	258	Westslope cutthroat	
			1985	2,010	251	Westslope cutthroat	
			1986	2,500	312	Westslope cutthroat	
			1987	2,000	250	Westslope cutthroat	
			1988	2,000	250	Westslope cutthroat	
			989	2,064	258	Westslope cutthroat	
			1990	2,000	250	Westslope cutthroat	
			1991	2,000	250	Westslope cutthroat	
			1992	2,000	250	Westslope cutthroat	
			1992	150	19	Brown trout	Stocked by mistake
			1993	2,053	257	Westslope cuttrout	(helicopter plant)
	Sand	5	1981	3,480	696	Westslope cutthroat	
	(2-172)		1982	8,360	1,672	Kokanee	
			1983	1,221	244	Henrys Lake cutthroat	
			1984	1,254	251	Westslope cutthroat	
			1985	1,260	252	Westslope cutthroat	
			1986	1,250	250	Westslope cutthroat	
			1987	1,250	250	Westslope cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Pend Oreille	Sand		1988	1,247	250	Westslope cutthroat	
			1989	1,250	250	Westslope cutthroat	
			1990	1,250	250	Westslope cutthroat	
			1991	1,250	250	Westslope cutthroat	
			1992	1,250	250	Westslope cutthroat	
			1993	1,026	205	Westslope cutthroat	
	Bloom (2-173)	20	1981	24,402	1,220	Brook trout	
			1982	10,620	531	Brook trout	
			1984	5;041	252	Brook trout	
			1985	4,599	230	Brook trout	
			1986	5,360	268	Brook trout	
			1987	5,000	250	Brook trout	
			1988	5,000	250	Brook trout	
			1989	5,000	250	Brook trout	
			1990	10,013	500	Brook trout	
			1990	500	25	Splake	(size 2)
			1991	4,000	200	Brook trout	
			1992	5,000	250	Brook trout	
			1992	2,000	100	Westslope cutthroat	Stocked by mistake (helicopter plant)
			1992	500	25	Splake	(size 2)
			1993	5,000	250	Brook trout	
			1993	500	25	Splake	(size 2)
	Porcupine (2-182)	13	1982	1,296	100	Kamloops rainbow	
			1983	2,872	220	Domestic Kamloops	(size 2)
			1984	1,016	78	Catchable rainbow	
			1985	1,000	77	Catchable rainbow	
			1986	1,075	83	Mt. Lassen rainbow	(size 3)
			1987				Road washed out
			1988	600	46	Mt. Lassen rainbow	(size 3)
			1989	690	53	Mt. Lassen rainbow	(size 3)
			1990	750	58	Catchable rainbow	
			1991			Not stocked	Road washed out
			1993	387	30	Kamloops rainbow	(size 3)

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Pend Oreille	Moose (2-185)	16.5	1987	1,000	61	Brown trout	Test control on stunted brook trout
			1988	4,515	274	Brown trout	
			1990	500	30	Brown trout	(size 3)
			1992	500	30	Brown trout	(size 2)
	Antelope (2-190)	16	1981	5,000	312	Westslope cutthroat	
			1982	5,032	314	Westslope cutthroat	
			1989	1,155	72	Mt. Lassen rainbow	(size 3)
			1990	1,000	63	Catchable rainbow	
			1990	200	12	Westslope cutthroat	(Broodstock)
			1991	2,000	125	Westslope cutthroat	(size 2) (size
			1991	1,100	69	Eagle Lake rainbow	3) (Eagle
			1991	50	3	Creston brdstck rainbow	Lake) (size 3)
			1992	1,363	85	Hayspur rainbow	(size 3)
			1993	1,387	87	Hayspur rainbow	
	Caribou (near Keokee Mtn.) (2-196)	6.8	1983	2,872	422	Henrys Lake cutthroat	
			1984	1,750	257	Westslope cutthroat	
			1985	1,700	250	Westslope cutthroat	
			1986	1,500	220	Westslope cutthroat	
			1987	1,704	250	Westslope cutthroat	
			1988	1,722	253	Westslope cutthroat	
			1989	1,700	250	Westslope cutthroat	
			1990	1,700	250	Westslope cutthroat	
			1991	1,700	250	Westslope cutthroat	
			1992	1,750	257	Westslope cutthroat	
			1993	1,700	250	Westslope cutthroat	
Spokane	Mirror (3-117)	5	1981	5,000	1,000	Westslope cutthroat	Winterkill lake, evaluate before further stocking Stock put-and-take (catchable) rainbow annually.
	Elsie (3-119)	10	1982	1,440	144	Catchable rainbow	
			1983	1,500	150	Catchable rainbow	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Spokane	Elsie		1984	2,865	286	Catchable rainbow	annually
			1985	3,005	300	Catchable rainbow	
			1986	3,024	302	Catchable rainbow	
			1987	2,000	200	Hayspur rainbow	(size 3)
			1988	4,050	405	Hayspur rainbow	(size 3)
			1989	2,856	284	Mt. Lassen rainbow	(size 3)
			1990	3,000	300	Eagle Lake/	
			1991	3,516	350	Hayspur rainbow	(size 3)
			1992	4,020	402	Hayspur rainbow	(size 3)
			1993	4,045	404	Hayspur rainbow	(size 3)
	Lower Glidden (3-123)	12	1981	1,950	162	Catchable rainbow	
			1982	1,880	157	Catchable rainbow	
			1983	1,000	83	Catchable rainbow	
			1984	4,945	412	Catchable rainbow	
			1985	3,018	251	Catchable rainbow	
			1986	3,011	251	Catchable rainbow	
			1987	3,277	273	Hayspur rainbow	(size 3)
			1988	3,001	250	Hayspur rainbow	(size 3)
			1989	2,836	236	Mr. Lassen rainbow	(size 3)
			1990	1,775	148	Catchable rainbow	
			1991	1,986	165	Hayspur rainbow	(size 3)
			1992	3,534	295	Hayspur rainbow	(size 3)
			1993	4,005	334	Hayspur rainbow	(size 3)
	Upper Glidden (3-124)	10	1980	992	99	Kamloops rainbow	
			1993	180	18	Bull trout	Brook trout control
	Gold (3-125)	3	1981	1,000	333	Westslope cutthroat	Shallow, need to evaluate for survival.
			1983	1,005	335	Henrys Lk cutthroat	
			1987	750	250	Westslope cutthroat	
			1989	750	250	Westslope cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Spokane	Gold		1991	750	250	Mt. Lassen rainbow	
			1993	500	167	Kamloops rainbow	
	Revett	12	1980	992	83	Kamloops rainbow	
	(3-130)		1993	309	26	Bull trout	Brook trout control
	Crater	5	1983	5,000	1,000	Grayling	Reserve for
	(3-133)		1987	2,100	420	Grayling	grayling.
			1988	2,500	500	Grayling	
			1990	2,500	500	Grayling	
			1991	2,500	500	Grayling	
			1993	2,500	500	Grayling	
	Dismal	?	1983	1,500		Catchable rainbow	Reduce stocking
	(3-138)		1984	537		Catchable rainbow	to 250 fish and
			1985	490		Catchable rainbow	evaluate
			1986	253		Catchable rainbow	
			1987	249		Hayspur rainbow	(size 3)
			1988	260		Mt. Lassen rainbow	(size 3)
			1988	260		Hayspur rainbow	(size 3)
			1989	225		Mr. Lassen rainbow	(size 3)
			1990	250		Catchable rainbow	
			1991	243		Hayspur rainbow	(size 3)
			1992	250		Hayspur rainbow	(size 3)
			1993	230		Hayspur rainbow	(size 3)
	Bacon	9	1981	4,000	444	Westslope cutthroat	
	(3-144)		1985	2,255	250	Westslope cutthroat	
			1987	2,250	250	Westslope cutthroat	
			1989	2,250	250	Westslope cutthroat	
			1991	2,250	250	Westslope cutthroat	
			1993	2,250	250	Westslope cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Spokane	Forage (3-146)	13	1987	3,150	242	Golden trout	Reserve for goldens or grayling.
			1988	3,250	250	Grayling	
			1989	2,000	154	Grayling	
			1990	3,250	250	Golden trout	
			1992	600	46	Grayling	
			1993	3,250	250	Grayling	
	Halo (3-147)	12	1981	5,000	417	Westslope cutthroat	
			1985	3,010	251	Westslope cutthroat	
			1987	3,000	250	Westslope cutthroat	
			1989	3,000	250	Westslope cutthroat	
			1991	3,000	250	Westslope cutthroat	
			1993	3,000	250	Westslope cutthroat	
	Crystal (3-160)	10	1981	9,988	999	Westslope cutthroat	
			1983	4,380	438	Henrys Lake cutthroat	
			1985	2,510	251	Westslope cutthroat	
			1987	2,510	251	Westslope cutthroat	
			1988	2,500	250	Westslope cutthroat	
			1989	2,500	250	Westslope cutthroat	
			1991	2,500	250	Westslope cutthroat	
			1993	2,500	250	Westslope cutthroat	
Little North Fork Clearwater	Devils Club (6-113)	4	1981	3,014	753	Westslope cutthroat	
			1986	1,000	250	Westslope cutthroat	
			1988	1,000	250	Westslope cutthroat	
			1991	1,093	273	Westslope cutthroat	
			1992	1,000	250	Westslope cutthroat	
	Big Talk (6-114)	?	1986	1,500		Westslope cutthroat	
			1988	2,500		Westslope cutthroat	
			1990	2,737		Westslope cutthroat	
			1992	2,500		Westslope cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Little North Fork Clearwater	Larkins (6-117)	12	1981	3,014	251	Westslope cutthroat	
			1986	3,000	250	Westslope cutthroat	
			1988	3,000	250	Westslope cutthroat	
			1990	3,278	273	Westslope cutthroat	
	Mud (6-118)	6	1981	3,014	502	Westslope cutthroat	
			1987	1,500	250	Westslope cutthroat	
			1989	1,500	250	Westslope cutthroat	
			1991	1,500	250	Mt. Lassen rainbow	
			1993	1,500	250	Hayspur rainbow	
	Hero (6-119)	4	1981	3,014	753	Westslope cutthroat	
			1986	1,000	250	Westslope cutthroat	
			1988	1,000	250	Westslope cutthroat	
			1990	1,093	273	Westslope cutthroat	
			1992	1,000	250	Westslope cutthroat	
	Heart (6-122)	40	1981	3,014	75	Westslope cutthroat	
			1986	10,000	250	Westslope cutthroat	
			1990	10,000	250	Mt. Lassen rainbow	
			1992	10,000	250	Mt. Lassen rainbow	
	Northbound (6-123)	12	1981	3,014	251	Westslope cutthroat	
			1986	3,000	250	Westslope cutthroat	
			1988	3,000	250	Westslope cutthroat	
			1990	3,278	273	Westslope cutthroat	
			1992	3,000	250	Westslope cutthroat	
	Skyland (6-125)	13	1981	3,014	232	Westslope cutthroat	
			1987	3,250	250	Westslope cutthroat	
			1989	3,250	250	Westslope cutthroat	
			1991	3,250	250	Mt. Lassen rainbow	
			1993	3,250	250	Hayspur rainbow	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Little North Fork Clearwater	Fawn (6-126)	13	1981	3,014	232	Westslope cutthroat	
			1986	3,250	250	Westslope cutthroat	
			1988	3,250	250	Westslope cutthroat	
			1990	3,565	274	Westslope cutthroat	
			1992	3,250	250	Westslope cutthroat	
	Noseeum (6-130)	4	1981	1,174	294	Rainbow/cutthroat hyb.	
			1985	1,008	251	Westslope cutthroat	
			1987	1,000	250	Westslope cutthroat	
			1989	1,000	250	Westslope cutthroat	
			1991	1,000	250	Westslope cutthroat	
			1993	1,000	250	Westslope cutthroat	
	Steamboat (6-131)	9	1981	1,174	130	Rainbow/cutthroat hyb.	Reserve for grayling
			1986	2,000	222	Grayling	
			1988	4,500	500	Grayling	
			1989	2,000	222	Grayling	
			1990	4,500	500	Grayling	
			1991	3,500	389	Grayling	
			1992	650	72	Grayling	
			1993	4,500	500	Grayling	
	Copper (6-201)	3	1981	1,000	333	Westslope cutthroat	
			1981	1,000	333	Rainbow/cutthroat hyb.	
			1985	765	255	Westslope cutthroat	
			1989	750	250	Westslope cutthroat	
			1991	750	250	Westslope cutthroat	
			1992	1,250	417	Westslope cutthroat	
			1993	750	250	Westslope cutthroat	
	Gold (6-202)	8	1986	2,000	250	Westslope cutthroat	
			1988	2,000	250	Westslope cutthroat	
			1990	2,185	273	Westslope cutthroat	

Appendix A. Continued.

Drainage	Lake	Surface acres	Year stocked	Number stocked	Stocking rate (fish/acre)	Stock of fish	Comments
Little North Fork Clearwater	Tin (6-204)	3	1987	750	250	Westslope cutthroat	
			1988	750	250	Westslope cutthroat	
			1990	750	250	Blackfoot rainbow	
			1992	750	250	Mt. Lassen rainbow	
	Silver (6-205)	10	1981	2,000	200	Westslope cutthroat	
			1981	888	89	Rainbow	
			1985	999	100	Mr. Lassen rainbow	
			1989	2,500	250	Westslope cutthroat	
			1991	2,500	250	Westslope cutthroat	
			1993	2,500	250	Hayspur rainbow	

Appendix B. Odd-year stocking schedule for the Panhandle Region mountain lakes.

Lake	Code No.	Surface acres	No. stocked	Species	Substitute species
Kootenai					
Hidden	01-103	50	12,500	C2	K1
Lake Mountain	01-104	7	1,750	C2	None
West Fork	01-109	12	3,000	Ki	C2
Long Mountain	01-112	3	1,500	GR	None
Parker	01-113	3	1,000	GN	GR
Smith	01-115	6	3,000	GR	None
Myrtle	01-122	20	5,000	C2	None
Pyramid	01-125	11	2,750	Kl	C2
Snow	01-134	10	2,500	C2	None
Roman Nose #3	01-137	12	3,000	K1	C2
Solomon	01-146	9	2,250	C2	K1
Spruce	01-147	5	1,250	K1	C2
Debt	01-150	5	1,250	C2	None
Callahan	01-166	10	2,500	C2	None
Pend Oreille					
Hunt	02-101	12	3,000	C2	None
Standard	02-103	16	4,000	C2	None
Two Mouth #2	02-107	5	1,250	C2	None
Mollies	02-114	2	500	C2	None
Fault	02-121	6	1,500	C2	None
McCormick	02-122	3.1	775	C2	None
Beehive	02-128	7	1,750	C2	None
Harrison	02-129	29	7,250	C2	None
Dennick	02-171	8	2,000	C2	None
Sand	02-172	5	1,250	C2	None
Bloom	02-173	20	5,000	BK*Size 2	None
Caribou (Near keokee Mtn)	02-196	6.8	1,700	C2	None

Appendix B. Continued.

Lake	Code No.	Surface acres	No. stocked	Species	Substitute species
Spokane					
Gold	03-125	3	750	Kl	None
Crater	03-133	5	2,500	GR	None
Bacon	03-144	9	2,250	C2	None
Forage	03-146	13	3,250	GN	GR
Halo	03-147	12	3,000	C2	None
Crystal	03-160	10	2,500	C2	None
Little North Fork Clearwater					
Mud	06-118	6	1,500	Kl	None
Skyland	06-125	13	3,250	Ki	None
Noseeum	06-130	4	1,000	C2	None
Steamboat	06-131	9	4,500	GR	None
Copper	06-201	3	750	C2	None
Silver	06-205	10	2,500	Kl	None

Total number of fish to be stocked:

C2 - 62,225
Kl - 18,000
GR - 11,500
GN - 5,250 (Grayling can be substituted for goldens)
BK - 5,000 - Size 2

Appendix C. Even-year stocking schedule for the Panhandle Region mountain lakes.

Lake	Code No.	Surface acres	No. stocked	Species	Substitute species
Kootenai					
Hidden	01-103	50	12,500	K1	C2
West Fork	01-109	12	3,000	C2	K1
Long Mountain	01-112	3	1,500	C2	None
Parker	01-113	3	1,000	GN	GR
Smith	01-115	6	3,000	GR	None
Big Fisher	01-117	10	2,500	C2	None
Trout	01-124	7	1,750	Kl	C2
Pyramid	01-125	11	2,750	C2	K1
Ball Creek	01-126	6	1,500	C2	None
Little Ball Creek	01-127	4	1,000	C2	None
Roman Nose #3	01-137	12	3,000	C2	K1
Solomon	01-146	9	2,250	C2	K1
Spruce	01-147	5	1,250	C2	K1
Queen	01-148	5	1,250	C2	None
Copper	01-154	5	1,250	C2	None
Estelle	01-167	5	1,250	BN	None
Pend Oreille					
Hunt	02-101	12	3,000	C2	None
Two Mouth #3	02-108	20	5,000	C2	None
Caribou (Near West Fk Mtn)	02-116	7.8	1,750	C2	None
Little Harrison	02-126	6.5	1,625	C2	None
Harrison	02-129	29	7,250	C2	None
Beaver	02-130	5	1,250	BN	None
Dennick	02-171	8	2,000	C2	None
Sand	02-172	5	1,250	C2	None
Bloom	02-173	20	5,000	BK*Size 2	None
Moose	02-185	16.5	4,200	BN	None
Caribou (Near Keokee Mtn)	02-196	6.8	1,700	C2	None

Appendix C. Continued.

Lake	Code No.	Surface acres	No. stocked	Species	Substitute species
Spokane					
Crater	03-133	5	2,500	GR	None
Forage	03-146	13	3,250	GN	GR
Little North Fork Clearwater					
Devils Club	06-113	4	1,000	C2	None
Big Talk	06-114	?	2,500	C2	None
Larkins	06-117	12	3,000	C2	None
Hero	06-119	4	1,000	C2	None
Heart	06-122	40	10,000	K1	None
Northbound	06-123	12	3,000	C2	None
Fawn	06-126	13	3,250	C2	None
Steamboat	06-131	9	4,500	GR	None
Gold	06-202	8	2,000	C2	None
Tin	06-204	3	750	K1	None

Total number of fish to be stocked:

C2 - 59,075
K1 - 25,000
GR - 11,500
GN - 4,250 (Grayling can be substituted for goldens)
BK - 5,000 - Size 2
BN - 6,700

1993 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management F-71-R-18

Project I: Surveys and Inventories

Subproject I-A: Panhandle Region

Job: b[1]

Title: Lowland Lakes Investigations

Contract Period: July 1, 1993 to June 30 1994

ABSTRACT

Standard lowland lake surveys were conducted on Ferran, Hayden, and Muskrat lakes in the Panhandle Region.

Midwater trawling in Lake Pend Oreille estimated total kokanee salmon *Oncorhynchus nerka kennerlyi* abundance at 397 fish/ha.

Midwater trawling in Spirit Lake in 1993 estimated 737'kokanee/ha, a decrease of 46.5 % from the last trawl in 1991. Trawl results also indicated a shift in age at maturity from 3+ to 2+.

The estimated number of northern pike *Esox lucius* in Cougar Bay, Coeur d'Alene Lake in March 1993 was 1,791 (95 % CI 1,309 <N <3,003), a three-fold increase since 1990. Anglers expended 2,142 h (+/- 552) to catch 109 (+/- 56) northern pike between March 13 and April 30, 1993. Exploitation rate estimated from tag returns was 23% between March 1993 and October 1993.

In 1993, 427 lake trout *Salvelinus namaycush* anglers were interviewed on Priest Lake. A total of 218 lake trout were caught, of which 37 were released for a catch rate of 4.5 h/fish. Modal length of fish in the catch was 457 mm.

Hatchery rainbow trout stocking evaluations were made on Cocolalla, Fernan, and Hauser lakes. No holdover 1992 adipose fm-clipped put-and-take rainbow trout O. *mykiss* were found in Cocolalla Lake during gill net and electrofishing sampling in May of 1993.

Anglers fished for an estimated 97,490 hours (672 h/ha) on Fernan Lake in 1993. They caught an estimated 46,974 fish. The return rate for put-and-take rainbow trout, stocked and harvested in 1993, was 38%.

Anglers fished an estimated 60,670 h (240 h/ha) on Hauser Lake. They caught an estimated 47,575 fish. The return rate for put-and-take rainbow trout stocked in 1993 was 57%. Return rate in 1993 for rainbow trout stocked in 1992 was 15%. Return rate of rainbow trout stocked in 1992 and harvested in 1992 and 1993 was 32%. Anglers harvested an estimated 1,166 put-grow-and-take rainbow trout for estimated weight return of 602 kg. The cost for put-and-take and put-grow-and-take rainbow returned to the creel was $0.67 and $2.32 per fish, respectively.

A total of 46,160 westslope cutthroat trout O. *clarki lewisi* were reared in six net pens on Lake Pend Oreille and released in May 1993. A limited census of north shore bank anglers indicated two adipose fm-clipped net pen cutthroat trout were caught in 57 h of effort.

Mirror Lake, renovated in 1991, was evaluated in 1993 and found to be producing robust cutthroat trout and brook trout *S. fontinalis* after restocking in 1992.

Five lowland lakes and the St. Maries River were stocked with channel catfish *Ictalurus punctatus*, and five lowland lakes received tiger muskie *Esox lucius x E. Masquinongy* in 1993 as a continuation of the Panhandle Region's new species introduction program.

Authors:

Lance Nelson
Regional Fishery Biologist

Jim Davis
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

OBJECTIVES

1. Conduct standard lowland lake surveys on Fernan, Hayden, and Muskrat lakes to assess the status of the fish populations and fisheries habitat.

2. Monitor the population status of kokanee salmon *Oncorhynchus nerka kennerlyi* in Lake Pend Oreille and Spirit Lake with midwater trawling.

3. Evaluate the current status of northern pike *Esox lucius* in Cougar Bay, Coeur d'Alene Lake.

4. Evaluate the slot limit effects on lake trout *Salvelinus namaycush* lengths in Priest Lake.

5. Evaluate the rate of return to the creel of put-and-take rainbow trout O. *mykiss* stocked in Cocolalla, Fernan, and Hauser lakes.

6. Evaluate the rate of return to the creel and the total weight returned of put-grow-and-take rainbow trout stocked in Hauser Lake. Compare costs associated with put-and-take stocking.

METHODS

Standard Lowland Lake Surveys

Standard lowland lake surveys (Horner et al., 1996) were conducted on Fernan, Hayden, and Muskrat lakes in 1993.

Fish Population Characteristics

Kokanee Population Abundance

Lake Pend Oreille kokanee O. *nerka kennerlyi* were sampled with a midwater trawl during the new moon phase of August 16 through August 19, 1993. Trawling methodology, statistical analysis, and kokanee abundance estimates followed techniques described by Bowles (1987). Age 0+ wild and hatchery kokanee were identified by length. Kokanee fry over 60 mm were recorded as hatchery origin. Kokanee abundance was calculated by a computer model developed by Rieman and Meyers (1990).

Spirit Lake kokanee were sampled with a midwater trawl during the new moon phase on July 21, 1992 with the same methodology used on Lake Pend Oreille. Five trawls were conducted at random locations.

Kokanee were divided into age classes by peaks in the length frequency distribution of the catch for each lake.

Northern Pike

Abundance-Biologists_estimated the abundance of northern pike in Cougar Bay, Coeur d'Alene Lake during a nine-day sampling period March 18 through March 26, 1993. Three to six experimental gill nets and two trap nets were used to collect northern pike. Gill nets were set daily at 0700 h and pulled at 1800 h. The gill nets were checked every two hours to reduce potential mortality of captured northern pike. The trap nets were checked once a day. All captured northern pike were weighed (g), measured (total length [TL] mm), sexed, and marked with an opercle punch. Biologists tagged 132 northern pike with $5.00 reward jaw tags to determine exploitation.

Biologists recorded the total number of northern pike caught or recaptured daily. A population estimate was calculated using the Schumacher and Eschmeyer's equation (Ricker 1975).

The equation was:

$$\frac{1}{\hat{N}} = \Sigma(M_t R_t) \div \Sigma(C_t M_t^2)$$

Where:

$\hat{N}$	=	Estimated population size
M_t	=	Total marked fish at large at the start of the t_{th} day, i.e., the number previously marked less any mortalities
M, ΣM_t	=	Total number fish marked
C_t	=	Total sample taken on day t
R_t	=	Number of recaptures in sample C_{th}
R, ΣR_t	=	Total recaptures during the survey

Creel Survey-Fishery personnel conducted a creel survey from March 13 through April 30, 1993. Counts were made on one weekday and one weekend day each week. At least two instantaneous counts of bank and boat anglers were made on each count day, although more counts were made some day. Anglers were interviewed to determine hours fished, catch, and harvest. The data was entered into the Creel Census System (Reece et al. 1992) for analysis.

Food Habits-Stomach contents of northern pike were evacuated as described by Rich (1992). Biologists recorded the species, length, and number of prey for each northern pike sampled as described by Rich (1992).

Age and Growth-Scale-samples were removed from captured northern pike as described by Nielsen and Johnson (1983). Technicians made plastic impressions of the scale using a Carver laboratory press. The impressions were then read on an Eberbach scale reader. Measurements for back-calculated lengths were made using a digitizer and the data was summarized by the DISBCAL89 (Missouri Department of Conservation, 1989) computer program.

Condition and Proportional Stock Density-Length-weight relationship was determined by regression:

$$\text{Log } W = \text{Constant} + (\text{slope X log } L)$$

Where:

Log W = Common log of weight(g)

Log L = Common log of length (TL mm)

Weights of sampled northern pike were used to calculate relative weights (W_r). W_r

$$= W = W_s x 100$$

Where: W = The weight of an individual northern pike

W_S = a length specific standard weight

(Log W_s = -5.369 + 3.059 Log L, Willis 1989)

The computer program FISHCALC89 (Missouri Department of Conservation, 1989) calculated the relative weight.

Biologists used the computer program FISHCALC89 to calculate proportional stock density (PSD) for captured northern pike.

$$PSD = \frac{\text{Number} \geq \text{minimum quality length (530 mm)}}{\text{Number} \geq \text{minimum stock length (350 mm)}} \times 100$$

Lake Trout

A limited creel survey of the lake trout fishery on Priest Lake was conducted in 1993. No statistical bounds were applied to the data.

Stocking Evaluations

Rainbow Trout

Hatchery personnel clipped the adipose fm of all put-and-take rainbow trout stocked into Hauser Lake in 1992 and 1993, Fernan Lake in 1993, and Cocolalla Lake in 1992. Put-grow-and-take rainbow trout stocked into Hauser Lake were not marked.

Fishery personnel conducted a creel survey to determine the number and weight of rainbow trout harvested from Hauser and Fernan lakes. The creel survey was conducted from April 1 to September 30, 1993. The survey period was divided into 28-day intervals. The survey period was stratified into weekend days and weekdays, mornings (0600-1300) and afternoons (1301-2000). Four weekday mornings and afternoons and three weekend mornings and afternoons were randomly selected. Two instantaneous angler counts were made during each survey day. The start time for the first count was randomly selected and the second count was made three hours later. Fishery personnel conducted angler interviews between count times. Personnel collected data on the number of anglers in each group, number of hours fished, and number and species of fish caught (released and harvested). Personnel measured total length (mm), weight (g), and examined each harvested rainbow trout for an adipose fm clip.

Fishery personnel entered data into the Idaho Department of Fish and Game's (IDFG) official Creel Survey Program (McArthur 1992). The program calculated estimates for fishing pressure, total fish caught, total fish harvested or released, and total fish harvested by species.

Survival of adipose fin-clipped hatchery put-and-take rainbow trout stocked in Cocolalla Lake in 1992 was evaluated in 1992 (Horner et al . , 1996) and again in May 1993 with gill net sampling.

Net Pen Cutthroat Trout

Six net pens (Horner et al., 1996), located in Garfield (2) and Scenic bays (4) on Lake Pend Oreille, were used to rear westslope cutthroat trout O. *clarki lewisi* in 1993.

A limited creel census of bank anglers along the north shore of Lake Pend Oreille was conducted on five weekend days between April 10 and May 9, 1993. The census route ran from the Highway 95 Long Bridge south of Sandpoint to Hope, Idaho.

Mirror Lake

Estimates of catch rates for trout in Mirror Lake in 1993 were derived from impromptu officer creel surveys during 1993. Length frequency of trout in Mirror Lake were taken from floating and sinking experimental gill net sets made July 8, 1993.

RESULTS AND DISCUSSION

Standard Lowland Lake Surveys

Ferran Lake

Fernan Lake is located east of Coeur d'Alene, Idaho (Figure 1). The surface area is 145 ha. There is one major tributary, Ferran Creek. Most of the shoreline is forested and the northwest end of the lake is residential.

Fernan Lake supports a two-story fishery with coldwater and warmwater fish species (Appendix A). Natural reproduction maintains the warmwater species; largemouth bass *Micropterus salmoides,* yellow perch *Perca flavescens,* black crappie *Pomoxis nigromaculatus,* brown bullhead *Ameiurus nebulosus,* pumpkinseed *Lepomis gibbosus,* tench *Tinca tinca,* and northern pike. Channel catfish *Ictalurus punctatus* have been stocked on a regular basis to maintained by stocking put-and-take fish. A few brook trout *S. fontinalis* and cutthroat trout O. *clarki* enter the lake via Fernan Creek and Coeur d'Alene Lake, respectively.

A minimum length limit of 305 mm for largemouth bass was in effect from 1986 to 1991. In 1992, the minimum length limit for bass was removed to simplify fishing regulations on Fernan Lake.

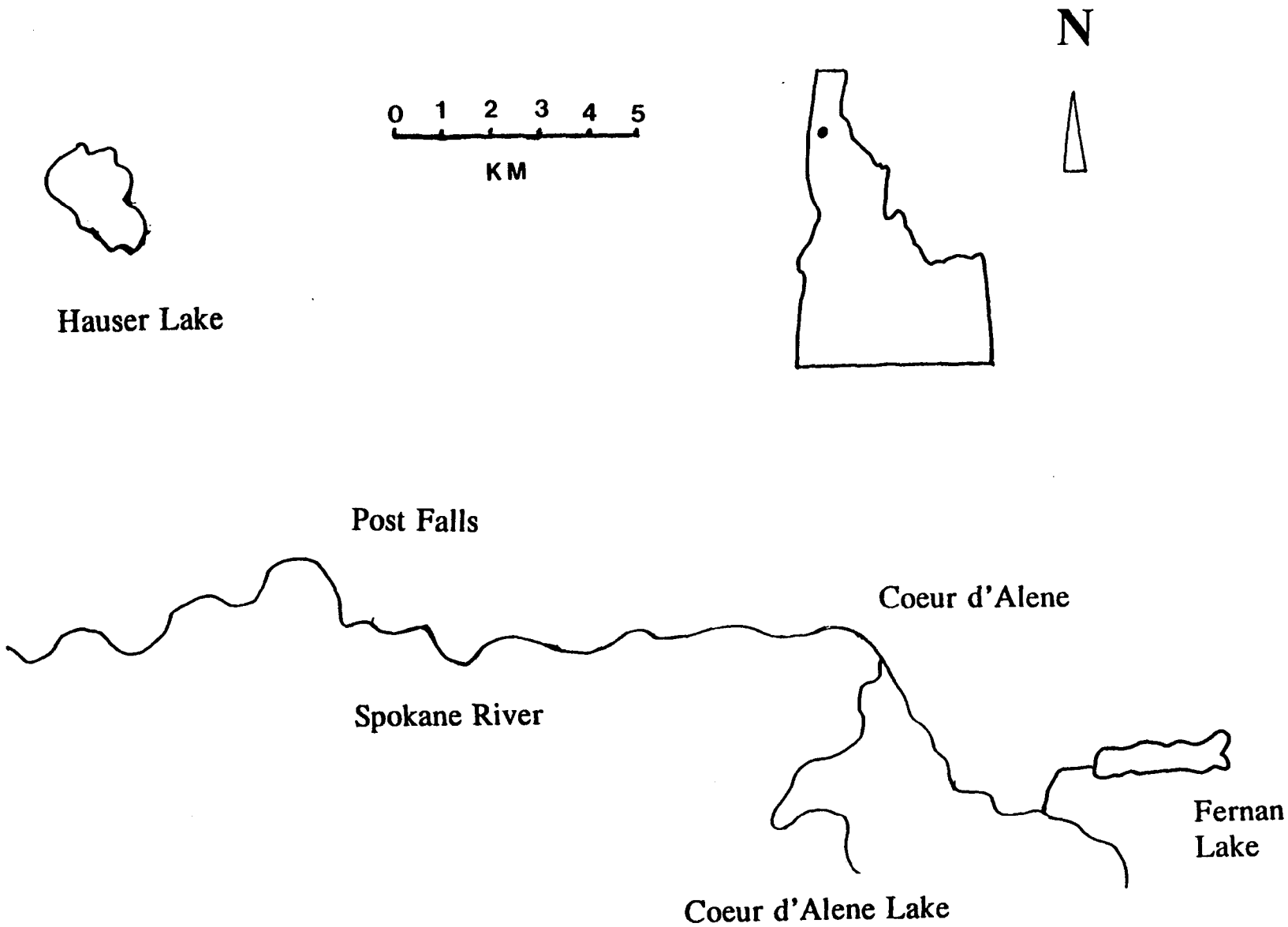

Figure 1. Map showing location of Fernan Lake, Idaho.

In 1993, a standard lake survey was conducted to assess the general health of the lake and fish populations present. Biologists collected limnological data from two locations in the lake (Table 1). The characteristics were very similar to data collected in 1986 (Table 2).

Biologists collected eight game fish species and two non-game fish species by gill net, trap net, and electrofishing (Appendix A). Largemouth bass were the most abundant game fish. Biologists collected 158 largemouth bass by electrofishing and gillnetting. Bass ranged in length from 80 to 520 mm (Figure 2). The PSD index was 10 and the relative stock density was 4. The length-weight relationship was described by:

$$\text{Log } W = -4.9727 + 3.037 (\text{Log } L)$$

Where: Log W = log base 10 of the weight

Log L = log base 10 of the length

Biologists aged 87 bass by scale readings. The ages ranged from 1 to 13 years (Figure 3). Back-calculated lengths at age are listed in Table 3.

The largemouth bass population in Fernan Lake appears to have changed since the 1981-82 bass study (Rieman 1982, 1983). The mean back-calculated lengths at age for bass have decreased since 1982 (Table 4). The length-weight equation had also changed since 1982 and indicated a decrease in growth (Figure 4). Paragamian (1982) reported a similar situation in Big Creek Lake, Iowa, where a 14-inch minimum length limit was in effect. In consecutive years of the study, back-calculated lengths at age for the 1972 year class of largemouth bass were less (Lee's phenomena). Paragamian attributed this apparent decline in growth to heavy fishing pressure removing the faster growing bass, leaving behind the slower growing bass. The slower growth was due more to genetic factors than environmental factors. The same could have been true for Fernan Lake where fishing pressure was heavy.

Aside from the slow-down in growth, the PSD, age structure, and length structure were similar to the data reported by Rieman (1983). The PSD index in 1981/82 was 11 and 8, respectively. The PSD index in 1993 was 10.3. There were no PSD values calculated during the period the minimum length regulation was in effect.

Most of the bass collected in 1981-82 and 1993 were 2 to 5 years of age (Figure 5). The ages ranged from 0 to 14 in 1981-82 and from 0 to 13 in 1993. The length frequency was similar, and most bass collected were below 220 mm (Figure 6).

Biologists collected 24 channel catfish *Ictalurus punctatus,* first stocked in 1987 (Table 5), that ranged in length from 300-470 mm (Figure 7). Age analysis of the channel catfish pectoral spines showed an age range of three to six years (Table 6).

Table 1. Limnological characteristics of Fernan Lake, Idaho, September 1993. Surface area is 145 ha.

	East End					West End				
Depth (m)	Temp	DO	Secchi	pH	AK	Temp	DO	Secchi	pH	AK
0.0	16.5	9.3				16.7	9.7			
0.5	9.3	9.0	2.0	7.52	20	9.7	9.5	3.2	7.85	20
1.0	16.2	8.9				16.0	9.6			
1.5	15.8	9.0				15.7	9.6			
2.0	15.5	9.2				15.7	9.4			
2.5	15.4	9.1				15.6	9.3			
3.0	15.3	9.1				15.6	9.2			
3.5	15.3	8.3				15.6	8.2			
4.0	15.2	8.0				15.5	8.7			
4.5	14.5	1.0				15.5	9.0			
5.0	--	--				15.5	8.9			
5.5	--	--				15.4	2.5			

Max depth 7.6 m
Mean depth 3.0 m

Table 2. Limnological characteristics of Fernan Lake, Idaho, July, 1986 and September, 1993.

	1986	1993
Secchi disk (m)	3.6	3.0
Alkalinity (ppm)	--	20
Conductivity (umhos)	39	26
MEI	2.19	--

	DO (mg/l)		Temp (C°)	
Depth (m)	1986	1993	1986	1993
0	8	9	23	16.5
.5	8	9		16
1	8	9		16
1.5	8	9		15
2	8	9	22	15
2.5	7.5	9		15
3	7	8		15
3.5	6.5	8	21	15
4	--	1		15

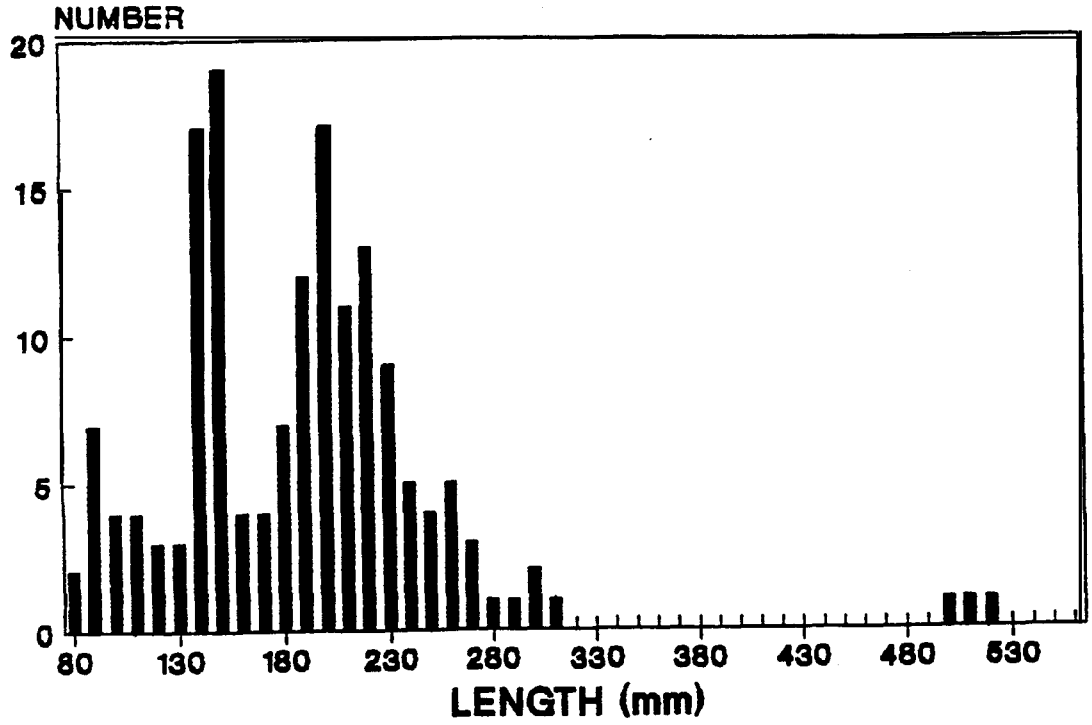

Figure 2. Length frequency of largemouth bass captured by electrofishing in Fernan Lake, Idaho, 1993.

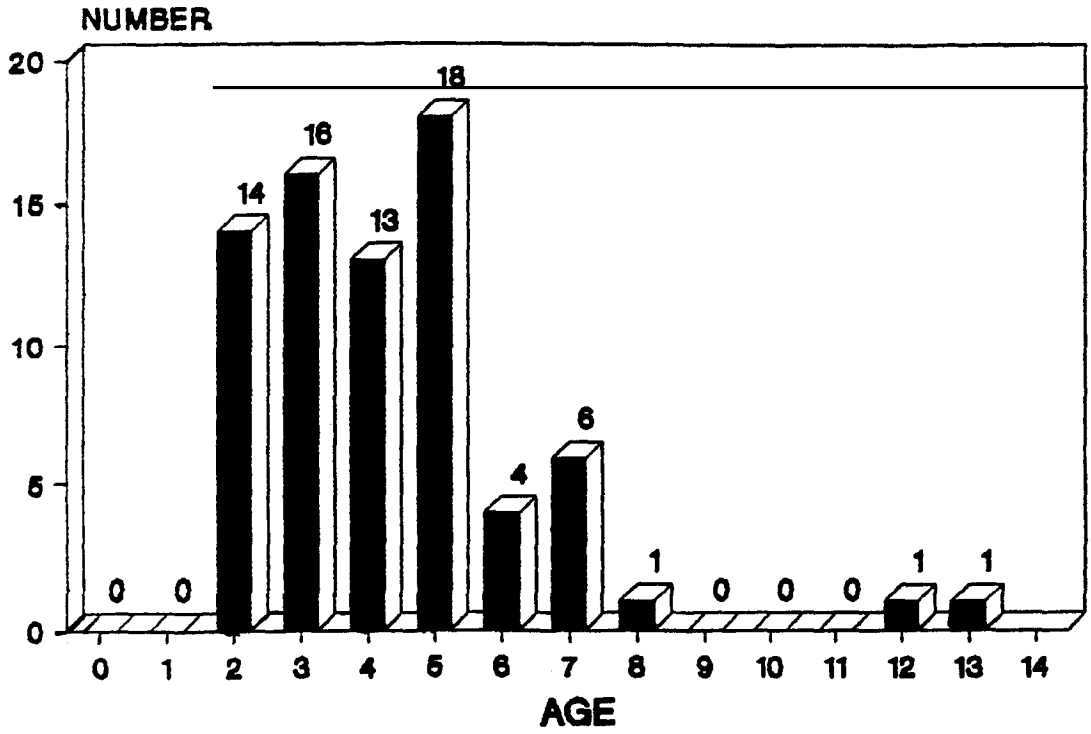

Figure 3. Age frequency of largemouth bass captured by electrofishing in Fernan Lake, Idaho, 1993.

Table 3. Mean back-calculated length for each age class of largemouth bass sampled by electrofishing from Fernan Lake, Idaho, 1993.

Year			Back-calculated Age												
Class	Age	N	1	2	3	4	5	6	7	8	9	10	11	12	13
1992	1	0	0.00												
1991	2	14	77.55	110.71											
1990	3	16	76.84	137.81	157.50										
1989	4	13	64.54	126.21	175.53	192.31									
1988	5	18	77.33	139.82	187.98	214.80	228.89								
1987	6	4	73.97	143.87	191.38	225.51	244.79	255.00							
1986	7	6	65.75	115.93	163.42	201.03	225.87	255.42	271.67						
1985	8	1	71.16	136.31	185.77	215.53	257.76	273.77	288.03	300.00					
1984	9	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
1983	10	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
1982	11	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1981	12	1	76.93	137.21	194.62	248.44	329.34	360.13	398.55	419.63	436.38	459.33	485.02	500.00	
1980	13	1	65.60	140.67	176.39	229.02	300.98	329.56	359.88	397.30	437.52	457.76	486.95	504.53	520.00
Mean Length			73.65	129.70	174.81	208.35	236.85	270.46	297.38	372.31	436.95	458.55	485.99	502.26	520.00
	N	74	74	74	60	44	31	13	9	3	2	2	2	2	1

93DJ.TBL

Table 4. Mean back-calculated length at each age for largemouth bass captured by electrofishing from Fernan Lake, Idaho, 1981/82 and 1993.

Year	Age/length													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1981/82	63	101	182	230	276	341	374	404	432	460	496	519	531	545
1993	74	130	175	208	237	270	297	372	437	459	486	502	520	

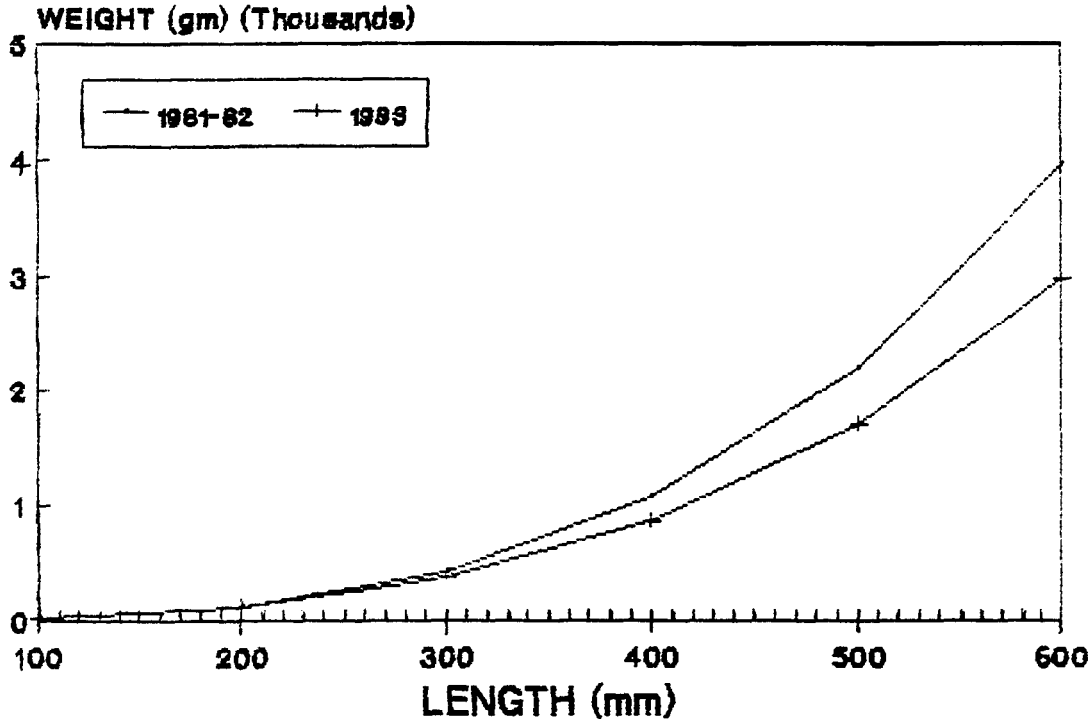

Figure 4. Length-weight relationship of largemouth bass captured by electrofishing in Fernan Lake, Idaho, 1981-82 and 1993.

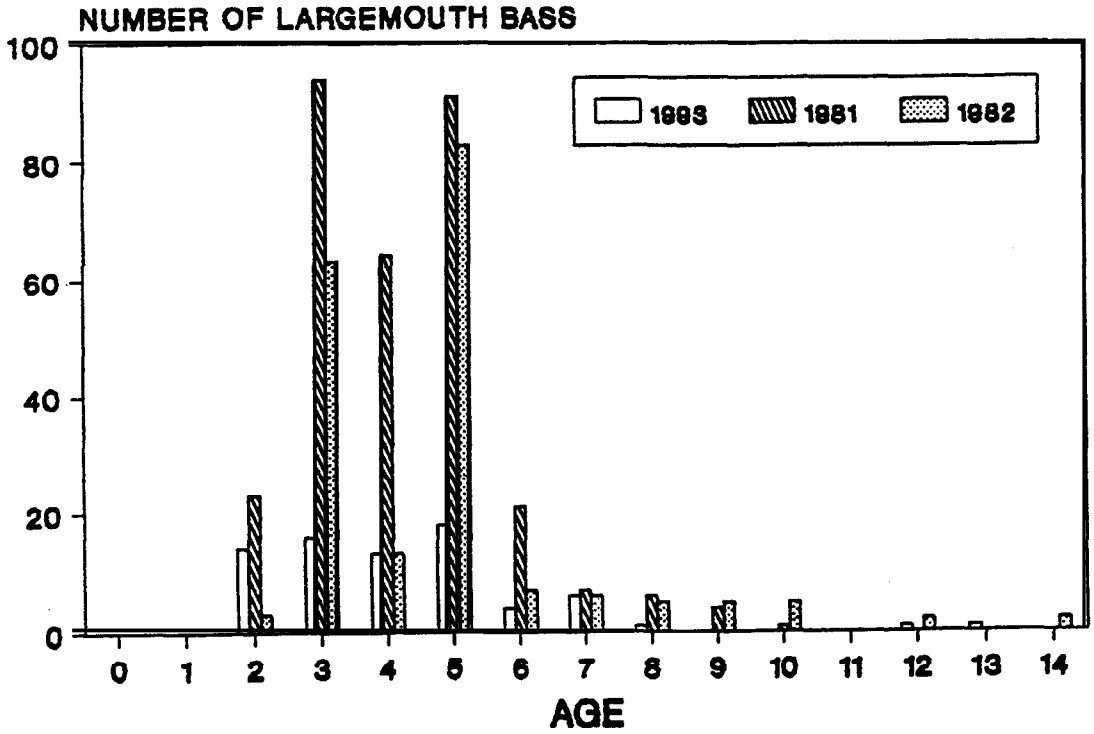

Figure 5. Age frequency of largemouth bass from Fernan Lake, Idaho, 1981-82 and 1993.

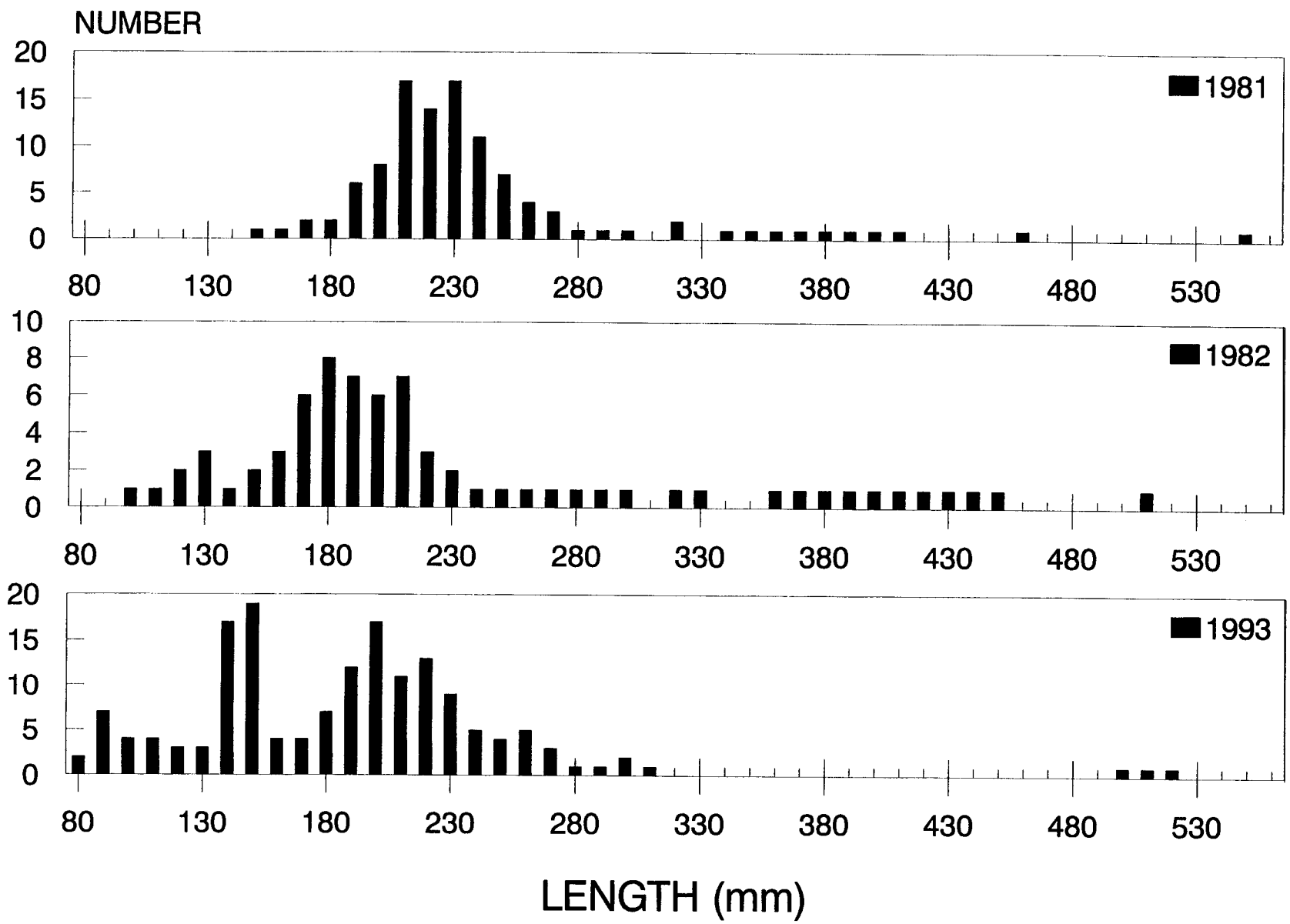

Figure 6. Length frequencies of largemouth bass captured by electrofishing in Fernan Lake, Idaho, 1981-82 and 1993.

Table 5. Channel catfish stocking records for Feman Lake, Idaho, 1987-1993.

Year	Number stocked[a]
1987	2,044
1988	4,980
1989	0
1990	4,000
1991	4,000
1992	0
1993	5,000

[a] Each stocking contained 1 and 2 year old fish.

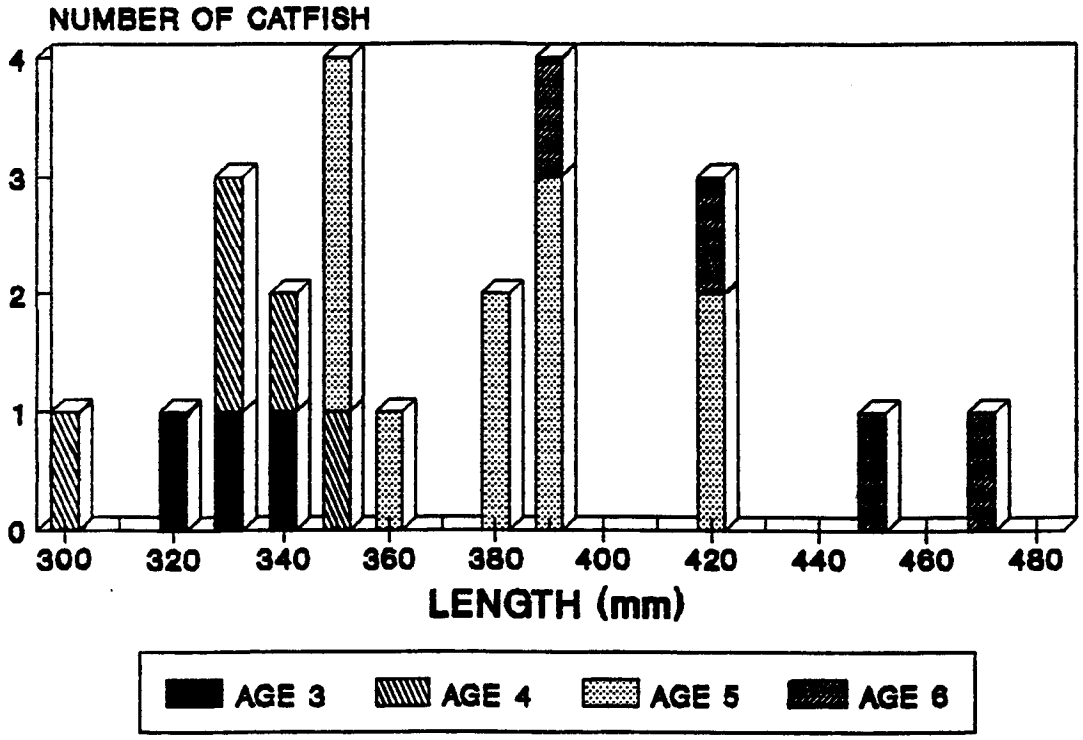

Figure 7. Length frequency of aged channel catfish captured by gill nets in Fernan Lake, Idaho, 1993.

Table 6. Mean length and weight of aged channel catfish collected by gill nets in Ferran Lake, Idaho, 1993.

Age	Number aged	Mean length (mm)	Length range (mm)	Mean weight (g)	Weight range (g)
3	3	333	320-340	277	250-310
4	5	330	300-350	310	230-400
5	11	380	350-420	480	320-650
6	4	438	390-470	815	460-1,100

Hayden Lake

Management direction for Hayden Lake has been to establish a quality fishery for both warmwater and coldwater fish species. Bass harvest was closed from 1983 through 1987 to allow smallmouth bass *Micropterus dolomieu* to establish. A two fish, 14-inch minimum length limit was in effect from 1988 through 1991. In 1992, bass regulations were changed to allow the harvest of two bass, none between 305 mm to 406 mm (12 to 16 inches) with a harvest season of July 1 to December 31. This change in the regulation was designed to conform to the statewide "quality" bass regulations. In 1990, restrictive regulations were placed on crappie limits; 15 fish none under 10 inches (250 mm). A two trout, 14-inch minimum length limit has been in place since 1988.

The lowland lake survey initiated in 1993 was the first year of an extended study of the lake to assess the health of the fish populations. A creel census is planned for 1995 to assess the contribution of hatchery trout to the fishery.

During April 1993, a total of 2.7 hours of electrofishing, 4 nights of trap net, and 15 nights of gill net sampling effort were expended on Hayden Lake. Game fish species collected included largemouth bass, smallmouth bass, black crappie, yellow perch, pumpkinseed, cutthroat trout, rainbow trout, brook trout, and mountain whitefish *Prosopium williamsoni* (Appendix B). Average back-calculated lengths at age for largemouth bass, smallmouth bass, black crappie, and pumpkinseed are presented in Table 7.

Length-at-age for largemouth bass in Hayden Lake is somewhat less than other north Idaho lakes. It takes nine to ten years to reach 305 mm in Hayden Lake, whereas this same length is attained by age 8 in Lower Twin and Fernan lakes and age 7 in Spirit Lake (Table 8). Smallmouth bass grow to 305 mm in six years.

The growth of black crappie in Hayden Lake is slower than other north Idaho lakes. It requires ten years for a black crappie to reach the minimum legal size of 250 mm (ten inches) in Hayden Lake, whereas, it only takes eight years in Lower Twin Lake, seven years in Cocolalla Lake, and six years in Spirit Lake (Table 8).

Muskrat Lake

Muskrat Lake is located in Bonner County, Idaho, approximately 9.5 km west of Sandpoint, Idaho. The water level of this small, approximately 8 ha, lake is influenced by the level of the Pend Oreille River. Only during the period of full or nearly full pool (regulated by Albeni Falls Dam) does water flow between Muskrat Lake and the Pend Oreille River through a culvert system. Muskrat Lake is divided into two separate bodies of water by a railroad bed and a culvert connects the two lakes. The west half of the lake is shallow and offers little fish

Table 7. Mean back-calculated lengths (mm) at age for largemouth bass (LMB), smallmouth bass (SMB), black crappie (BC), and pumpkinseed (PS) sampled from Hayden Lake, Idaho, in 1993.

	Age												
Species	1	2	3	4	5	6	7	8	9	10	11	12	13
LMB	49	69	96	123	154	185	221	257	299	343	393	446	520
SMB	64	118	157	208	264	315							
BC	33	54	75	96	118	142	169	196	220	246	286	330	
PS	47	76	105	128	146								

Table 8. Mean back-calculated lengths (mm) at age for largemouth bass and black crappie collected from north Idaho lowland lakes and the year collected.

SPECIES/ LAKE	YEAR	AGE 1	2	3	4	5	6	7	8	9	10	11	12	13	14
LARGEMOUTH BASS															
Lower Twin	1992	63	101	125	155	196	231	276	329	366	380	411	447	465	490
Hayden	1993	49	69	96	123	154	185	221	257	299	343	393	446	520	
Fernan	1993	74	130	175	204	237	270	297	372	437	459	486	502	520	
Cocolalla	1992	71	94	118	152	189	223	257	282	296	399				
Muskrat	1993	51	76	101	129	164	193	236	274	321	372				
Spirit	1992	63	105	146	194	230	283	334							
BLACK CRAPPIE															
Lower Twin	1992	56	82	113	139	168	193	220	260						
Hayden	1993	33	54	75	96	118	142	169	196	220	246	286	330		
Cocolalla	1992	63	101	148	184	202	229	246							
Spirit	1992	64	94	136	206	230	251	272							

habitat. The land surrounding Muskrat Lake is privately owned. Angler/landowner conflicts have arisen in the past, keeping most anglers away from this secluded body of water.

In 1993, the Idaho Department of Fish and Game negotiated a lease agreement with the Union Pacific Railroad for sportsmen access on the northwest third of the east half of Muskrat Lake (Figure 8). During the June 30, 1993 survey, only the east half of Muskrat Lake was sampled. The deepest area located during the survey was 8 m. Dissolved oxygen levels at this time did not fall below 5.0 ppm until the probe was on the bottom of the lake in the anoxic mud. No thermocline was found (Appendix C). Fish species collected were largemouth bass, yellow perch, pumpkinseed, and tench (Appendix C). Age analysis of the largemouth bass scales showed growth rates slower than that typical for north Idaho. Legal size largemouth bass, 305 mm (12 inch), were nine years old (Table 8, Appendix C).

Fish Population Characteristics

Kokanee Population Abundance

Lake Pend Oreille-The total population estimate of kokanee in Lake Pend Oreille during the August trawling was 8,983,000 kokanee (Table 9). This estimate of kokanee numbers is presented for the purpose of following the trend data available for Lake Pend Oreille. Newer, more sensitive computer models capable of more accurately estimating the number of kokanee in Lake Pend Oreille are being investigated.

Modal lengths of age 0 (wild and hatchery combined), 1, 2, 3, and 4 kokanee were 30 mm, 140 mm, 190 mm, 220 mm, and 240 mm, respectively.

Spirit Lake-The total population estimate of kokanee in Spirit Lake from the 1993 trawl data was 422,398 fish (Table 10). The modal lengths of age 0, 1, 2, and 3 kokanee were 38 mm, 170 mm, 210, and 220 mm, respectively. Only one age 3 kokanee was sampled, however.

A problem with fluctuating kokanee year class strength in the early 1980s was addressed with supplemental stocking of kokanee fry. From 1984 through 1988, between 57,142 and 100,000 fry were stocked annually (Table 10). The exact stocking number was based on midwater trawl estimates of age 0 kokanee. This stocking did not appear to stabilize the population and was discontinued in 1989.

Angler complaints about smaller than normal kokanee during the 1992-1993 winter ice fishery prompted us to look at the size and age of kokanee in the catch. Age analysis of otoliths from angler caught kokanee in January of 1993 indicated the majority of the fish being caught were age 2+ kokanee. We also looked at past length frequency data from trawl caught kokanee

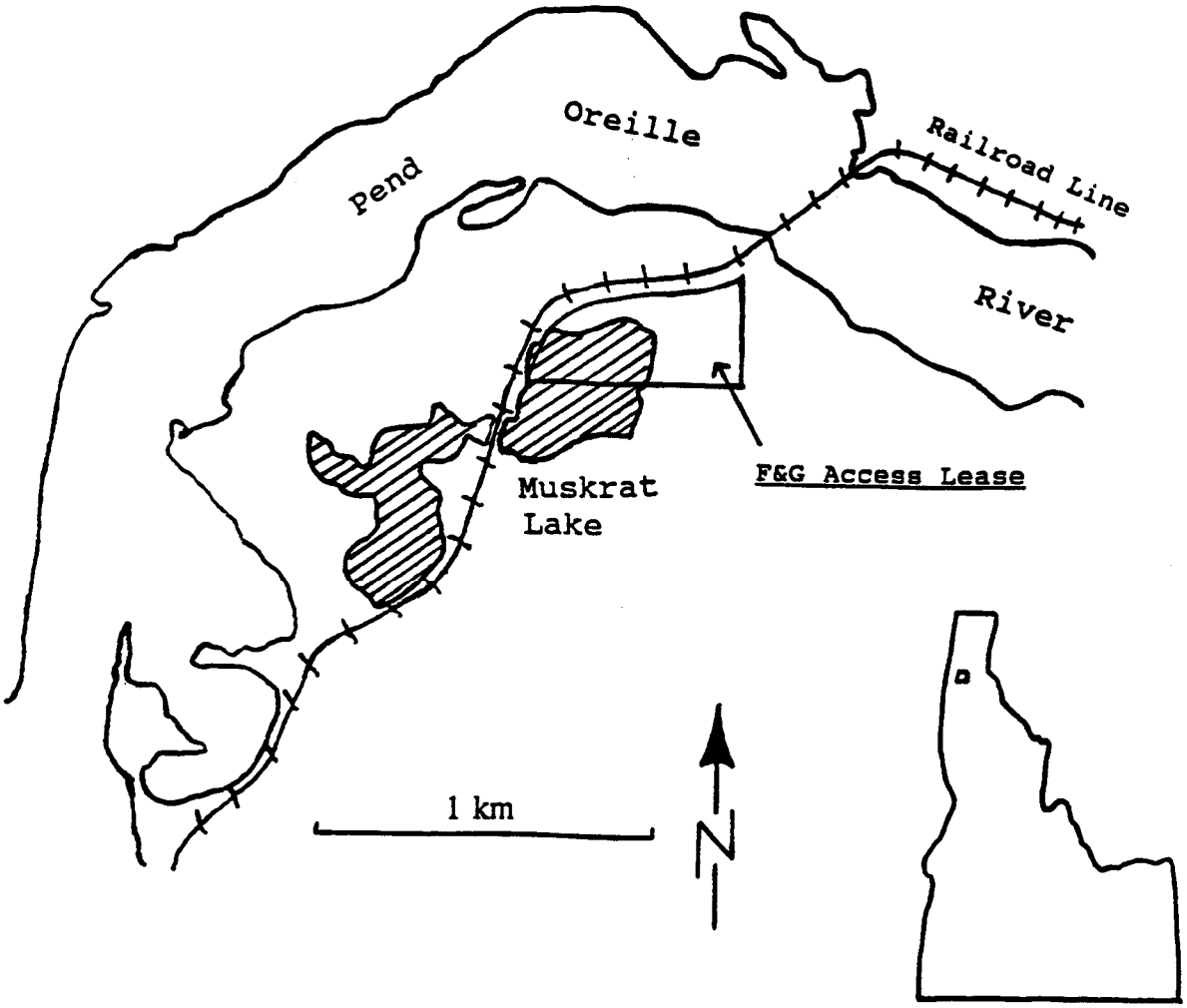

Figure 8. Muskrat Lake, Idaho, and area leased from Union Pacific Railroad by the Idaho Department of Fish and Game for sportsmen access.

Table 9. Population estimates (in millions) and density (N/ha) for kokanee in Lake Pend Oreille, Idaho, 1986 through 1993.

	Population Esimate							
	Age							Density
Year	0	1	2	3	4	5	Total	(N/ha
1986	1.65	1.15	0.68	0.54	0.24		4.26	189
	(72.9)	(50.8)	(30.0)	(23.8)	(10.6)			
1987	3.55	0.78	0.84	0.43	0.42		6.02	266
	(156.8)	(34.4)	(37.1)	(19.0)	(18.5)			
1988	7.31	1.66	0.51	0.38	0.35		10.21	451
	(322.8)	(73.3)	(22.5)	(16.8)	(15.5)			
1989	4.50	1.17	1.20	0.45	0.37	0.04	7.71	341
	(198.7)	(51.7)	(53.0)	(19.9)	(16.3)	(1.8)		
1990	3.35	1.59	1.45	0.33	0.20		6.93	306
	(147.9)	(70.2)	(64.0)	(14.6)	(8.8)			
1991	1.97	0.83	1.77	0.77	0.27		5.61	248
	(87.0)	(36.7)	(78.2)	(34.0)	(11.9)			
1992	4.54	1.32	0.75	1.19	0.54		8.35	369
	(200.5)	(58.3)	(33.1)	(52.5)	(23.8)			
1993	3.26	2.11	1.46	1.46	0.70		8.98	397
	(144.0)	(93.2)	(64.5)	(64.5)	(30.9)			

Table 10. Estimates of kokanee year classes (1977-1992) made by midwater trawling in Spirit Lake, Idaho, 1981-1993. Estimates are in thousands of kokanee. Parenthesize numbers are from computer program generated data as compared to a hand calculation method.

	Year Estimated												
Class	1993	1992[f]	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981
1992	88.1												
1991	411.8												
1990	205.3		661.4										
1989	19.3		316.7	149.3									
1988	(52.5)		131.0	399.2	120.2								
1987	(244.1)		40.1	112.8	130.5	71.18							
1986	(114.4)		(458.4)	90.3	223.2	225.8	46.3[b]						
1985	(11.5)		(215.6)	(110.0)	85.8	92.4	178.7	16.6°					
1984			(90.0)	(285.8)		156.3	347.5	287.3	164.4°				
1983			(26.0)	(84.1)			97.6	107.9	206.8	3.5[e]			
1982				(62.0)				56.5	113.2	17.4	143.3		
1981									74.3	160.8	72.6	526.0	
1980										103.1	146.8	209.0	281.3
1979											54.2	57.7	73.4
1978												48.0	82.1
1977													92.6
Ages I-IV	636.3		487.7	602.3	439.5	474.5	623.8	451.7	394.3	281.3	473.6	314.7	248.1
	(370.0)		(331.6)	(431.9)									
Totals	724.5		1,149.2	751.5	559.7	545.6	670.1	467.7	558.7	284.8	616.8	840.7	529.4
	(422.5)		(790.0)	(541.9)									

[a] 75,000 kokanee fry released in 1988.
[b] 60,800 kokanee fry released in 1987.
[c] 57,142 kokanee fry released in 1986.
[d] 109,931 kokanee fry released in 1985.
[e] 100,000 kokanee fry released in 1984.
[f] No trawling conducted in 1992 due to low lake level.

from Spirit Lake and compared it to length-at-age data from Coeur d'Alene Lake and Lake Pend Oreille kokanee.

This cursory look at the data showed just the opposite of what the anglers were reporting; the kokanee in Spirit Lake were larger at the same age than kokanee in either Coeur d'Alene Lake or Lake Pend Oreille (Figure 9). The dominance of the age 2+ kokanee in the angler catch continued throughout the spring, summer, and fall fishery. This year class dominance was also apparent in the trawl catch. Only 2.7% of the 600 kokanee sampled during the midwater trawling were age 3+.

Length and age at maturity of kokanee in the 1993 trawl catch was less than previous years. In the 1990 trawling, no mature kokanee under 230 mm were found. In the 1991 trawling, no mature kokanee under 220 mm were found (trawling was not possible in 1992 due to low water conditions and our inability to launch the trawler). In the 1993 trawling, the vast majority of sexually mature kokanee were age 2+. Kokanee as small as 170 mm were found to be mature with 85 % of the fish over 200 mm being sexually mature. This early maturation is possibly a symptom of fast growth. Scott Patterson's (IDFG, personal communication) graduate research into kokanee maturity has indicated the trigger for a kokanee to spawn the following fall is tripped when that fish attains approximately 185 mm total length by the winter solstice of the previous year.

The most apparent explanation for the lack of age 3+ kokanee and the early maturing kokanee is the high angler exploitation of kokanee in Spirit Lake. Results from the 1992 creel census on Spirit Lake (Horner et al., 1996) estimated 102,000 kokanee were harvested from April through September 1992. This equates to approximately a 48% to 55 % exploitation rate of age 2+ and 3+ kokanee in 1992. This exceptional harvest resulted in the dominance of the 1991 year class of age 2+ kokanee in the 1993 fishery and the potential for accelerated growth of age 1+ kokanee (> 185 mm by the winter solstice) due to a reduction in the density of kokanee in Spirit Lake.

The dominance of the 1991 year class of kokanee in Spirit Lake was being expressed in the 1993-1994 winter ice fishery. Anglers were reporting catches of larger kokanee. The average size of angler caught kokanee in February 1994 was approximately 200 mm.

Northern Pike

Population Status-Two major differences in the northern pike population in Cougar Bay, Coeur d'Alene Lake, between 1990 and 1993 were obvious after examining the data. There had been a change in the length and age structure and abundance of the population. In 1993, biologists caught fewer northern pike over 750 mm and less than 400 mm (1 year old) than in 1990 (Figure 10). The change in size structure of the population was also reflected in the decrease in the PSD from 94 to 87 in 1990 and 1993, respectively. The reduction in fish greater

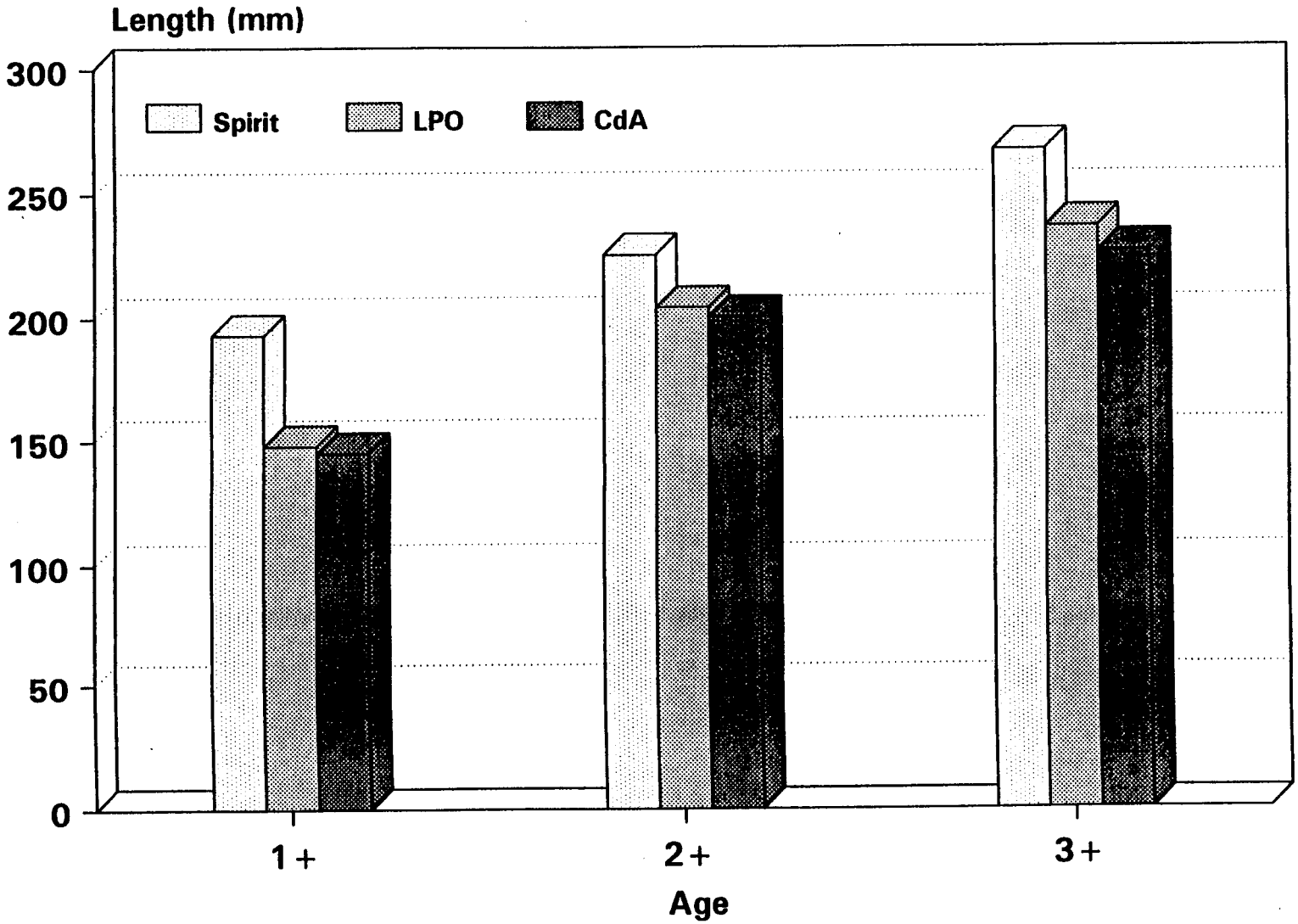

Figure 9. Mean September length at age for trawl caught kokanee from Spirit (1987-1991), Pend Oreille (1987-1991), and Coeur d'Alene (1989-1991) lakes, Idaho.

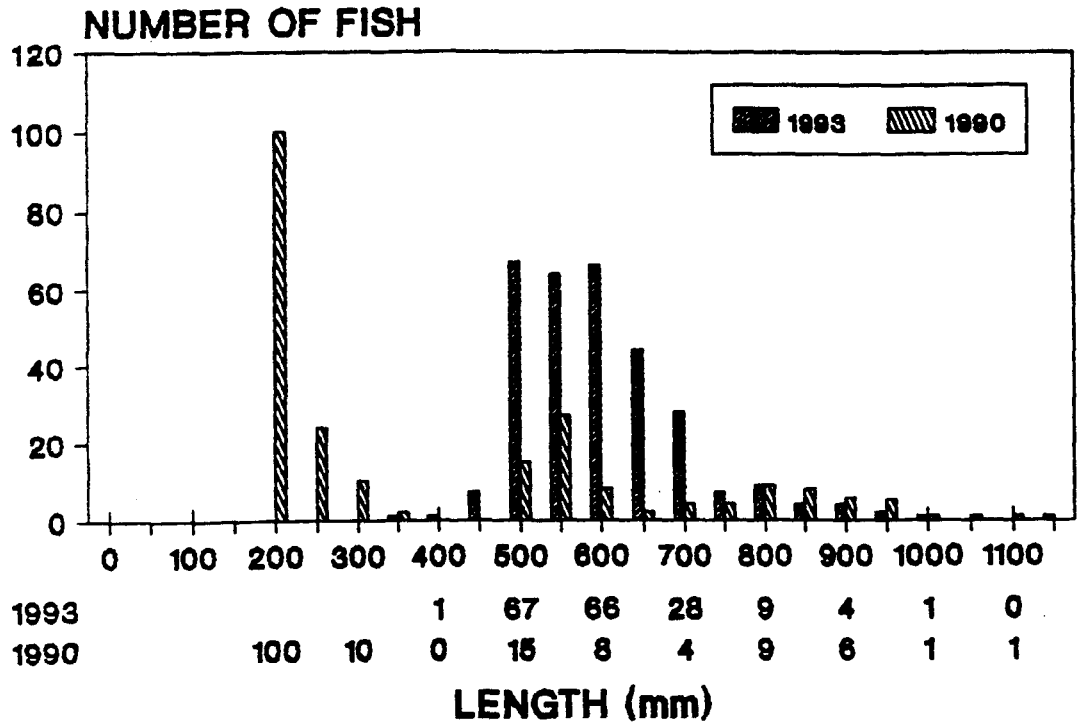

Figure 10. Comparison of length frequencies for gill net and trap net caught northern pike from Cougar Bay, Coeur d'Alene Lake, Idaho, 1990 and 1993.

than 750 mm was probably a direct result of angler harvest. Most anglers released northern pike they thought were too small and harvested the larger northern pike. The reduction in the number of northern pike less than 400 mm was most likely the result of a year class failure due to environmental factors. Sampling bias due to the low water level and the lack of open water during the first four days of sampling may have also accounted for a reduction in the number and size of northern pike sampled in 1993.

Changes in the age frequency mirrored the changes in the length frequency for the same reasons. Biologists collected fewer northern pike over four years of age in 1993 than in 1990 (Figure 11).

The other significant change in the northern pike population in Cougar Bay since 1990 was the estimated three-fold increase in the total population; 1,791 (95% Confidence Interval [CI] 1,309 to 3,003) and 550 (95% CI 380 to 994) in 1993 and 1990, respectively. Sampling conditions may explain some of the difference. In 1993, northern pike were concentrated at the mouth of Cougar Bay because of low water and ice cover. Sampling was concentrated in this area. In 1990, water levels were higher and the entire bay was ice free and sampling was spread throughout the entire bay, which may have caused the collection of northern pike to be more difficult.

Growth rate of northern pike has not changed significantly since 1990; however, condition appears to be less in 1993 than in 1990 (Figure 12). The length-weight equation in 1990 (Rich 1992) was Log W = -6.282 + 3.423 Log L, and the length-weight equation for 1993 was Log W = -6.4662 + 3.491 Log L (Figure 12). This may be an indication that the northern pike population is beginning to reach carrying capacity in Cougar Bay because of the slightly slower growth in the younger age groups. Mean back-calculated lengths at age indicated that growth in the first three years has begun to slow down. Rich (1992) reported back-calculated lengths for ages 1, 2, and 3 of 312 mm, 604 mm, and 749 mm. In 1993, the back-calculated lengths for ages 1, 2, and 3 were 296 mm, 471 mm, and 602 mm (this was based on aging northern pike scales and may not be 100% accurate).

The relative weight (W_r) values for most of the length groups of northern pike in Cougar Bay were well above 100 (Figure 13). A W_r of 100 for a broad range of size groups indicates the fish are growing under optimum conditions. Rich (1992) reported a mean W_r of 127. The mean W_r was 129 in 1993. The high W in 1993 indicated that the northern pike population was still growing under optimum conditions. Growth rates of northern pike in 1993 in Cougar Bay were still faster than many northern pike growth rates reported by Carlander (1971).

Food Habits-Yellow perch comprised 76%, by number, of the food items flushed from 117 northern pike stomachs. The mean length of yellow perch consumed by northern pike in the spring of 1993 was 68.5 mm and ranged from 36 mm to 147 mm. The mean length of yellow perch collected in gill nets and trap nets was 150 mm (sampling may have been biased toward large fish). It appeared that northern pike selected for smaller (more vulnerable) yellow

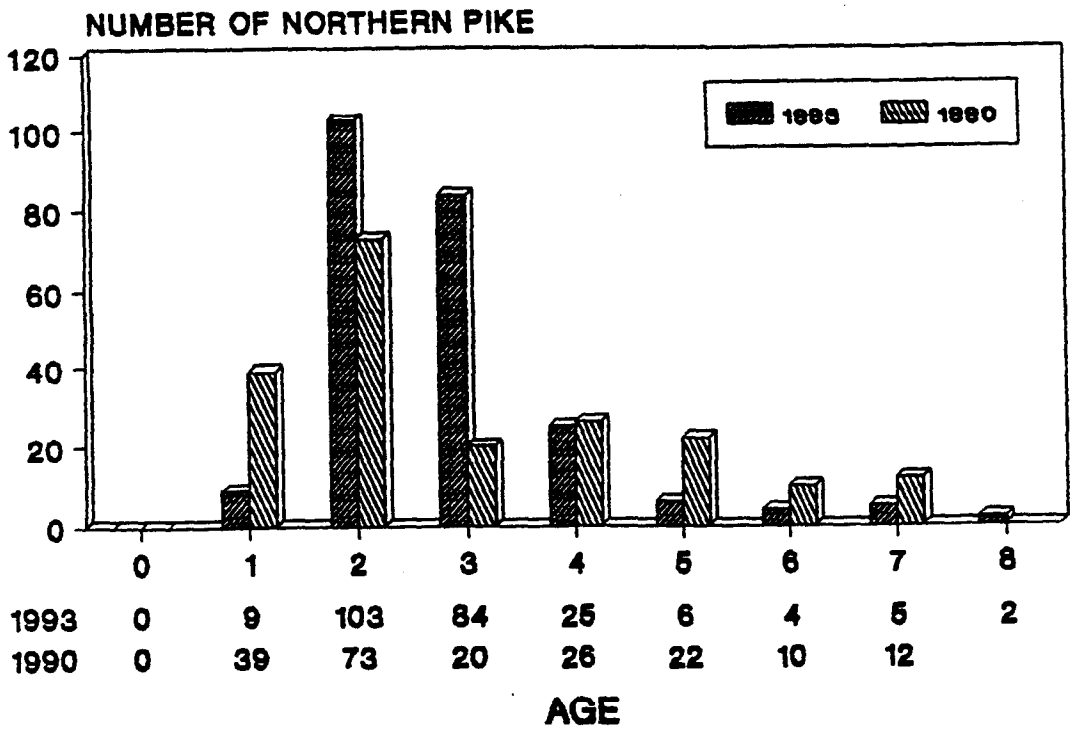

Figure 11. Age frequencies of gill net and trap net caught northern pike from Cougar Bay, Coeur d'Alene Lake, Idaho, 1990 and 1993.

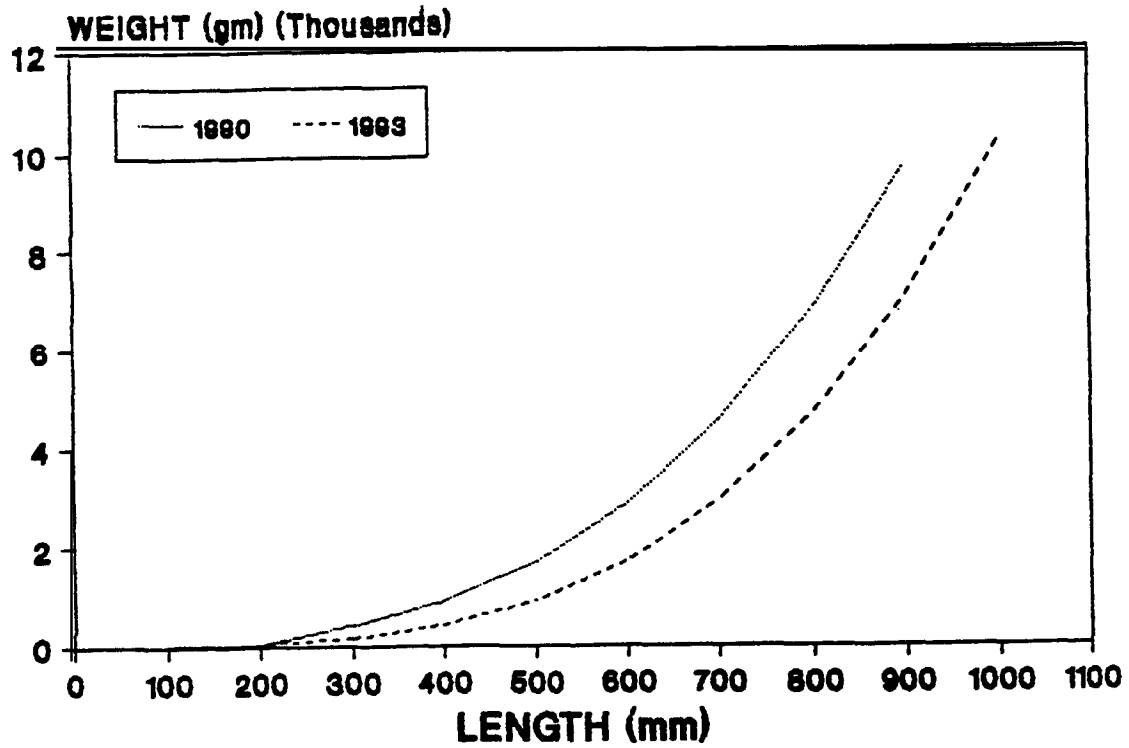

Figure 12. Length-weight equation for gill net and trap net caught northern pike from Cougar Bay, Coeur d'Alene Lake, Idaho, 1990; Log w = -6.282 + 3.423 Log L and 1993; Log W = -6.4662 + 3.491 Log L.

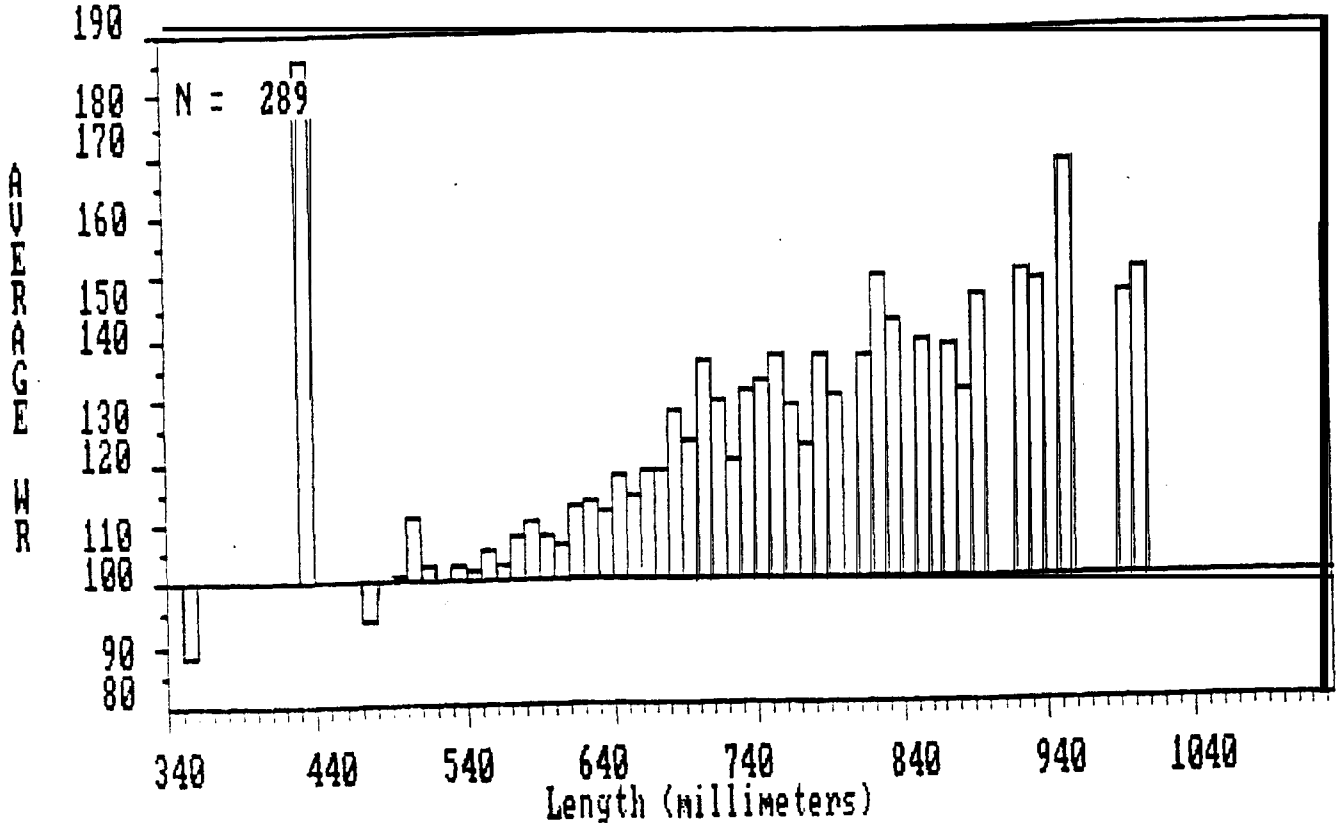

Figure 13. Mean W_r for each length group of gill net and trap net caught northern pike from Cougar Bay, Coeur d'Alene Lake, Idaho, 1993.

perch. Rich (1992) reported yellow perch comprised 44% of the diet, by number, of northern pike in the spring of 1990 in Cougar Bay. The mean length of yellow perch consumed by northern pike in 1990 was 128 mm. The decline in mean size of yellow perch in the diet may indicate a decline in the abundance of larger sized fish and shift to smaller yellow perch. Decreased growth rates and smaller preferred forage fish in their stomachs may indicate northern pike are beginning to have a detrimental effect on their forage base.

The lack of cutthroat trout in the diet was probably due to absence of cutthroat trout from Cougar Bay. Only one cutthroat trout was collected during the sampling period. Rich (1992) reported the presence of cutthroat trout in northern pike stomachs throughout the year.

Creel Survey-Harvest of northern pike was suspected as the major factor contributing to the decline in large northern pike (greater than 750 mm). Between March 13, 1993 and April 30, 1993, anglers harvested 81 northern pike in 2,142 h of effort, for a catch rate of 26.4 h/fish (Appendix D). The estimated fishing effort was significantly lower in 1993 than in 1991; 2,142 h and 14,685 h, respectively (the 1991 creel survey period was March 23 to April 14). Harvest was also significantly less in 1993 than in 1991, 81 and 672, respectively. Catch rates were 26 h/fish harvested in 1993 compared to 22 h/fish harvested in 1991.

Two major factors contributed to the decline in effort. In 1993, access to the lake for shore anglers was prohibited. Shore anglers contributed only 18% of the total fishing effort. In 1991, when shore access was available, shore anglers contributed 68% of the fishing effort. The other factor was publicity. In 1991, four state record northern pike over 15 kg (30 lbs) were caught in Cougar Bay. The local and national publicity following the capture of these record sized fish probably encouraged more anglers to fish than would have normally fished had state record fish not been caught. In 1993, there was less promotion of the northern pike fishery in Cougar Bay, and this may have helped to reduce fishing effort.

Exploitation of northern pike based on tag returns was 23% between March 1993 and October 1993. Rich (1992) reported an exploitation rate of 30% based on tag returns. Both these rates were probably minimum estimates. Fish tagged during 1993 were being caught during the 1994 spring fishery. Rich (1992) reported that fishing was the major component of total mortality.

The northern pike population has changed during the past three years. Large fish are less numerous, but total population abundance is as good or better than in 1990. Growth rates have declined some, but northern pike in Cougar Bay are still some of the fastest growing in the country, and on the average, heavier than pike from other waters. A decline in forage length may be the early warnings of a heavily impacted forage base and future declines in northern pike growth rates. Trophy pike (> 10 kg) are still caught annually in Coeur d'Alene Lake, so there are no plans to change current management direction at this time.

Lake Trout

During 1993, biologists and officers interviewed 264 resident and 163 nonresident lake trout anglers on Priest Lake. These 427 anglers spent 927 hours to catch 218 lake trout for a catch rate of 4.5 h/fish. Only 37 of these fish were released, and only 4 of the 37 fish were in the slot limit release size of 660 mm to 813 mm (26 to 32 inches). The modal length of lake trout in the catch was 457 mm (Figure 14). This data indicated a significant shift in the length frequency of lake trout in the angler catch since the last recorded data in 1987 (Figure 14). While the 1993 catch and effort data was limited and somewhat biased to the winter ice fishery (Figure 15), the length frequency of fish in the catch indicated that there were very few fish entering the protected slot limit. A structured creel census is scheduled for 1994 to more accurately quantify angler effort and harvest of lake trout from Priest Lake.

Stocking Evaluations

Rainbow Trout

Fishery managers have had to maximize the return of put-and-take rainbow trout because of the increasing costs of raising and stocking these fish. Stocking has been reduced where fisheries have had low return rates. Other fisheries have had fish redistributed to areas of easier accessibility for anglers or to areas that receive higher amounts of fishing effort. Fishery managers have also used put-grow-and-take rainbow trout instead of put-and-take rainbow trout to reduce the overall cost of stocking fish.

Fishery administrators have established some guidelines for evaluating the success of a put-and-take fishery and a put-grow-and-take fishery. In a put-and-take fishery a minimum of 40% of the fish stocked should be caught by anglers to be considered successful. In a put-grow-and-take fishery, anglers should harvest a minimum 100% of the weight of put-grow-and-take originally stocked to be considered successful.

Three lakes were evaluated in 1993; Cocolalla, Fernan, and Hauser lakes.

Cocolalla Lake-The second year of a two-year study (Horner et al., 1996) was completed on Cocolalla Lake in 1993. The emphasis was on overwinter survival of put-and-take rainbow trout.

Six gill nets, set overnight in Cocolalla Lake on May 24, 1993, failed to catch any of the adipose fin-clipped put-and-take rainbow trout that were stocked in 1992. Put-and-take rainbow trout from the 1993 stocking were sampled in addition to westslope cutthroat trout,

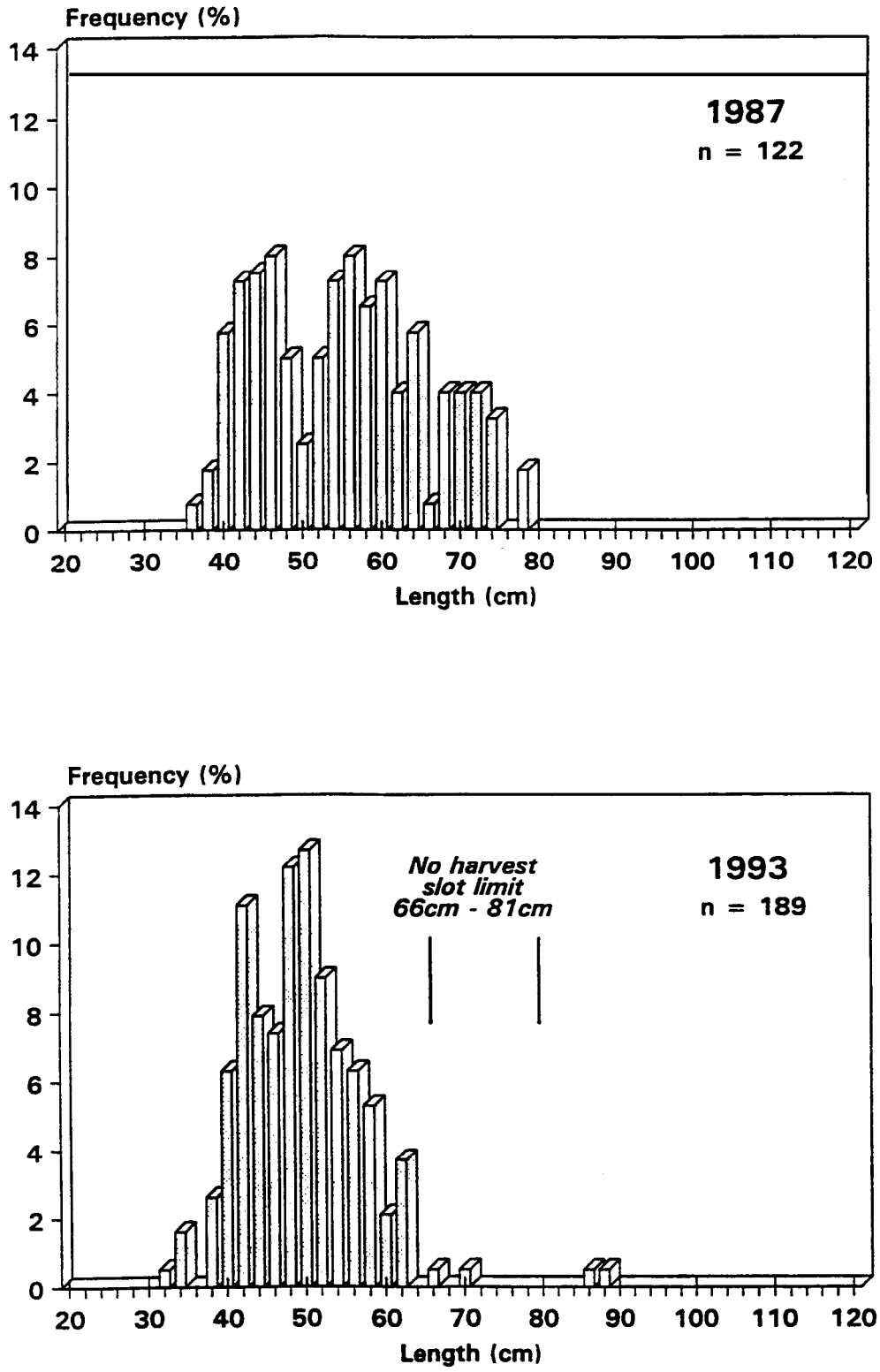

Figure 14. Length frequency of lake trout caught in Priest Lake, Idaho, 1987 and 1993.

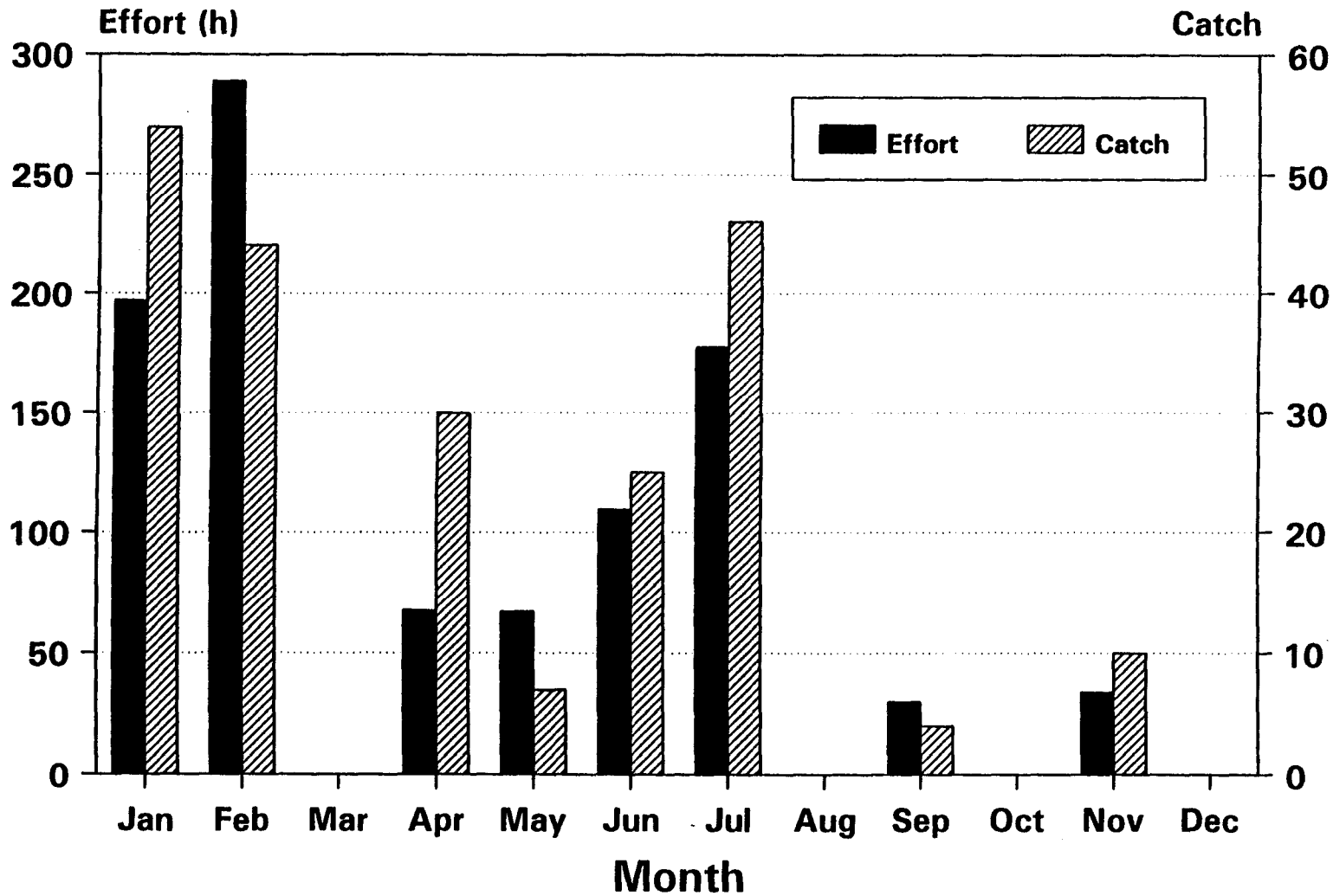

Figure 15. Angler effort and catch of lake trout from Priest Lake, Idaho, 1993.

rainbow/cutthroat hybrids, brook trout, and brown trout *Salmo trutta*. With the exception of the 1993 put-and-take rainbow trout, which evidenced typical tattered fins, all the salmonids captured were in good to excellent condition. Warmwater species captured included channel catfish, black crappie, largemouth bass, pumpkinseed, and yellow perch.

The lack of the adipose-marked rainbow trout in the catch and relatively high abundance of other salmonids indicates the poor "holdover" success of put-and-take size rainbow in Cocolalla Lake. Return to the creel of these marked rainbow trout in the 1992 creel census (Horner et al., 1996) was 7.7%. We anticipated in 1992 that there would be a substantial "holdover" of these trout to 1993. This did not appear to be the case. There are several explanations for the apparent lack of "holdover" put-and-take rainbow trout in Cocolalla Lake. We know that fish move from Cocolalla Lake, via Cocolalla Creek, to Round Lake and that these fish supplement the Round Lake fishery. Also, Cocolalla Lake receives some of the lightest fishing pressure for mid-size lowland lakes in the area. Effort was estimated at 27 h/ha in 1992 (Horner et al., 1996) as compared to Spirit Lake and Hauser Lake at 54 h/ha and 140 h/ha, respectively. There may not be sufficient angling effort on Cocolalla Lake to meet the goal of 40% return to the creel of our put-and-take rainbow trout. While there is a summer high temperature/low oxygen problem in Cocolalla Lake (Horner et al., 1996) it is not severe enough to preclude wild salmonids.

Fernan Lake-A one-year study was completed on Fernan Lake to determine the rate of return for put-and-take rainbow trout stocked into the lake. The previous evaluation was conducted in 1984 and the return rate was 50%.

Anglers fished for an estimated 97,490 h (672 h/ha) (Appendix E). They caught an estimated 46,974 fish (324 fish/ha), 23,390 were harvested, and 23,578 were caught and released. An estimated total of 7,775 adipose fin-clipped put-and-take rainbow trout were harvested (38% return). Anglers also caught an estimated 2,245 unclipped put-and-take rainbow trout stocked prior to 1993. If the number of holdover unmarked rainbow trout were added to the return rate estimate, this estimate could approach 50%.

Anglers caught an estimated 6,204 largemouth bass, and 79% were released (Appendix E). The lengths of largemouth bass harvested ranged from 205 mm to 460 mm. Other warmwater fish harvested included black crappie, yellow perch, pumpkinseed, brown bullhead, and channel catfish (Appendix E).

Fernan Lake continued to be a popular urban fishery. The increase in fishing pressure since 1984 (Table 11) may reflect the steady population growth of Coeur d'Alene and the surrounding area (11% since 1990). The amount of fishing pressure on Fernan Lake was one of the highest in the Panhandle Region (Table 12). Even though the fishing effort has increased, the return rate of put-and-take rainbow has remained the same (Table 11). The number of put-and-take rainbow stocked into Fernan Lake has ranged between 21,665 and 29,240 and averaged 25,560 from 1984 to 1993.

Table 11. Estimated fishing effort, catch rates, and percent return to the creel for put-and-take rainbow trout in Ferran. Lake, Idaho, April - September 1984-1986 and 1993.

Year	Number of anglers interviewed	Fishing effort (h)	Fishing effort per hectare	Catch rate		Percent return for stocked trout
				Trout	Spiny ray	
1984	592	63,000	434	.13	.23	50
1985	532	67,742	467	.34	.57	
1986	273	72,000	497	.12	.31	
1993	1,270	97,490	672	.10	.19	50

Table 12. Fishing effort (h/ha) for selected lowland lakes in north Idaho, 1986 and 1993.

Lake	1986	1993
Hauser	266	240
Ferran	387	672
Hayden	70	
Upper Twin	70	
Lower Twin	275	
Brush	1,080	
Robinson	1,111	
Smith	750	

Return to the creel may be affected by fishing effort, survival rate of stocked fish, and emigration. On Fernan Lake, the increase in total fishing effort did not cause an increase in the return rate for put-and-take rainbow trout. Shore anglers provided 77% of the fishing effort and caught 76% of the trout. Boat anglers provided 23 % of the fishing effort and caught 24% of the trout. Trout harvest by shore anglers may be at a maximum because access was limited by available parking. The best trout fishing locations were occupied most of the time. Any increase in shoreline angler effort would have occurred in locations where harvest of trout would not have been affected. However, the lake appears to be able to handle an increase in boat anglers. Boat anglers have access to areas not available to the shore anglers. The increase in boat angler effort would probably result in an increase in the return rate for trout.

The fish health and stock of fish used affects the survival of stocked rainbow trout and would affect the rate of return. Summer trout habitat may be a limiting factor some years (not in 1993). If the number of trout stocked exceeded the carrying capacity of the summer trout habitat, the potential for a lower survival rate would increase. In this situation, reducing the number of trout stocked annually could improve the survival rate. If harvest remained the same, the return rates would increase.

Emigration may be a factor affecting the return to the creel. The outlet of Fernan Lake provides an escape route for fish during high flow periods. Unfortunately, a screen small enough to prevent fish loss during high flows would result in an unacceptably high risk of flooding to shoreline property owners. Inflow often exceeds outflows during flood events causing the lake to rise.

Hauser Lake-Hauser Lake has received put-and-take and put-grow-and-take rainbow trout for many years. In 1993, biologists completed the second year of a two-year study to determine the rate of return for put-and-take and put-grow-and-take rainbow trout in Hauser Lake.

Anglers fished for an estimated 60,670 h (240 h/ha) (Appendix F). They caught an estimated 47,575 fish. A total of 22,624 fish were released, and 24,948 fish were harvested (Appendix F). Anglers harvested an estimated 6,987 put-and-take rainbow trout stocked in 1992 and 1993 (Table 13). The return rate for put-and-take rainbow trout stocked in 1993 was 57%. The return rate for put-and-take rainbow trout stocked in 1992 and caught in 1993 was 15%. The total return rate for put-and-take rainbow trout stocked in 1992 and caught in 1992 and 1993 was 32% (this data does not include fish caught during the period from October 1992 to March 1993). If the number of marked holdover rainbow trout stocked in 1992 and harvested in 1993 are combined with the number of 1993 marked rainbow trout harvest in 1993 the return rate estimate would approach 72%. Anglers also harvested 1,166 put-grow-and-take rainbow trout from trout stocked in 1990, 1991, and 1992 that averaged 516 g/fish for a total weight of 602 kg (1,324 lbs). The total weight of put-grow-and-take rainbow stocked in 1990, 1991, and 1992 was 467 kg (1,050 lbs), 614 kg (1,350 lbs), and 500 kg (1,100 lbs), respectively.

Table 13. Summary of fishing effort estimates and harvest estimates (± 95% CI) on Hauser Lake, Idaho, April-September 1993.

Interval	Number fish kept	Number fish released	Number fish caught	Number AD RBT kept	Number RBT kept	Number LMB kept	Number CC kept	Number PS kept	Number perch kept	Number crappie kept	Number other kept	Total hours effort	Effort/ha
1	581	240	822	157	224	0	0	0	203	0	0	3,795	15
	(466)	(261)	(589)	(167)	(277)	0	0	0	(340)	0	0	(1,033)	
2	4,339	1,272	5,612	1,414	408	2,010	0	0	257	46	0	12,036	48
	(2,389)	(1,008)	(3,105)	(1,071)	(306)	(1,548)	0	0	(302)	(98)	0	(4,594)	
3	2,160	3,468	5,628	885	178	304	0	0	173	275	197	8,838	35
	(747)	(1,975)	(2,182)	(469)	(130)	(362)	0	0	(180)	(276)	(233)	(1,641)	
4	6,051	3,034	9,085	1,511	162	654	0	71	61	2,954	269	10,544	42
	(3,697)	(1,363)	(4,418)	(687)	(144)	(926)	0	(100)	(86)	(2,823)	(228)	(1,896)	
5	8,722	5,918	14,645	2,240	140	188	0	0	14	5,920	642	13,061	52
	(6,663)	(2,456)	(7,339)	(1,290)	(135)	(192)	0	0	(30)	(6,866)	(491)	(3,003)	
6	1,536	1,458	2,994	780	54	411	0	28	0	54	134	6,553	26
	(1,058)	(1,015)	(1,582)	(489)	(79)	(840)	0	(52)	0	(80)	(235)	(1,645)	
7	1,559	7,234	8,789	0	0	0	0	0	0	677	134	5,853	23
	(1,448)	(13,218)	(14,380)	0	0	0	0	0	0	(1,326)	(263)	(1,986)	
Season total	24,948	22,624	47,575	6,987	1,166	3,567	0	99	708	9,926	1,376	60,670	240
	(8,230)	(13,734)	(17,246)	(1,942)	(482)	(2,032)	0	(112)	(498)	(7,547)	(687)	(6,643)	

AD RBT	Adipose-clipped put-and-take rainbow trout.
RBT	rainbow trout
LMB	largemouth bass
CC	channel catfish
PS	pumpkinseed
Other	Includes tench, brook trout, cutthroat trout, brown trout, green sunfish, and brown bullhead.

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Black crappie and largemouth bass were the most abundant warmwater fish harvested (Table 13). Although channel catfish were present in Hauser Lake, fishery personnel did not contact an angler that had caught any. Catfish anglers tend to fish at night and leave before fishery personnel can contact them.

Put-and-take rainbow trout stocked in 1992 and 1993 contributed to the return rate for rainbow trout in 1993. Put-and-take rainbow trout stocked in 1992 and 1993 were separated in the creel based on length. Hatchery personnel estimated growth for rainbow trout could reach 25 mm/month in an ideal hatchery system, but in Hauser Lake, growth would probably not reach 25 mm/month (Dan Beers, IDFG, personal communication). Using this information and being conservative because fish stocked in 1993 ranged from 240 mm to 300 mm in length, biologists decided that adipose-clipped put-and-take rainbow trout 330 mm in length or greater in April, May, and June and 355 mm or greater in July, August, and September were probably stocked in 1992. This group of trout comprised 26% of the fish observed in the creel. Assuming this percentage was representative of the trout fishery, the estimated number of trout stocked in 1992 and 1993 that were harvested in 1993 was 1,817 and 5,170 fish, respectively. These numbers represent 15 % and 57% return to the creel for trout stocked in 1992 and 1993, respectively.

The return rates may fluctuate on a yearly basis because the number of trout that hold over from year to year varies. The fluctuation would be influenced by fishing effort and harvest, as well as stocking survival, fish stock used, fish health, and predation. Even though the return to the creel of adipose-clipped rainbow trout in 1993 was comprised of two groups, the total percentage of adipose-clipped trout returned was 72%. It does not matter when the stocked fish were harvested, only that they were harvested. The put-and-take stocking program in Hauser Lake exceeded the recommended rate of return in the statewide Five Year Fish Management Plan.

The put-grow-and-take rainbow trout harvested in 1993 were probably comprised of fish stocked in 1990, 1991, and 1992. Biologists could not separate these groups of fish. The estimated rate of return was also true for these fish as for the put-and-take trout. It does not matter when these fish were harvested, only that they were harvested and that the total harvested weight was greater than the weight originally stocked. The average weight for the three groups of put-grow-and-take trout was 527 kg. The estimated total weight of put-grow-and-take trout harvested in 1993 was 602 kg. The put-grow-and-take rainbow trout stocking program in Hauser Lake also exceeded management plan criteria.

One of the underlying questions of the study was "Is stocking put-grow-and-take trout less costly than stocking put-and-take trout?" The real cost must be measured in the cost of fish returned to the creel not just in the cost to rear and stock a given number of trout.

Put-and-take rainbow trout cost $0.52 per fish stocked in north Idaho. In 1993, the 9,000 put-and-take fish stocked in Hauser Lake cost $4,680. A total of 6,987 adipose-clipped trout were harvested for a cost of $0.67 per fish harvested. Put-grow-and-take trout cost about $0.14 per fish stocked in north Idaho. The mean number of put-grow-and-take trout stocked in Hauser

Lake during 1990-1992 was 19,362 fish for a mean annual cost of $2,711. The cost per fish harvested was $2.32 per fish (1,166 trout harvested).

If we stocked put-grow-and-take trout exclusively in Hauser Lake, we would have to increase the number of fish stocked to provide the same harvest provided by put-and-take trout. Assuming survival, growth, harvest, and predation for put-grow-and-take trout remained the same, we would have to stock 135,384 trout at a cost of $18,954 ($0.14 per put-grow-and-take trout stocked). Put-and-take trout provide the most cost effective way to provide a trout fishery in Hauser Lake.

The harvest and fishing effort estimates in 1993 were significantly different than in 1992. The estimates in 1993 were more accurate than in 1992 because more creel data were collected in 1993. Technicians conducted 732 interviews and contacted 1,270 anglers in 1993. In 1992, technicians conducted 264 interviews and contacted 430 anglers. The number of completed-trip interviews was also greater in 1993 than in 1992; 180 and 104, respectively. The increase in collected data resulted in smaller confidence intervals and more accurate estimates.

The fishing effort and harvest estimates were minimum estimates because the ice fishing season was not included in the creel survey. Hatchery personnel stocked put-and-take trout in September and October in 1992 *and* October in 1993 to enhance the ice fishery for rainbow trout.

Net Pen Cutthroat Trout

A total of 46,160 westslope cutthroat trout were released from six net pens located in Scenic Bay and Garfield Bay on Lake Pend Oreille, Idaho in 1993. Since the inception of the program in the fall of 1989, a total of 107,001 westslope cutthroat trout have been reared and released in Lake Pend Oreille with the net pen program (Table 14).

Exploitation of net pen reared cutthroat trout has ranged from 1.21 % in 1991 to 1.38% in 1992, as calculated from returns of $5.00 reward Floy tags. While all net pen fish received an adipose fin clip in 1993, no fish were Floy-tagged. No reward tags were returned in 1993. A limited creel census was conducted along the north shore of Lake Pend Oreille from the Long Bridge south of Sandpoint on Highway 95 to Hope, Idaho between April 10 and May 9, 1993. A total of 54 bank anglers were interviewed. They fished for a total of 114 h and caught five cutthroat trout (22.8 h/fish), of which two were of net pen origin (adipose fin-clipped). Judging from the observed length of the two net pen cutthroat trout, 320 mm and 270 mm, these fish were from the 1991 and 1992 releases. In addition to the cutthroat trout, other fish reported caught during the survey were 15 lake whitefish *Coregonus clupeaformis*, 280 mm to 380 mm in length; 4 bull trout, 3 were under 508 mm (20 inches) minimum size regulation and were released, and one 560 mm bull trout harvested; one 250 mm yellow perch; and one 280 mm peamouth *Mylocheilus caurinus.*

Table 14. The numbers and size of net pen reared westslope cutthroat trout released into Lake Pend Oreille, Idaho, 1990 - 1993.

Year	Number of fish released	Mean length at release (mm)	Number of net pens	Release date
1990	38,841	160	4	May
1991	34,870	171	6	May 31
1992	50,130	173	6	May 15
1993	46,160	173	6	May 15-16

The limited census was not an accurate reflection of net pen program success. Anglers have reported catching a high percentage of adipose fm-clipped cutthroat trout in the 300 mm to 400 mm length range, and the local conservation officer has seen numerous net pen reared cutthroat trout in the angler harvest (outside the creel census period). This program has been very popular with the public, and effort appears to be shifting to cutthroat trout now that harvest of bull trout has been restricted (John Scott, IDFG, personal communication).

Mirror Lake

Catch rates for cutthroat trout, rainbow trout, and brook trout in Mirror Lake in 1993 averaged 0.83 fish/h as derived from officer creel surveys. A total of five impromptu creel days showed 29 anglers fished a total of 54 hours to catch 30 cutthroat trout, 12 rainbow trout, and 3 brook trout. Nine additional creel days failed to provide angler effort and catch data. On July 8, 1993, four gill net units produced a catch of 52 cutthroat trout, 10 rainbow trout, and 10 brook trout. Length frequencies ranged from 160 mm to 250 mm for cutthroat trout, 250 mm to 300 mm for rainbow trout, and 230 mm to 310 mm for brook trout. Condition factor for all the fish sampled was better than average.

Additional observations of the Mirror Lake fishery include the reported presence of brown trout and spawning kokanee. Brown trout were not restocked in Mirror Lake after the 1991 renovation, but have been reported in the catch by reliable sources. It is presumed that brown trout were in the outlet stream of Mirror Lake, downstream from the dewatered section, during the rotenone application in 1991 (Horner et al., 1995). With a subsequent high water period in 1992 or 1993, they gained access back into the lake. The number of brown trout in Mirror Lake is likely small, non-reproducing, and not expected to adversely impact the put-and-grow stocking strategy for the lake.

Male kokanee kelts, measuring approximately 250 mm, were caught during the 1993-1994 ice fishery on Mirror Lake. This early maturing of male kokanee is a characteristic that has been reported in hatchery kokanee broodstock (Scott Patterson, IDFG, personal communication). While the brown trout were unexpected and the 250 mm spawning kokanee are smaller than desired, the Mirror Lake fishery as a whole is right on line with the renovation goal of providing a "low tech," yield, salmonid only fishery that is reminiscent of the historical fishery on Mirror Lake.

New Species Introductions

Channel catfish and tiger muskie *Esox lucius x E. masquinongy* introductions in the Panhandle Region first occurred in 1985 and 1989, respectively (Table 15). No stockings of

Table 15. New species introduced in north Idaho lowland lakes and rivers 1983 through 1993.

SPECIES/ LAKE	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
BLUEGILL											
Brush Lake	--		--	--	--	--	238	--	--	--	--
Dawson Lake	--		--	--	--		130	9,000	--	--	--
Kelso Lake	--	400	-	-	--		--	--	--	--	--
Robinson Lake	--		--	--	--	--	408	--	--	--	--
Rose Lake	--		--	--	--	--	--	15,000	--	--	--
Shepherd Lake	--		--	--	--	--	300	12,000	--	--	--
Smith Lake	--		--	--	--	--	100	--	--	--	--
CHANNEL CATFISH											
Blue Lake	--	-	--	--	--	--	--	2,000	2,000	-	3,000
Cocolalla Lake	--	-	15,272	--	2,044	4,980	10,000	8,000	8,000	-	9,000
Dawson Lake	--	-	--	--	-	--	2,000	2,000	2,000	-	2,000
Ferran Lake	--	-	--	--	2,044	4,980	--	4,000	4,000	-	5,000
Hauser Lake	--	-	--	--	-	--	10,000	8,000	8,000	-	8,000
St. Joe River	--	-	--	--	--	--	12,000	5,000	5,000	--	--
St. Maries River	--	_	--	_	-	--	12,000	5,000	5,000	-	5,000
TIGER MUSKIE											
Blue Lake	--	--	--	--	--	--	350	352	115	--	150
Dawson Lake	--	--	--	--	--	--	75	110	35	--	50
Freeman Lake	--	--	--	--	--	--	100	110	35	--	50
Hauser Lake	--	--	--	--	--	--	1,650	1,650	550	--	600
Shepherd Lake	--			--	--	350	352	105	-	150	--
St. Joe River	--	--	--	--	--	-	850	924	350	--	--
SMALLMOUTH BASS											
Hayden Lake	213	-	2,050	4,000	--		--	--	--	--	--
SPLAKE											
Hayden Lake	--		--	--	--		--	4,709	--	4,000	5,000
Bloom Lake	--		--	--	--		--	500	--	500	500
Perkins Lake	--		--	--	--		--	500	--	500	500

either species were made in 1992 due to the lack of availability. In 1993, 35,000 channel catfish, approximately 200 mm to 230 mm in length, were purchased from Dunn's Catfish Farm in Oklahoma and hauled to Idaho. Five lowland lakes and the St. Manes River in the Panhandle Region received 32,000 of the 35,000 channel catfish (Table 15).

Prior to 1993, tiger muskie juveniles were obtained at the fry stage and reared at Hagerman Fish Hatchery. Due to cool water temperatures at Hagerman Hatchery, the size and condition of the tiger muskie at release in September was less than desired, and survival was felt to be extremely poor. In 1993, 2,500 tiger muskie, approximately 300 mm in length, were purchased from a private hatchery in Minnesota and hauled to Idaho at a cost of $7.00 to $8.00 each. Of these 2,500 fish, 1,000 were stocked in five north Idaho lowland lakes (Table 15).

Anglers have reported catching and releasing tiger muskie less than the legal length limit of 76 cm in Hauser, Shepherd, Dawson, and Freeman lakes. A legal length, 6 kg tiger muskie was caught and released in Hauser Lake during the summer of 1993. An 84 cm long and 3.5 kg fish was taken from Hauser Lake on May 21, 1993 and recorded as the first state record tiger muskie. This program will produce trophy size fish with time. We may discontinue stocking lakes where northern pike are present due to angler misidentification of tiger muskie and northern pike.

Splake *Salvelinus fontinalis x S. namaycush, a* lake trout/brook trout hybrid, have been stocked into three Idaho panhandle waters (Table 15). To date, we have sampled only one fish from Hayden Lake. Anglers have not reported catching any splake.

RECOMMENDATIONS

1. Continue monitoring the kokanee population in Spirit Lake to determine if fish size increases as anticipated. Investigate fry stocking as a means of modifying growth rate if kokanee size does not increase.

2. Maintain existing harvest opportunity for northern pike with liberal seasons and bag limits. Manage for low density pike populations to maximize pike growth rates while reducing impacts on other game fish species. Evaluate pike population status in Coeur d'Alene Lake in 1996.

3. Significantly reduce or eliminate put-and-take rainbow trout stocking in Cocolalla Lake due to poor return to the creel.

4. Reduce overall stocking of put-and-take rainbow trout in Fernan Lake from 25,000 to 20,000 annually and attempt to stock fewer fish more frequently to increase the return rate.

5. Discontinue stocking put-grow-and-take rainbow trout in Hauser Lake due to poor return rates. Increase stocking of put-and-take rainbow trout slightly to compensate for discontinued stocking of put-grow-and-take rainbow trout.

6. Continue with net pen rearing of westslope cutthroat trout for Lake Pend Oreille so long as the public supports the program. Accurately quantify the rate of return to the creel.

7. Continue species diversity program by stocking channel catfish and tiger muskie. The stocking priority for channel catfish would be Cocolalla Lake, St. Maries River, Fernan, Dawson, Hauser, and Blue lakes. The stocking priority for tiger muskie would be Dawson, Shepard, Hauser, Freeman, and Blue lakes.

8. Evaluate splake survival and growth in Hayden, Perkins, and Bloom lakes.

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A P P E N D I C E S

Appendix A. Fernan Lake - Lake Survey Report

Fernan Lake - Narrative

Fernan Lake is located just east of Coeur d'Alene, Idaho. It is about 300 acres in surface area and has an average depth of 12 ft and a maximum of 25 ft. Most of the shoreline of Fernan Lake is forested, the northwest corner of the lake is residential. There are two public boat launches, one at the east end and one at the west end of the lake.

During the mid-summer period, Fernan Lake stratifies (thermal layering) where colder, more dense water is near the bottom of the lake and resists mixing with the warmer layers near the surface. When the lake is in this period of stratification, dissolved oxygen levels drop to near zero in the water below the 15 ft level. Water temperature in the top layer often exceeds 70 degrees. This limits the usable area for trout to a narrow band just above the 15 ft level where dissolved oxygen levels and water temperature are compatible for trout.

In 1993, the Idaho Department of Fish and Game conducted a fishery survey and an angler survey to assess the fishery. Ten species of game fish were found and two species of non-game fish. The game fish included rainbow trout, westslope cutthroat trout, brook trout, largemouth bass, northern pike, yellow perch, black crappie, pumpkinseed, channel catfish, and brown bullhead. The non-game fish species sampled included tench and longnose sucker. The largemouth bass population appears to be healthy. Collected bass ranged in length from 3 to 21 inches. Length at age was less for the older age groups in 1993 than in 1981/82. Length at age in 1993 was age 1 = 2.9 inches, age 2 = 5.1 inches, age 3 = 6.9 inches, age 4 = 8.2 inches, and age 5 = 9.3 inches. In 1981/82 length at age was; age 1 = 2.5 inches, age 2 = 4.0 inches, age 3 = 7.2 inches, age 4 = 9.1 inches, and age 5 = 10.9 inches.

Channel catfish grow well in Fernan Lake and lengths ranged 12 to 19 inches. Channel catfish were first stocked into Ferran Lake in 1987.

Information gathered from the angler survey in 1993 showed a minimum of 97,000 hours of fishing effort took place on Fernan Lake between April and September 1993. During that time, anglers harvested 23,000 fish. Rainbow trout accounted for 43 % of the fish harvested. Black crappie provided 17% and yellow perch provided 21 % of the fish harvested.

LOWLAND LAKES AND RESERVOIRS
STANDARD DATA BASE

LIMNOLOGICAL CHARACTERISTICS
(To be measured during July 20-Sept. 10 period.
Measurement locations to be indicated on file map.)

LAKE/RESERVOIR NAME: FERNAN LAKE **REGION:** 1

DATE: 9-10-93 **PERSON COMPLETING FORM:** Hunt/DAVIS

MINIMUM DATA SET:

pH: 7.7 (surface) — (bottom) Total alkalinity (ppm): 26 (surface) — (bottom)

Conductivity (µmhos): 26 (surface)

Secchi (m): 3.2 (location 1), 3.0 (location 2), 2.8 (location 3), 2.9 (location 4) = 2.95 (mean)

Temperature and D.O. profile:
(measured at 1-m increments or 10 depth intervals)

Temperature (°C):	16.3	16.1	15.8	15.6	15.5	15.5	15.5	15.4	15.5	15.4
D.O. (ppm): (may be suspect)	9.3	9.3	9.3	9.3	9.2	9.2	8.3	8.4	9.0	8.9
Depth (m):	.5	1	1.5	2	2.5	3	3.5	4	5	5.5

Volume of trout habitat (<21°C, >5 ppm D.O.): _____ m^3

Trout habitat as a percent of full pool volume: _____ %

OPTIONAL ADDITIONAL DATA:

Chlorophyll a (µ g/L): _____ Total phosphates (mg/L): _____

T.D.S. (mg/L): _____ Nitrate nitrogen (mg/L): _____

Zooplankton (no/L >____): _____

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
COVER SHEET

LAKE/RESERVOIR NAME: Ferron Lake **REGION:** 1

DATE: 7-12-93 **SAMPLE CREW:** Davis, Hunt, Wilmont

SCALE ENVELOPE NUMBERS: _____ **TO** _____

SAMPLING CONDITIONS:

Water Temp. (°C @ .5 m): 16.0 Air Temp. Range (°C): _____ to _____

Secchi Range (m): 2.8 to 3.2

Wind (may circle more than one): (0-10) 10-20 20+ mph

N NE E SE S SW (W) NW

SAMPLING EFFORT:

Combined floating and sinking gill net: 2 nights

Electrofishing: 1 hours; trap net: 2 nights

Other (including add'l size selective sampling): _____

SAMPLING LOCATIONS:

Draw or attach a lake/reservoir map and indicate fisheries and limnological sampling locations; footnoting with narrative if necessary.

KEY:

Trap Net

S-X Secchi reading

Gill Net (F,S,FS)

TDO-X Surface/bottom and profile readings

Electrofishing

LOWLAND LAKES AND RESERVOIRS
STANDARD DATA BASE

FISHERIES CHARACTERISTICS

YEAR: 1993 PERIOD SURVEYED: APRIL - SEPTEMBER
EXPANDABLE: NO (YES) ; FOR PERIOD: APR. 1 to SEPT. 30
HOURS OF EFFORT: TOTAL - 97490 PER ACRE - 314 h/ac.
TOTAL CATCH RATE: 0.48 fish/h TOTAL HARVEST RATE: 0.24 fish/h
HARVEST: NO. PER ACRE - 75.5 POUNDS PER ACRE - _____

SPECIES COMPOSITION (%) OF HARVEST BY NUMBER:

SPECIES:	RBT	LMB	Channel Cat	Y. Perch	B Crappie	
%:	44	6	1%	21%	18%	
SPECIES:	Other					
%:	3%					

YEAR: _____ PERIOD SURVEYED: _____
EXPANDABLE: NO YES ; FOR PERIOD: _____
HOURS OF EFFORT: TOTAL - _____ PER ACRE - _____
TOTAL CATCH RATE: _____ TOTAL HARVEST RATE: _____
HARVEST: NO. PER ACRE - _____ POUNDS PER ACRE - _____

SPECIES COMPOSITION (%) OF HARVEST BY NUMBER:

SPECIES:						
%:						
SPECIES:						
%:						

YEAR: _____ PERIOD SURVEYED: _____
EXPANDABLE: NO YES ; FOR PERIOD: _____
HOURS OF EFFORT: TOTAL - _____ PER ACRE - _____
TOTAL CATCH RATE: _____ TOTAL HARVEST RATE: _____
HARVEST: NO. PER ACRE - _____ POUNDS PER ACRE - _____

SPECIES COMPOSITION (%) OF HARVEST BY NUMBER:

SPECIES:						
%:						
SPECIES:						
%:						

LOWLAND LAKES AND RESERVOIRS
STANDARD DATA BASE

WATER AREA CHARACTERISTICS

Lake/Reservoir Name: FERNAN LAKE Region: 1

Date: 7/12/93 Person Completing Form: DAVIS

Hydrological Unit: _____ Catalogue No.: 03000001 06

Type of Water: X Natural ___ Man-made ___ Impounded Natural

Full Pool: Volume _____ (acre ft.) Area 319 (acres)

Elevation 2300 (ft.) Maximum Depth 24.9 (ft.)

Minimum Pool: Volume _____ (acre ft.) Elevation _____ (ft.)

Mean Annual Inflow (or Outflow): _____ (acre ft.)

Trophic Status: __Oligotrophic X Mesotrophic X Eutrophic MEI($\sqrt{(TDS)/d}$): _____

Shoreline Length: _____ (km) Watershed area 4144 ha

Approximate % Shoreline in:

Urban	Agriculture	Range	Forest	Wetland
30			70	

Approximate % Shoreline Ownership:

Federal	State	Private
20	10%	70%

Known Winter Kills?: X No ___ Yes _____ (years)

Littoral Zone Substrate:

Bedrock	+	Boulder/Rubble	+	Gravel	+	Sand	+	Silt/Mud/Detritus	= 100%
25		10		10		5		50	

Littoral Zone Cover: Total 80 %

Large Organic Debris	+	Docks	+	Boulder/Rubble	+	Vegetation	= 100%
5		5				90	

LOWLAND LAKES AND RESERVOIRS
STANDARD DATA BASE

FISH COMMUNITY CHARACTERISTICS

LAKE/RESERVOIR NAME: FERNAN LAKE REGION: 1 DATE: 7/12/93

Catch Per Unit* of Combined Gear Sampling Effort

SPECIES	LENGTH - RANGE(mm)	No.	%	Wt.(kg)	%
LMB	80 - 520	158	50	22.0	51
C C	300 - 470	24	7.6	11.6	27
	260 - 320	22	7.0	4.5	10
Cutthroat	210 - 310	5	1.6	1.0	2
Perch	80 - 230	9	2.8	0.8	2
B Crappie	70 - 230	11	3.5	0.6	1
Pumpkinseed	50 - 160	21	6.6	0.7	2
B. Bullhead	180 - 330	5	1.6	1.8	4
	-				
	-				
	-				
GAME FISH SUBTOTAL:		255	81	43	100
TENCH	190 - 470	60	19.0		
Longnose Sucker	- 440	1	0.3		
	-				
	-				
	-				
	-				
	-				
	-				
	-				
	-				
	-				
	-				
NON-GAME FISH SUBTOTAL:		61	19.3		
ALL SPECIES TOTAL:		316	100%		100%

*One hour electrofishing, one trap net night, and one combined floating and sinking gill net night.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
AGE AND GROWTH SUMMARY SHEET

LAKE/RESERVOIR NAME: FERNAN LAKE **REGION:** 1

DATE OF COLLECTION: 7-12-93

SPECIES LARGEMOUTH BASS

Age group	Number aged	Back calculated length (mm) at each annulus							Length at capture
		I	II	III	IV	V	VI	VII	
0	0								
I	0								
II	14	77.55	110.7						110.7
III	16	76.84	137.8	157.5					157.5
IV	13	64.54	126.2	175.5	192.3				192.3
V	18	77.32	139.8	188.0	214.8	288.9			288.9
VI	4	73.97	143.8	191.4	225.5	244.8	255.0		255.0
VII	6	65.75	115.9	163.4	201.0	225.9	255.4	271.7	271.7
Average length		73.65	129.7	174.81	208.35	236.9	270.5	297.4	—
Number aged		74	74	60	44	31	13	9	74

SPECIES: _____

Age group	Number aged	Back calculated length (mm) at each annulus							Length at capture
		I	II	III	IV	V	VI	VII	
0									
I									
II									
III									
IV									
V									
VI									
VII									
Average length									
Number aged									

SPECIES: _____

Age group	Number aged	Back calculated length (mm) at each annulus							Length at capture
		I	II	III	IV	V	VI	VII	
0									
I									
II									
III									
IV									
V									
VI									
VII									
Average length									
Number aged									

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
SPECIES SUMMARY SHEET

ICH COMPOSITION OF: (species) Largemouth bass LAKE/RESERVOIR: Fernon Lk

T: 7-12-93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
								340-349							
50-59								350-359							
60-69								360-369							
70-79								370-379							
80-89	2	1.3	7.0					380-389							
90-99	7	4.4	9.8					390-399							
00-109	4	2.5	13					400-409							
10-119	4	2.5	17					410-419							
20-129	3	1.9	22					420-429							
30-139	3	1.9	29					430-439							
40-149	17	10.8	34					440-449							
50-159	19	12	39					450-459							
60-169	4	2.5	47					460-469							
70-179	4	2.5	50					470-479							
80-189	7	4.4	72					480-489							
90-199	12	7.6	86					490-499							
00-209	17	10.8	96					500-509	1	.6	1900				
10-219	11	7	113					510-519	1	.6	2800				
20-229	13	8.2	134					520-529	1	.6	2300				
30-239	9	5.7	161					530-539							
40-249	5	3.2	170					540-549							
50-259	4	2.5	200					550-559							
60-269	5	3.2	225					560-569							
70-279	3	1.9	320					570-579							
80-289	1	.6	290					580-589							
90-299	1	.6	320					590-599							
00-309	2	1.3	340					600-609							
10-319	1	.6	360					610-619							
20-329								620-629							
30-339								TOTAL	158		29,410				

[illegible] 12 [illegible] 146 [illegible]

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
SPECIES SUMMARY SHEET

ATCH COMPOSITION OF: (species) Channel Catfish LAKE/RESERVOIR: Ferman Lk

ATE: 7-12-93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
50-59							
60-69							
70-79							
80-89							
90-99							
100-109							
110-119							
120-129							
130-139							
140-149							
150-159							
160-169							
170-179							
180-189							
190-199							
200-209							
210-219							
220-229							
230-239							
240-249							
250-259							
260-269							
270-279							
280-289							
290-299							
300-309	1	4.2	230		4		
310-319							
320-329	1	4.2	250		3		
330-339	3	12.5	296		3 4 4		

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
340-349	2	8.3	370		3-4		
350-359	3	12.5	390		5,5-4		
360-369	1	4.2	440		5		
370-379	1	4.2	450				
380-389	3	12.5	443		5,5,5		
390-399	3	12.5	480		5,6,5		
400-409							
410-419	1	4.2	640		5		
420-429	2	8.3	625		5-5		
430-439							
440-449	1	4.2	800		6		
450-459	1	4.2	900		6		
460-469							
470-479	1	4.2	1100		6		
480-489							
490-499							
500-509							
510-519							
520-529							
530-539							
540-549							
550-559							
560-569							
570-579							
580-589							
590-599							
600-609							
610-619							
620-629							
TOTAL	24		11,627				

TOTAL CATCH PER EFFORT OF: GILL NET 23 ELECTROFISHING TRAP NET 1

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
SPECIES SUMMARY SHEET

CATCH COMPOSITION OF: (species) Hatchery 2B LAKE/RESERVOIR: FERNAN

DATE: 7-12-93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
								340-349							
50-59								350-359							
60-69								360-369							
70-79								370-379							
80-89								380-389							
90-99								390-399							
100-109								400-409							
110-119								410-419							
120-129								420-429							
130-139								430-439							
140-149								440-449							
150-159								450-459							
160-169								460-469							
170-179								470-479							
180-189								480-489							
190-199								490-499							
200-209								500-509							
210-219								510-519							
220-229								520-529							
230-239								530-539							
240-249								540-549							
250-259								550-559							
260-269	2	.9	195					560-569							
270-279	5	22.7	220					570-579							
280-289	7	31.8	210					580-589							
290-299	3	13.6	225					590-599							
300-309	1	4.5						600-609							
310-319	3	13.6	300					610-619							
320-329	1	4.5						620-629							
330-339								TOTAL	22	100	4535				

TOTAL CATCH PER EFFORT OF: GILL NET 14 ELECTROFISHING 8 TRAP NET 0

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
SPECIES SUMMARY SHEET

TCH COMPOSITION OF:(species) Cutthroat LAKE/RESERVOIR: FERNAN

TE: 7-12-93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
								340-349							
50-59								350-359							
60-69								360-369							
70-79								370-379							
80-89								380-389							
90-99								390-399							
00-109								400-409							
10-119								410-419							
20-129								420-429							
30-139								430-439							
40-149								440-449							
[illegible]								450-459							
50-169								460-469							
70-179								470-479							
80-189								480-489							
90-199								490-499							
200-209								500-509							
210-219	1	20	100					510-519							
220-229	1	20	150					520-529							
230-239	1	20	150					530-539							
240-249								540-549							
250-259								550-559							
260-269								560-569							
270-279								570-579							
280-289								580-589							
290-299								590-599							
[illegible] 309	1	20	250					600-609							
310-319	1	20	300					610-619							
320-329								620-629							
330-339								TOTAL	5		950				

LOWLAND LAKES AND RESERVOIRS FISH SURVEY

SPECIES SUMMARY SHEET

.TCH COMPOSITION OF: (species) Perch LAKE/RESERVOIR: Fernan Lk

.TE. 7-12-93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
								340-349							
50-59								350-359							
60-69								360-369							
70-79								370-379							
80-89	1	11	6					380-389							
90-99								390-399							
100-109								400-409							
110-119								410-419							
120-129								420-429							
130-139								430-439							
140-149								440-449							
150-159								450-459							
160-169								460-469							
170-179								470-479							
180-189	1	11	60					480-489							
190-199	3	33	83					490-499							
200-209	2	22	90					500-509							
210-219								510-519							
220-229								520-529							
230-239	2	22	133					530-539							
240-249								540-549							
250-259								550-559							
260-269								560-569							
270-279								570-579							
280-289								580-589							
290-299								590-599							
300-309								600-609							
310-319								610-619							
320-329								620-629							
330-339								TOTAL	9		761				

[illegible] 4 [illegible] 5 [illegible] 0

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
SPECIES SUMMARY SHEET

TCH COMPOSITION OF: (species) Black Crappie LAKE/RESERVOIR: Fernan Lk

TE. 7-12-93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
								340-349							
50-59								350-359							
60-69								360-369							
70-79	2	18.2	5					370-379							
80-89	2	18.2	7					380-389							
90-99		0						390-399							
100-109								400-409							
110-119								410-419							
120-129								420-429							
130-139								430-439							
140-149	1	9.1	40					440-449							
150-159	1	9.1	60					450-459							
160-169	3	27.3	63					460-469							
170-179								470-479							
180-189								480-489							
190-199								490-499							
200-209								500-509							
210-219								510-519							
220-229	1	9.1	160					520-529							
230-239	1	9.1	170					530-539							
240-249								540-549							
250-259								550-559							
260-269								560-569							
270-279								570-579							
280-289								580-589							
290-299								590-599							
300-309								600-609							
310-319								610-619							
320-329								620-629							
330-339								TOTAL	11		643				

3 8 0

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
SPECIES SUMMARY SHEET

TCH COMPOSITION OF: (species) Pumpkinseed LAKE/RESERVOIR: Fernon LK

T. 7-12-93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
								340-349							
50-59	2	9.5	3.5					350-359							
60-69								360-369							
70-79								370-379							
80-89	2	9.5	11					380-389							
90-99	3	14.3	16					390-399							
00-109	1	4.8	10					400-409							
10-119								410-419							
20-129	5	23.8	40					420-429							
30-139	4	19	34					430-439							
40-149	3	14.3	53					440-449							
50-159								450-459							
60-169	1	4.8	100					460-469							
70-179								470-479							
80-189								480-489							
90-199								490-499							
00-209								500-509							
10-219								510-519							
20-229								520-529							
30-239								530-539							
40-249								540-549							
50-259								550-559							
60-269								560-569							
70-279								570-579							
80-289								580-589							
90-299								590-599							
300-309								600-609							
310-319								610-619							
320-329								620-629							
330-339								TOTAL	21	-	682				

2 18 1

LOWLAND LAKES AND RESERVOIRS FISH SURVEY

SPECIES SUMMARY SHEET

ATCH COMPOSITION OF:(species) Bullhead LAKE/RESERVOIR: Frenon UK

ATE: 7-12-93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
								340-349							
50-59								350-359							
60-69								360-369							
70-79								370-379							
80-89								380-389							
90-99								390-399							
100-109								400-409							
110-119								410-419							
120-129								420-429							
130-139								430-439							
140-149								440-449							
150-159								450-459							
160-169								460-469							
170-179								470-479							
180-189	1	20	100					480-489							
190-199								490-499							
200-209								500-509							
210-219								510-519							
220-229								520-529							
230-239								530-539							
240-249								540-549							
250-259								550-559							
260-269								560-569							
270-279								570-579							
280-289								580-589							
290-299	1	20	350					590-599							
300-309								600-609							
310-319	2	40	400					610-619							
320-329								620-629							
330-339	1	20	550					TOTAL	5	-	1800				

TOTAL CATCH PER EFFORT OF: GILL NET _____ ELECTROFISHING TRAP NET 5

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
SPECIES SUMMARY SHEET

ATCH COMPOSITION OF: (species) TENCH LAKE/RESERVOIR: FERNAN LK

ATE: 7-12-93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
								340-349							
50-59								350-359							
60-69								360-369							
70-79								370-379	2						
80-89								380-389	1						
90-99								390-399	1						
100-109								400-409	2						
110-119								410-419	3						
120-129								420-429	2						
130-139								430-439	2						
140-149								440-449	6						
150-159								450-459	3						
160-169								460-469	1						
170-179								470-479	1						
180-189								480-489							
190-199	1							490-499							
200-209								500-509	(Betch 35)						
210-219								510-519							
220-229								520-529							
230-239								530-539							
240-249								540-549							
250-259								550-559							
260-269								560-569							
270-279								570-579							
280-289								580-589							
290-299								590-599							
300-309								600-609							
310-319								610-619							
320-329								620-629							
330-339								TOTAL							

TOTAL CATCH PER EFFORT OF: GILL NET 12 ELECTROFISHING 13 TRAP NET 35

Appendix B. Hayden Lake - Lake Survey Report

Hayden Lake - Narrative

Hayden Lake is a high quality recreational lake located five miles north of the city of Coeur d'Alene, Idaho. Hayden Lake has a surface area of approximately 4,200 acres with a maximum depth approaching 200 ft. The southern and western shorelines of the lake are bordered by the cities of Dalton Gardens, Hayden and Hayden Lake. Approximately 85% of the shoreline of Hayden Lake is developed with summer and year-round residences. Hayden Lake receives water from approximately 20 tributary streams. Hayden Creek is the largest tributary and it supports a significant run of wild rainbow and cutthroat trout. All tributaries to Hayden Lake are closed to fishing to provide spawning and rearing areas for wild trout. The outlet of Hayden Lake is located at the southwest corner of the lake and only flows during spring high water.

Hayden Lake is managed by the Idaho Department of Fish and Game as a quality warmwater and coldwater fishery. The current regulation for bass on Hayden Lake provides a catch and release period from January 1 to June 30 and a catch and keep season from July 1 through December 31. Daily bag and possession limit for bass is 2 fish none between 12" and 16". Black crappie limits in Hayden Lake are 15 in possession, none under 10" and a year-round season. Trout limits are 2 in possession, none under 14" and a year-round season. Stocking of fingerling rainbow and cutthroat trout as well as wild production maintains the fishery.

The Idaho Department of Fish and Game conducted a lowland lake survey on Hayden Lake in 1993. Game fish species sampled during the survey and the range of lengths found were: largemouth bass, 4" to 20.4"; smallmouth bass, 3.5" to 12.2"; black crappie, 4.3" to 12.2"; cutthroat trout, 4.3" to 24.8"; rainbow trout, 5.9" to 25.6"; brook trout 7.5" to 8.6"; mountain whitefish, 15" to 16.5"; yellow perch, 2.3" to 11.4"; pumpkinseed, 2.7" to 6.3". Non-game species present in the sample included bridgelip suckers, squawfish, brown bullhead, and tench. While we did not sample northern pike in 1993, they have been caught in Hayden Lake. Both northern pike and walleye have been stocked illegally into Hayden Lake. Northern pike have established a small population. Walleye have not established a reproducing population.

Splake, a lake trout/brook trout hybrid, were stocked into Hayden Lake in 1990, 1992, and 1993. Only one splake has been caught in gill nets. Anglers have not reported catching any splake.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
COVER SHEET

LAKE/RESERVOIR NAME: Hayden Lake **REGION:** 1

DATE: 4/5-6, 26 / 93 **SAMPLE CREW:** Nelson, Davis

SCALE ENVELOPE NUMBERS: _____ **TO** _____

SAMPLING CONDITIONS:

Water Temp. (°C @ .5 m): 5°C Air Temp. Range (°C): 2 to 8

Secchi Range (m): _____ to _____

Wind (may circle more than one): (0-10) 10-20 20+ mph

N NE E SE S (SW) W NW

SAMPLING EFFORT:

Combined floating and sinking gill net: 15 nights

Electrofishing: 2.714 hours; trap net: 4 nights

Other (including add'l size selective sampling): _____

SAMPLING LOCATIONS:

Draw or attach a lake/reservoir map and indicate fisheries and limnological sampling locations; footnoting with narrative if necessary.

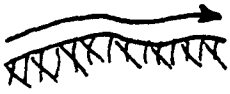
KEY:

Trap Net

S-X Secchi reading

Gill Net (F,S,FS)

TDO-X Surface/bottom and profile readings


Electrofishing

LOWLAND LAKES AND RESERVOIRS
STANDARD DATA BASE

FISH COMMUNITY CHARACTERISTICS

LAKE/RESERVOIR NAME: Hayden LK REGION: 1 DATE: 4 15-26 93

Catch Per Unit* of Combined Gear Sampling Effort

SPECIES	LENGTH - RANGE(mm)	No.	%	Wt.(kg)	%
LMB	100 - 520	1,243	1.8		
SMB	90 - 310	0.322	0.5		
BC	110 - 310	3.270	4.8		
PE	60 - 290	31.685	46.7		
PS	70 - 160	5.757	8.5		
LWS	380 - 420	0.138	0.2		
CTT	110 - 630	2.947	4.3		
HRBT	150 - 340	0.138	0.2		
BK(splake?)	190 - 220	0.092	0.1		
RBT	140 - 650	0.507	0.7		
	-				
GAME FISH SUBTOTAL:		46.099	68.0		
BLS	190 - 440	0.921	1.4		
SQ	260 - 530	5.480	8.1		
TT	330 - 440	5.803	8.6		
BBH	180 - 320	9.487	14.0		
	-				
	-				
	-				
	-				
	-				
	-				
	-				
	-				
NON-GAME FISH SUBTOTAL:		21.691	32.0		
ALL SPECIES TOTAL:		67.790	100%		100%

*one hour electrofishing, one trap net night, and one combined floating and sinking gill net night.

LAKE/RESERVOIR NAME: Hayden CR REGION: 1

DATE: 4/5,7,26/93 SAMPLE CREW LEADER: Nelson / Davis

Length range	Species PE				Species BC			
(mm)	G.N.	T.N.	E.F.	Add'l	G.N.	T.N.	E.F.	Add'l
60-69			1				1	
70-79			1					
80-89			2					
110-119			6		1			
120-129			11					
130-139	1		5					
140-149	5		5					
150-159	5		18					
160-169	5		23					
170-179	3		11					
180-189	4		13				1	
190-199	6		5		1			
200-209	2		3				2	
210-219	2						3	
220-229			2		1		10	
230-239	4				2		5	
240-249	1		1		3		12	
250-259	1		1		1		1	
260-269							5	
270-279								
280-289	1						1	
290-299	1							
300-309					2			
310-319								
320-329								
330-339								
340-349								
Batch Samples:								
Size Range								
Numbers	432		107					
Total Weight								

LAKE/RESERVOIR NAME: [illegible]

DATE: 4/5-7/93 SAMPLE CREW LEADER: Nelson / Davis

Length range	Species PS				Species SMB					
(mm)	G.N.	T.N.	E.F.	Add'l	G.N.	T.N.	4/	6/	8/	Add'l
40-49									2	
70-79			III						5	
80-89			IIII						8	
90-99							I		13	
100-109	I								6	
110-119	I	I							8	
120-129	IIII		III				I		10	
130-139	~~IIII~~	II	IIII				I	II	7	
140-149			III				I	III	4	
150-159	I		IIII					II	2	
160-169	I		I					IIII	7	
170-179								I	6	
180-189							I	IIII		
190-199							I		I	
200-209								I		
210-219								II		
220-229								I		
230-239								I		
240-249										
250-259										
260-269										
270-279										
280-289										
290-299										
300-309										
310-319								I		
320-329										
330-339										
340-349										
Batch Samples:										
Size Range										
Numbers	1, 4, 9, 36 17, 8	4,	9							
Total Weight										

DATA SHEET (_____ of _____)

LAKE/RESERVOIR NAME: Hayden Lk REGION: 1

DATE: 4/5, 7, 26 & 8/30 SAMPLE CREW LEADER: Nelson / Davis

Species LMB

Length range (mm)	April G.N.	April T.N.	April E.F.	Aug E.F.	(mm)	April G.N.	April T.N.	April E.F.	Aug E.F.
					370-379				
					380-389			2	
					390-399			1	
100-109			2		400-409	1			
110-119					410-419			1	1
120-129					420-429			3	
130-139					430-439			1	
140-149			1		440-449			1	
150-159			1		450-459			1	
160-169			2		460-469				
170-179				1	470-479				
180-189				2	480-489			1	
190-199			1	3	490-499				
200-209		1		2	500-509				
210-219				1	510-519				
220-229					520-529			1	
230-239			1	1	530-539				
240-249				1	540-549				
250-259					550-559				
260-269					560-569				
270-279					570-579				
280-289					580-589				
290-299					590-599				
300-309			1		600-609				
310-319					610-619				
320-329			1		620-629				
330-339			1	1	Batch:				
340-349	1			1	Size				
350-359	1				Number				
360-369				1	Tot.Wt.				

DATA SHEET (_____ or _____)

LAKE/RESERVOIR NAME: Hayden REGION: 1

DATE: 4/5-7/93 SAMPLE CREW LEADER: Nelson / Davis

Length Age	Species Bridge lip sucker								
(mm)	G.N.	T.N.	E.F.	Add'l	(mm)	G.N.	T.N.	E.F.	Add'l
					370-379				
					380-389				
					390-399				
					400-409				
110-119					410-419				
120-129					420-429				
130-139					430-439				
140-149					440-449	1			
150-159					450-459				
160-169					460-469				
170-179					470-479				
180-189					480-489				
190-199			1		490-499				
200-209					500-509				
210-219					510-519				
220-229			1		520-529				
230-239					530-539				
240-249					540-549				
250-259					550-559				
260-269					560-569				
270-279					570-579				
280-289					580-589				
290-299					590-599				
300-309					600-609				
310-319					610-619				
320-329					620-629				
330-339					Batch:				
340-349			1		Size				
350-359					Number	2, 4, 2, 2, 2,		4,	
360-369					Tot.Wt.				

DATA SHEET (_____ of _____)

LAKE/RESERVOIR NAME: Hayden REGION: 1

DATE: 4/5-7/92 SAMPLE CREW LEADER: Nelson / Davis

Length Age	Species lake white fish								
(mm)	G.N.	T.N.	E.F.	Add'l	(mm)	G.N.	T.N.	E.F.	Add'l
					370-379				
					380-389			1	
					390-399	1			
					400-409				
110-119					410-419				
120-129					420-429			1	
130-139					430-439				
140-149					440-449				
150-159					450-459				
160-169					460-469				
170-179					470-479				
180-189					480-489				
190-199					490-499				
200-209					500-509				
210-219					510-519				
220-229					520-529				
230-239					530-539				
240-249					540-549				
250-259					550-559				
260-269					560-569				
270-279					570-579				
280-289					580-589				
290-299					590-599				
300-309					600-609				
310-319					610-619				
320-329					620-629				
330-339					Batch:				
340-349					Size				
350-359					Number				
360-369					Tot.Wt.				

LOWLAND LAKES AND RESERVOIRS FISH SURVEY

DATA SHEET (_____ of _____)

LAKE/RESERVOIR NAME: Hayden REGION: 1

DATE: 4/5-7/93 SAMPLE CREW LEADER: Nelson/Davis

Length range	Species Squaw Fish								
(mm)	G.N.	T.N.	E.F.	WT $\frac{R}{\bar{x}}$ (g)	(mm)	G.N.	T.N.	E.F.	WT $\frac{R}{\bar{x}}$ (g)
					370-379	III		~~IIII~~	430-520 $\bar{x}$-480
					380-389	II		~~IIII~~ I	480-570 $\bar{x}$-503
					390-399	II		I	$\bar{x}$-570
					400-409	II		~~IIII~~ I	510-590 $\bar{x}$-563
110-119					410-419	I		I	$\bar{x}$-640
120-129					420-429	I		II	$\bar{x}$-730
130-139					430-439			I	
140-149					440-449			I	
150-159					450-459			I	
160-169					460-469	II			
170-179					470-479				
180-189					480-489			I	1100
190-199					490-499				
200-209					500-509				
210-219					510-519	I			
220-229					520-529			I	1500
230-239					530-539	I			
240-249					540-549				
250-259					550-559				
260-269	I				560-569				
270-279					570-579				
280-289					580-589				
290-299					590-599				
300-309					600-609				
310-319					610-619				
320-329					620-629				
330-339					Batch:				
340-349					Size				
350-359					Number	2,7,9,8 4B		6	
360-369			III	390-460 $\bar{x}$-433	Tot.Wt.				

4/26

DATA SHEET (_____ of _____)

LAKE/RESERVOIR NAME: Hayden REGION: 1

DATE: 4/5-7/93 SAMPLE CREW LEADER: Nelson / Davis

Length range	Species Tench								
(mm)	G.N.	T.N.	E.F.	Add'l	(mm)	G.N.	T.N.	E.F.	Add'l
					370-379			1	
					380-389				
					390-399	1			
					400-409				
110-119					410-419				
120-129					420-429				
130-139					430-439		1		
140-149					440-449			1	
150-159					450-459				
160-169					460-469				
170-179					470-479				
180-189					480-489				
190-199					490-499				
200-209					500-509				
210-219					510-519				
220-229					520-529				
230-239					530-539				
240-249					540-549				
250-259					550-559				
260-269					560-569				
270-279					570-579				
280-289					580-589				
290-299					590-599				
300-309					600-609				
310-319					610-619				
320-329					620-629				
330-339	1		1		Batch:				
340-349			11		Size				
350-359	1				Number	11, 2, 3, 6 3,	15, 45	29,	
360-369	11		1		Tot.Wt.				

4/26

DATA SHEET (_____ of _____)

LAKE/RESERVOIR NAME: Hayden REGION: 1

DATE: 4/5-7/92 SAMPLE CREW LEADER: Nelson/Davis

Length range	Species BBH								
(mm)	G.N.	T.N.	E.F.	Add'l	(mm)	G.N.	T.N.	E.F.	Add'l
					370-379				
					380-389				
					390-399				
					400-409				
110-119					410-419				
120-129					420-429				
130-139					430-439				
140-149					440-449				
150-159					450-459				
160-169					460-469				
170-179					470-479				
180-189	//				480-489				
190-199					490-499				
200-209					500-509				
210-219	//				510-519				
220-229	///				520-529				
230-239	//				530-539				
240-249	//				540-549				
250-259	///				550-559				
260-269	////				560-569				
270-279	/				570-579				
280-289	//				580-589				
290-299	/				590-599				
300-309					600-609				
310-319					610-619				
320-329	/				620-629				
330-339					Batch:				
340-349					Size				
350-359					Number	28, 28,	27, 29, 43, 4	24	
360-369					Tot.Wt.				

LOWLAND LAKES AND RESERVOIRS FISH SURVEY

DATA SHEET (_____ of _____)

LAKE/RESERVOIR NAME: Hayden REGION: 1

DATE: 4/5-7/93 SAMPLE CREW LEADER: Nelson / Davis

Length range	Species CTT								
(mm)	G.N.	T.N.	E.F.	Add'l	(mm)	G.N.	T.N.	E.F.	Add'l
					370-379				
					380-389				
					390-399				
630-639	1				400-409	///			
110-119		1			410-419	~~////~~			
120-129					420-429	~~////~~ ~~////~~ //			
130-139					430-439	~~////~~ ///			
140-149					440-449	~~////~~ ~~////~~ //			
150-159					450-459	~~////~~ //			
160-169			1		460-469	////			
170-179					470-479	///			
180-189	//				480-489	/			
190-199					490-499	//			
200-209					500-509	/			
210-219					510-519				
220-229					520-529				
230-239					530-539				
240-249					540-549				
250-259					550-559				
260-269					560-569				
270-279					570-579				
280-289					580-589				
290-299					590-599				
300-309					600-609				
310-319					610-619				
320-329					620-629				
330-339					Batch:				
340-349					Size				
350-359					Number				
360-369					Tot.Wt.				

LAKE/RESERVOIR NAME: Hayden REGION:
DATE: 4/5-7/93 SAMPLE CREW LEADER: Nelson/Davis

Length range	Species BK (Splake?)				Species HRBT			
(mm)	G.N.	T.N.	E.F.	Add'l	G.N.	T.N.	E.F.	Add'l
110-119								
120-129								
130-139								
140-149								
150-159							1	
160-169								
170-179								
180-189								
190-199	1						1	
200-209								
210-219								
220-229		1						
230-239								
240-249								
250-259								
260-269								
270-279								
280-289								
290-299								
300-309								
310-319								
320-329								
330-339								
340-349							1	
Batch Samples:								
Size Range								
Numbers								
Total Weight								

4/26

LOWLAND LAKES AND RESERVOIRS FISH SURVEY

DATA SHEET (_____ of _____)

LAKE/RESERVOIR NAME: Henden REGION: 1

DATE: 4/5-7/93 SAMPLE CREW LEADER: Nelson / Davis

Length Range	Species RBT								
(mm)	G.N.	T.N.	E.F.	Add'l	(mm)	G.N.	T.N.	E.F.	Add'l
					370-379				
					380-389				
630-639			1		390-399				
650-659	1				400-409				
110-119					410-419				
120-129					420-429				
130-139					430-439				
140-149			1		440-449	1			
150-159			1		450-459				
160-169					460-469				
170-179					470-479				
180-189					480-489				
190-199					490-499				
200-209					500-509				
210-219					510-519	1			
220-229					520-529				
230-239					530-539				
240-249					540-549				
250-259					550-559				
260-269					560-569				
270-279					570-579				
280-289					580-589	///			
290-299					590-599	1			
300-309					600-609	1			
310-319					610-619				
320-329					620-629				
330-339					Batch:				
340-349					Size				
350-359					Number				
360-369					Tot.Wt.				

Appendix C. Muskrat Lake - Lake Survey

Muskrat Lake - Narrative

Muskrat Lake is located in Bonner County, Idaho approximately six miles west of Sandpoint, Idaho. The water level of this small, approximately 20 acre, lake is controlled by the water level of the Pend Oreille River. It is only during high pool of Lake Pend Oreille, controlled by Albeni Falls Dam, that Muskrat Lake reaches it's maximum size and depth (approximately 25 feet) and the only time that water flows between Muskrat Lake and the Pend Oreille River. Muskrat Lake is divided into two bodies of water by the railroad bed. The west half of the lake is shallow and offers little fish habitat.

The land surrounding Muskrat Lake is privately owned. The northwest third of the east half of the Muskrat Lake shoreline is owned by Union Pacific Railroad. In 1993 the Idaho Department of Fish and Game negotiated a lease agreement with Union Pacific Railroad to allow sportsmen access to Muskrat Lake. This agreement is restricted to day use only, no campfires allowed and entails only that portion of the lake shore owned by Union Pacific Railroad. Anglers utilizing the rest of the lake are guaranteed access as long as they are on the surface of the lake. Any contact made with the bottom of the lake or shoreline area outside the Union Pacific property line could be construed as trespass by the landowner.

In 1993 the east half of Muskrat Lake was surveyed by Idaho Department of Fish and Game biologists. Game fish species found during the survey consisted of largemouth bass 3 1/2 inches to 15 3/4 inches in length, yellow perch in the seven inch range and small six inch pumpkinseed sunfish, also found present were tench, a non-game fish.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
COVER SHEET

LAKE/RESERVOIR NAME: Muskrat Lk REGION: 1

DATE: 8/30/93 SAMPLE CREW: Nelson

SCALE ENVELOPE NUMBERS: _____ TO _____

SAMPLING CONDITIONS:

Water Temp. (°C @ .5 m): 16.4 Air Temp. Range (°C): 21 to 24

Secchi Range (m): 7.3 to _____

Wind (may circle more than one): 0-10 (10-20) 20+ mph

N NE E SE S SW W (NW)

SAMPLING EFFORT:

Combined floating and sinking gill net: 0 nights

Electrofishing: 0.437 hours; trap net: 0 nights

Other (including add'l size selective sampling): 0

SAMPLING LOCATIONS:
Draw or attach a lake/reservoir map and indicate fisheries and limnological sampling locations; footnoting with narrative if necessary.

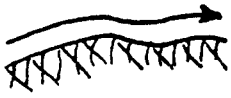
KEY:

Trap Net

S-X Secchi reading

Gill Net (F,S,FS)

TDO-X Surface/bottom and profile readings


Electrofishing Entire shoreline

LOWLAND LAKES AND RESERVOIRS
STANDARD DATA BASE

LIMNOLOGICAL CHARACTERISTICS
(To be measured during July 20-Sept. 10 period.
Measurement locations to be indicated on file map.)

LAKE/RESERVOIR NAME: Muskrat REGION: 1

DATE: 6/30/93 PERSON COMPLETING FORM: Nelson

MINIMUM DATA SET:

pH: 8.7 (surface) — (bottom) Total alkalinity (ppm): 40 (surface) — (bottom)

Conductivity (µmhos): 5.6 (surface)

Secchi (m): 7.3 (location 1), ____ (location 2), ____ (location 3), ____ (location 4) = 7.3 (mean)

Temperature and D.O. profile:
(measured at 1-m increments or 10 depth intervals)

Temperature (°C):	16.4	16.3	16.3	15.9	15.1	14.0	11.0	8.6	7.7	
D.O. (ppm):	9.6	9.4	9.6	9.9	9.5	10.0	12.5	10.0	2.1	
Depth (m):	0	1	2	3	4	5	6	7	8 Bottom	

Volume of trout habitat (<21°C, >5 ppm D.O.): ____ m^3

Trout habitat as a percent of full pool volume: ____ %

OPTIONAL ADDITIONAL DATA:

Chlorophyll a (µ g/L): ____ Total phosphates (mg/L): ____

T.D.S. (mg/L): ____ Nitrate nitrogen (mg/L): ____

Zooplankton (no/L >____): ____

LOWLAND LAKES AND RESERVOIRS
STANDARD DATA BASE

FISH COMMUNITY CHARACTERISTICS

LAKE/RESERVOIR NAME: Muskrat REGION: 1 DATE: 6/30/93

Catch Per Unit* of Combined Gear Sampling Effort 0.437 units/3 = 3.

SPECIES	LENGTH - RANGE(mm)	No.	%	Wt.(kg)	%
LMB	90 - 400	4.80	15.6	9.2987	
PE	30 - 190	5.82	19.0		
PS	50 - 150	19.36	63.0	1.2086	
	-				
	-				
	-				
	-				
	-				
	-				
	-				
	-				
GAME FISH SUBTOTAL:		29.98	97.6		
Tench	210 - 38	0.73	2.4	0.36	
	-				
	-				
	-				
	-				
	-				
	-				
	-				
	-				
	-				
	-				
	-				
NON-GAME FISH SUBTOTAL:		0.73	2.4		
ALL SPECIES TOTAL:		30.71	100%		100%

*one hour electrofishing, one trap net night, and one combined floating and sinking gill net night.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
SPECIES SUMMARY SHEET

CATCH COMPOSITION OF:(species) LMB LAKE/RESERVOIR: Muskrat

DATE: 6/30/93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
								340-349	0.393	8.3	533.3		9+		
50-59								350-359							
60-69								360-369							
70-79								370-379							
80-89								380-389	0.131	2.8	800.0	97	9+		
90-99	0.262	5.6	9.5	114	2&3+			390-399							
100-109	0.131	2.8	12.0	100	3+			400-409	0.131	2.8	1050.0	108	10+		
110-119								410-419							
120-129	0.262	5.6	25.0	119	3&4+			420-429							
130-139	0.655	13.9	38.0	130	2,3,4+			430-439							
140-149	0.131	2.8	50.0	147	3+			440-449							
150-159	0.131	2.8	40.0	105	5+			450-459							
160-169	0.131	2.8	70.0	135	4+			460-469							
170-179								470-479							
180-189	0.131	2.8	100	132	5+			480-489							
190-199	0.131	2.8	100	111	6+			490-499							
200-209								500-509							
210-219	0.393	8.3	136.6	119	5&6+			510-519							
220-229								520-529							
230-239								530-539							
240-249	0.262	5.6	205.0	107	7&9+			540-549							
250-259	0.262	5.6	255.0	118	8+			550-559							
260-269								560-569							
270-279	0.262	5.6	270.0	97	7&8+			570-579							
280-289								580-589							
290-299	0.131	2.8	370.0	106	8+			590-599							
300-309	0.131	2.8	420.0	108	8+			600-609							
310-319								610-619							
320-329	0.262	5.6	460.0	97	7&9+			620-629							
330-339	0.393	8.3	546.6	104	9&9+			TOTAL	4.716	100	9298.7	106.5			

TOTAL CATCH PER EFFORT OF: GILL NET 0 ELECTROFISHING 36 TRAP NET 0

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
SPECIES SUMMARY SHEET

CATCH COMPOSITION OF:(species) Pumpkinseed LAKE/RESERVOIR: Muskrat Lk

DATE: 6/30/93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
								340-349							
50-59	0.131	1.25	2					350-359							
60-69	0.524	5.0	4					360-369							
70-79	0.786	7.5	6		2+			370-379							
80-89	1.965	18.75	11.5		3+			380-389							
90-99	3.537	33.75	12.3		3-5+			390-399							
100-109	1.965	18.75	17		5+			400-409							
110-119	1.048	10.0	26.75		4-6+			410-419							
120-129	0.262	2.5	33		5&6+			420-429							
130-139	0.131	1.25	45					430-439							
140-149								440-449							
150-159	0.131	1.25	70		6+			450-459							
160-169								460-469							
170-179								470-479							
180-189								480-489							
190-199								490-499							
200-209								500-509							
210-219								510-519							
220-229								520-529							
230-239								530-539							
240-249								540-549							
250-259								550-559							
260-269								560-569							
270-279								570-579							
280-289								580-589							
290-299								590-599							
300-309								600-609							
310-319								610-619							
320-329								620-629							
330-339								TOTAL	10.48	60.2	1208.6				

TOTAL CATCH PER EFFORT OF: GILL NET 0 ELECTROFISHING 133 TRAP NET 0

SPECIES SUMMARY SHEET

CATCH COMPOSITION OF: (species) Yellow Perch LAKE/RESERVOIR: Muskrat Lake

DATE: 6/30/93 PERIOD:

Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M	Length range (mm)	No. per unit effort	%	mn wt. (gms)	Wr	Age(s)	Maturity ♂ I/M	Maturity ♀ I/M
30-49	0.131	2.5						340-349							
50-59								350-359							
60-69								360-369							
70-79	0.393	7.5						370-379							
80-89	0.131	2.5						380-389							
90-99	0.131	2.5						390-399							
100-109								400-409							
110-119	0.131	2.5						410-419							
120-129	0.524	10.0						420-429							
130-139	0.524	10.0						430-439							
140-149								440-449							
150-159	0.524	10.0						450-459							
160-169	0.393	7.5						460-469							
170-179	0.262	5.0						470-479							
180-189								480-489							
190-199	0.131	2.5						490-499							
200-209								500-509							
210-219								510-519							
220-229								520-529							
230-239								530-539							
240-249								540-549							
250-259								550-559							
260-269								560-569							
270-279								570-579							
280-289								580-589							
290-299								590-599							
300-309								600-609							
310-319								610-619							
320-329								620-629							
330-339								TOTAL	3.275	62.5					

TOTAL CATCH PER EFFORT OF: GILL NET 0 ELECTROFISHING 40 TRAP NET 0

Appendix D. Cougar Bay, Coeur d'Alene Lake

Northern Pike Creel Census

Appendix D. Cougar Bay, Coeur d'Alene Lake

Northern Pike Creel Census

Date: 04/08/94 Time: 3:57:31 pm

Idaho Department of Fish and Game
Creel Survey System
Creel Survey Definition

Project Identification Number: 03-41-43

Project Name: PIKE COUGAR BAY 93
Project Leader: DAVIS
Body of Water: COUGAR BAY
EPA Stream No.: 0000000000000000
Survey Start Date: 03/13/93
Survey End Date: 04/30/93
Type Survey: ROVING
Number of Sections: 1
Number Days per Interval: 49
Number of Survey Intervals: 1
Number of Time Periods Per Day: 2
Number of Day Types: 2
Boat Counts Used: Y
Nonuniform Sampling Used:
for Sections: N
for Day Periods: N
Purpose of Survey: PIKE HARVEST COUGAR BAY CDA LAKE & EFFORT ESTIMATE 1993

Species 1: NP .
Species 2:
Species 3:
Species 4:

Section Areas (hectares)

Section 1: 0.0 Section 2: 0.0 Section 3: 0.0
Body of Water Total Area: 0.0

End of Report

Angler Summary Report
Idaho Department of Fish and Game

04/08/94

Body of Water: COUGAR BAY EPA Number: 0000000000000000

Angler Composition

Total Number of Anglers:	173
Percent of resident:	77.46%
Percent of non-resident:	22.54%

Total Number of Interviews:	77
Ave Number Anglers/Interview:	2.25

Percentage of Interviews with --

1 angler :	20.78%
2 anglers:	44.16%
3 anglers:	22.08%
4 anglers:	9.09%
5 anglers:	2.60%
>5 anglers:	0.00%

Percentage of Anglers:

Catching:		Releasing:		Harvesting:	
0:	75.72%	0:	95.38%	0:	76.88%
1:	13.87%	1:	2.89%	1:	16.18%
2:	3.47%	2:	0.00%	2:	1.73%
3:	5.20%	3:	0.00%	3:	5.20%
4:	0.00%	4:	0.00%	4:	0.00%
5:	0.00%	5:	0.00%	5:	0.00%
more than 6:	1.73%	more than 6:	1.73%	6:	0.00%

Type of Fishing (from Instantaneous Counts)

Boat:	68.12%
Bank:	31.88%
Tube:	0.00%
Ice:	0.00%

Method of Fishing

Bait:	98.95%
Lure:	1.05%
Fly:	0.00%

Catch Composition

NP: 100.00%

Number of Completed trips :	141
Average Time Spent Fishing:	5.04

Date: 04/08/94 Tine: 4:00:35 pm

Page: 1

Idaho Department of Fish and Game

Creel Survey System

Pressure Report by Interval and Daytype

Summary

Body of Water: COUGAR BAY Year: 1993 EPA Number: 0000000000000000

SECTION NUMBER	INTERVAL	DAYTYPE	BOAT ANGLERS HOURS	BANK ANGLERS HOURS	TUBE ANGLERS HOURS	ICE ANGLERS HOURS	TOTAL ANGLERS HOURS
1	1	Weekday	688	184	8	8	864
		Weekend	1872	286	8	8	1278
	Interval	1 totals:	1752	398	8	8	2142
		+1— at 95% C.I.:	538	154	8	8	552
	Section	1 totals:	1752	398	8	8	2142
		+I—at 95% C.I.:	538	154	8	8	552
		Season totals:	1752	398	8	8	2142
		+/— at 95% C.I.:	538	154	8	8	552

End of Report.

Idaho Department of Fish and Game
Creel Survey System
Summary for Catch Rate by Day Type and Interval - for Total hours

Body of Water: COUGAR BAY 1993 EPA Number: 0000000000000000

SEC	INT	DAYTYPE	CR KEPT	CR RELSD	CR CSHT	CR- KEPT	NP REL
1	1	Weekday	0.05	0.02	0.07	0.05	0.02

Idaho Department of Fish and Game
Creel Survey System
Summary for Harvest by Section and Interval

Body of Water: COUGAR BAY

Year of Census: 1993 EPA Number: 0000000000000000

SEC NUM	INT	DY CD	FISH KEPT	FISH RELEASED	FISH CAUGHT	NP
1	1	1	44	15	59	44
		2	37	12	58	37
	Int 1 Tot:		81	27	189	81
	+/-95%CI:		51	7	58	51
	Sec 1 Tot:		81	27	184	81
	+/-45% CI:		51	1	58	51
	Seasn Tot:		81	27	189	81
	+/-45% CI:		51	7	58	51

End Report.

Appendix E. Fernan Lake Creel Census

Date: 02/14/94 Time: 10:08:10 am

Idaho Department of Fish and Game
Creel Survey System
Creel Survey Definition

Project Identification Number: 03-41-43

Project Name: FERNAN93
Project Leader: DAVIS
Body of Water: FERNAN LAKE
EPA Stream No.: 0000000000000000
Survey Start Date: 04/01/93
Survey End Date: 09/30/93
Type Survey: ROVING
Number of Sections: 1
Number Days per Interval: 28
Number of Survey Intervals: 8
Number of Time Periods Per Day: 2
Number of Day Types: 2
Boat Counts Used: Y
Nonuniform Sampling Used:
for Sections: N
for Day Periods: N

Purpose of Survey: return to the creel of P&T rainbow and effort estimates

Species 1: AD-RBT
Species 2: RBT
Species 3: PE
Species 4: BC
Species 5: LMB
Species 6: PS
Species 7: CC
Species 8: OTHER
Species 9: NP
Species 10:

Section Areas (hectares)

Section 1: 136.00 Section 2: 0.00 Section 3: 0.00
Body of Water Total Area: 136.00

Er f Report

Date: 02/14/94 Time: 10:08:32 am

Idaho Department of Fish and Game
Creel Survey System
Creel Survey Definition

Project Identification Number: 03-41-43

Project Name: FERNAN93
Project Leader: DAVIS
Body of Water: FERNAN LAKE
EPA Stream No.: 0000000000000000
Survey Start Date: 04/01/93
Survey End Date: 09/30/93
Type Survey: ROVING
Number of Sections: 1
Number Days per Interval: 28
Number of Survey Intervals: 8
Number of Time Periods Per Day: 2
Number of Day Types: 2
Boat Counts Used: Y
Nonuniform Sampling Used:
for Sections: N
for Day Periods: N

Purpose of Survey: return to the creel of P&T rainbow and effort estimates

Species 1: AD-RBT
Species 2: RBT
Species 3: PE
Species 4: BC
Species 5: LMB
Species 6: PS
Species 7: CC
Species 8: OTHER
Species 9: NP
Species 10:

Section Areas (hectares)

Section 1: 136.00 Section 2: 0.00 Section 3: 0.00
Body of Water Total Area: 136.00

End of Report

Angler Summary Report
Idaho Department of Fish and Game

02/14/94

Body of Water: FERNAN LAKE EPA Number: 0000000000000000

Angler Composition

Total Number of Anglers:	1947
Percent of resident:	80.02%
Percent of non-resident:	14.54%

Total Number of Interviews:	109
Ave Number Anglers/Interview:	1.79

Percentage of Interviews with --

1 angler :	46.97%
2 anglers:	34.04%
3 anglers:	11.28%
4 anglers:	5.23%
5 anglers:	0.73%
)5 anglers:	0.83%

Percentage of Anglers:

Catching:		Releasing:		Harvesting:	
0:	53.67%	0:	70.47%	0:	73.19%
1:	14.95%	1:	10.22%	1:	13.51%
2:	11.71%	2:	8.01%	2:	6.16%
3:	6.37%	3:	4.06%	3:	2.31%
4:	3.13%	4:	1.39%	4:	0.87%
5:	2.26%	5:	2.05%	5:	0.56%
more than 6:	7.91%	more than 6:	3.80%	6:	3.39%

Type of Fishing (from Instantaneous Counts)

Boat:	22.60%
Bank:	77.38%
Tube:	0.02%
Ice:	0.00%

Method of Fishing

Bait:	91.18%
Lure:	8.68%
Fly:	0.14%

Catch Composition

AD-RBT:	39.55%	RBT:	7.15%
PE :	25.39%	BC :	10.24%
LMB:	6.31%	PS:	7.01%
CC:	0.98%	OTHER:	3.09%
NP:	0.28%		

Number of Completed trips :	207
Average Time Spent Fishing:	2.79

Idaho Department of Fish and Game
Creel Survey System
Pressure Report by Interval and Daytype
Summary

Body of Water: FERNAN LAKE Year: 1993 EPA Number: 0000000000000000

SECTION NUMBER	INTERVAL I	DAYTYPE	BOAT ANGLERS I HOURS	BANK I ANGLERS I HOURS	TUBE ANGLERS HOURS	ICE ANGLERS HOURS	TOTAL ANGLERS HOURS
1	1	Weekday		1750	6720	0	0	8470
		Weekend	1048	2856	0	0	3904	
	Interval 1 totals:			2798	9576	0	0	12374
	+/- at 95% C. I.:			2529	3370	0	0	4214
1	2	Weekday		3088	6286	0	0	9374
		Weekend	3344	4128	0	0	7472	
	Interval 2 totals:			6432	.10414	0	0	16846
	+/- at 95% C.I.:			2233	2494	0	0	3347
1	3	Weekday		1998	5059	0	0	7057
		Weekend	3559	6012	0	0	9571	
	Interval 3 totals:			5557	11071	0	0	16628
	+/- at 95% C.I.:			2496	2346	0	0	3426
1		Weekday		2000	5160	0	0	7160
		Weekend	4800	4848	16	0	9664	
	Interval 4 totals:			6800	10008	16	0	16824
	+/- at 95% C.I.:			2917	2395	32	0	3774
1	5	Weekday		3320	5796	0	0	9116
		Weekend	3888	3302	0	0	7190	
	Interval 5 totals:			7208	9098	0	0	16306
	+/- at 95% C. I.:			2378	1780	0	0	2970
1	6	Weekday		2182	3665	0	0	5847
		Weekend	1920	2790	0	0	4710	
	Interval 6 totals:			4102	6455	0	0	10557
	+/- at 95% C. I.:			2039	2367	0	0	3124
	7	Weekday		182	486	0	0	669

Idaho Department of Fish and Game
Creel Survey System
Pressure Report by Interval and Daytype
Summary

Body of Water: FERNAN LAKE Year: 1993 EPA Number: 0000000000000000 ---

SECTION NUMBER	INTERVAL	DAYTYPE	BOAT ANGLERS HOURS	BANK ANGLERS HOURS	TUBE ANGLERS HOURS	ICE ANGLERS HOURS	TOTAL ANGLERS
1	7	Weekend	3197	4090	0	0	7286
Interval		7 totals:	3379	457	0	0	795
		+/- at 95% C.I.:	962	1059	0	0	1430
Section		1 totals:	3627	61198	16	0	9749
		+/- at 95% C.I.:	6071	6221	32	0	8693
Season totals:			36276	61198	16		97490
		+/- at 95% C.I.:	6071	6221	32	0	8693

End of Report.

Idaho Department of Fish and Game
Creel Survey System
Summary for Catch Rate by Day Type and Interval - for Total hours

Body of Water: FERNAN LAKE 1993 EPA Number: 0000000000000000

SEC	INT	DAYTYPE	CR KEPT	CR RELSD	CR CGHT	CR-KEPT	AD-RBT REL	CR-KEPT	RBT REL	CR-KEPT	PE REL	CR-KEPT	BC REL	CR-KEPT	LMB REL	CR-KEPT	PS REL	CR-KEPT	CC REL	CR-KEPT	OTHER REL
1	1	Weekday	0.53	0.08	0.61	0.00	0.00	0.15	0.00	0.02	0.00	0.34	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Weekend	0.31	0.27	0.58	0.01	0.00	0.06	0.00	0.14	0.01	0.09	0.03	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
	2	Weekday	0.41	0.26	0.67	0.07	0.05	0.02	0.00	0.17	0.07	0.06	0.01	0.00	0.05	0.07	0.04	0.00	0.00	0.01	0.01
		Weekend	0.31	0.30	0.61	0.01	0.00	0.05	0.00	0.18	0.08	0.01	0.01	0.01	0.06	0.07	0.11	0.00	0.00	0.00	0.00
	3	Weekday	0.27	0.35	0.62	0.18	0.04	0.01	0.01	0.02	0.06	0.00	0.01	0.01	0.07	0.01	0.13	0.00	0.00	0.00	0.03
		Weekend	0.22	0.24	0.46	0.15	0.03	0.01	0.01	0.02	0.06	0.00	0.01	0.02	0.05	0.00	0.07	0.00	0.00	0.00	0.00
	4	Weekday	0.14	0.33	0.47	0.08	0.02	0.00	0.00	0.01	0.03	0.00	0.00	0.03	0.10	0.00	0.15	0.02	0.01	0.01	0.00
		Weekend	0.19	0.15	0.34	0.13	0.00	0.00	0.00	0.01	0.03	0.00	0.02	0.01	0.03	0.00	0.05	0.00	0.01	0.02	0.02
	5	Weekday	0.25	0.24	0.49	0.15	0.00	0.00	0.00	0.03	0.05	0.00	0.01	0.02	0.07	0.02	0.08	0.00	0.01	0.02	0.01
		Weekend	0.13	0.45	0.58	0.08	0.01	0.00	0.00	0.01	0.03	0.00	0.00	0.02	0.17	0.00	0.21	0.00	0.00	0.01	0.01
	6	Weekday	0.14	0.24	0.38	0.06	0.01	0.00	0.00	0.04	0.04	0.01	0.00	0.00	0.09	0.01	0.10	0.01	0.01	0.00	0.00
		Weekend	0.07	0.11	0.18	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.03	0.00	0.05	0.01	0.01	0.02	0.03
	7	Weekday	0.00	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00
		Weekend	0.04	0.18	0.22	0.01	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.01	0.08	0.00	0.05	0.00	0.00	0.00	0.01
	8	Weekday	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Weekend	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sec 1 wkdy CR:			0.22	0.20	0.42	0.07	0.01	0.02	0.00	0.04	0.03	0.05	0.01	0.01	0.05	0.01	0.08	0.00	0.00	0.00	0.01
Sec 1 wknd CR:			0.16	0.21	0.37	0.05	0.01	0.01	0.00	0.05	0.03	0.01	0.01	0.01	0.05	0.01	0.07	0.00	0.00	0.01	0.01
Sec 1 Sson CR:			0.20	0.20	0.41	0.06	0.01	0.02	0.00	0.04	0.03	0.04	0.01	0.01	0.05	0.01	0.08	0.00	0.00	0.00	0.01
Wkdy Season CR:			0.22	0.20	0.42	0.07	0.01	0.02	0.00	0.04	0.03	0.05	0.01	0.01	0.05	0.01	0.08	0.00	0.00	0.00	0.01
Wknd Season CR:			0.16	0.21	0.05	0.05	0.01	0.01	0.00	0.05	0.03	0.01	0.01	0.01	0.05	0.01	0.07	0.00	0.00	0.01	0.01
Ave Season CR:			0.20	0.20	0.41	0.06	0.01	0.02	0.00	0.04	0.03	0.04	0.01	0.01	0.05	0.01	0.08	0.00	0.00	0.00	0.01

End of Report.

Idaho Department of Fish and Game
Creel Survey System
Summary for Harvest by Section and Interval

Bod, Water: FERNAN LAKE Year of Census: 1993 EPA Number: 0000000000000000

SEC NUM	INT	DY CD	FISH KEPT	FISH RELEASED	FISH CAUGHT	AD-RBT	RBT	PE	BC	LMB	PS	CC	OTHER
1	1	1	4515	644	5167	0	1287	161	2905	161	0	0	0
		2	1191	1070	2260	23	219	535	363	47	0	0	0
Int 1 Tot:			5706	1714	7427	23	1506	696	3268	208	0	0	0
+/- 95%CI:			5327	1545	5493	50	1408	546	5461	352	0	0	0
1	2	1	3881	2390	6271	628	197	1565	600	0	684	0	112
		2	2324	2257	4580	67	366	1330	97	97	531	0	30
Int 2 Tot:			6205	4647	10851	695	563	2895	697	97	1215	0	142
+/- 95%CI:			2679	1752	3682	480	322	2010	755	136	1335	0	140
1	3	1	1927	2470	4404	1284	99	169	0	71	35	0	0
		2	2058	2335	4393	1464	77	220	0	144	19	0	0
Int 3 Tot:			3985	4805	8797	2748	176	389	0	215	54	0	0
+/- 95%CI:			1438	1910	2755	1234	213	246	0	208	65	0	0
1	4	1	1017	2334	3351	580	0	36	0	179	0	143	36
		2	1846	1411	3257	1266	0	106	0	106	0	0	213
Int 4 Tot:			2863	3745	6608	1846	0	142	0	285	0	143	249
+/- 95%CI:			1134	1507	2087	922	0	150	0	288	0	185	324
1	5	1	2279	2160	4439	1395	0	310	0	191	191	0	155
		2	935	3236	4170	590	0	79	0	158	29	14	65
Int 5 Tot:			3214	5396	8609	1985	0	389	0	349	220	14	220
+/- 95%CI:			1176	2058	2641	930	0	425	0	204	247	3	268
1	6	1	824	1386	2210	345	0	216	41	0	41	41	0
		2	316	513	824	38	0	38	0	80	0	38	80
Int 6 Tot:			1140	1899	3034	383	0	254	41	80	41	79	80
+/- 95%CI:			747	1228	1303	364	0	356	66	126	92	115	119
1	7	1	0	82	82	0	0	0	0	0	0	0	0
		2	277	1290	1566	95	0	95	0	95	0	0	0

Idaho Department of Fish and Game
Creel Survey System
Summary for Harvest by Section and Interval

Body of Water: FERNAN LAKE Year of Census: 1993 EPA Number: 0000000000000000

SEC NUM	INT	DY CD	FISH KEPT	FISH RELEASED	FISH CAUGHT	AD-RBT	RBT	PE	BC	LMB	PS	CC	OTHER
Int 7 Tot:			277	1372	1648	95	0	95	0	95	0	0	0
+/- 95%CI:			375	952	1251	191	0	167	0	196	0	0	0
1	8	1	0	0	0	0	0	0	0	0	0	0	0
		2	0	0	0	0	0	0	0	0	0	0	0
Int 8 Tot:			0	0	0	0	0	0	0	0	0	0	0
+/- 95%CI:			0	0	0	0	0	0	0	0	0	0	0
Sec 1 Tot:			23390	23578	46974	7775	2245	4860	4006	1329	1530	236	691
+/-95% CI:			6402	4245	8119	1908	1460	2181	5513	604	1363	217	459
Seasn Tot:			23390	23578	46974	7775	2245	4860	4006	1329	1530	236	691
+/-95% CI:			6402	4245	8119	1908	1460	2181	5513	604	1363	217	459

End of Report.

Appendix F. Hauser Lake Creel Census

Date: 04/08/94 Time: 4:03:54 pm

Idaho Department of Fish and Game
Creel Survey System
Creel Survey Definition

Project Identification Number: 03-41-43

Project Name: HAUSER CREEL
Project Leader: DAVIS
Body of Water: HAUSER LAKE
EPA Stream No.: 0000000000000000
Survey Start Date: 04/01/93
Survey End Date: 09/30/93
Type Survey: ROVING
Number of Sections: 1
Number Days per Interval: 28
Number of Survey Intervals: 8
Number of Time Periods Per Day: 2
Number of Day Types: 2
Boat Counts Used: Y
Nonuniform Sampling Used:
for Sections: N
for Day Periods: N

Purpose of Survey: EVALUATE P&T AND P&G&T RAINBOW EFFORT ESTIMATES

Species 1: AD-RBT	Species 2: RBT
Species 3: LMB	Species 4: PE
Species 5: BC	Species 6: CC
Species 7: NP	Species 8: PS
Species 9: BK	Species 10: CT
Species 11: OTHER	Species 12:

Section Areas (hectares)

Sec`'In 1: 284.0 Section 2: 0.0 Section 3: 0.0
Body of Water Total Area: 284.0

End of Report

Angler Summary Report
Idaho Department of Fish and Game

04/08/94

Body of Water: HAUSER LAKE EPA Number: 0000000000000000

Angler Composition

Total Number of Anglers:	1270
Percent of resident:	81.81%
Percent of non-resident:	17.40%

Total Number of Interviews:

Ave Number	1.73

Percentage of Interviews with --

1 angler :	47.95%
2 anglers:	34.56%
3 anglers:	12.30%
4 anglers:	3.69%
5 anglers:	0.96%
>5 angl	0.00%

Percentage of Anglers:

Catching:	Releasing:		Harvesting:	
	0:	74.41%	0:	64.41%
	1:	7.72%	1:	14.25%
	2:	5.75%	2:	7.80%
	3:	2.76%	3:	3.78%
	4:	1.57%	4:	2.52%
	5:	0.94%	5:	1.26%
more than	more than 6:	6.85%	6:	5.98%

Type of Fishing (from Instantaneous Counts)

Boat:	33.33%
Bank:	66.55%
Tube:	0.12%
Ice:	0.00%

Method of Fishing

Bait:	84.48%
Lure:	15.08%
Fly:	0.43%

Catch Composition

AD-RBT :	28.50%		
LMB :	2.77%	PE :	
BC:	14.19%	CC:	
NP :	0.00%	PS:	
BK:	0.00%	CT :	
OTHER:	5.12%		

Number of Completed	180
Average Time Spent	3.13

Idaho Department of Fish and Game
Creel Survey System
Pressure Report by Interval and Daytype
Summary

Body of Water: HAUSER LAKE Year: 1993 EPA Number: 0000000000000000

SECTION	INTERVAL	DAYTYPE	BOAT ANGLERS HOURS	BANK ANGLERS HOURS	TUBE ANGLERS HOURS	ICE ANGLERS HOURS	TOTAL NUMBER ANGLERS
1	1	Weekday	910	1400	0	0	2310
		Weekend	691	774	20	0	1485
	Interval 1 totals:		1601	2174	20	0	3795
	+/- at 95% C.I.:		787	668	41	0	1033
1	2	Weekday	3308	2187	0	0	5494
		Weekend	4238	2304	0	0	6542
	Interval 2 totals:		7546	4491	0	0	12036
	+/- at 95% C. I.:		4386	1367	0	0	4594
1	3	Weekday	1371	2063	0	0	3434
		Weekend	2272	3132	0	0	5404
	Interval 3 totals:		3643	5195	0	0	8838
	+/- at 95% C.I.:		1119	1201	0	0	1641
1	4	Weekday	1600	3460	0	0	5060
		Weekend	2412	3072	0	0	5484
	Interval 4 totals:		4012	6532	0	0	10544
	+/- at 95% C. I.:		1395	1283	0	0	1896
1	5	Weekday	4219	4053	0	0	8272
		Weekend	2448	2331	9	0	4789
	Interval 5 totals:		6667	6384	9	0	13061
	+/- at 95% C.I.:		2695	1325	18	0	3003
1	6	Weekday	2062	2613	0	0	4676
		Weekend	555	1312	0	0	1867
	Interval 6 totals:		2617	3925	0	0	6543
	+/- at 95% C. I.:		1363	922	0	0	1645
1	7	Weekday	1419	2635	0	0	4053

Idaho Department of Fish and Game
Creel Survey System
Pressure Report by Interval and Daytype
Summary

Body of Water: HAUSER LAKE Year: 1993 EPA Number: 0000000000000000

SECTION NUMBER	INTERVAL	DAYTYPE	ANGLERS HOURS	BOAT ANGLERS HOURS	BANK ANGLERS HOURS	TUBE ANGLERS HOURS	ICE ANGLERS HOURS	TOTAL ANGLERS
1	7	Weekend	540 1260	0	0	1800		
Interval 7 totals: +/-			1959	3895	0	0		5853
at 95% C. I. :			1190	1590	0	0		1986
Section 1 totals:			28045	32596	29	0		60670
+/- at 95% C.I.:			5796	3246	45	0		6643
Season totals:			28045	32596	29	0		60670
+/- at 95% C.I.:			5796	3246	45	0		6643

End of Report.

Idaho Department of Fish and Game
Creel Survey System
Summary for Harvest by Section and Interval

Body ter: HAUSER LAKE Year of Census: 1993 EPA Number: 0000000000000000

SEC NUM	INT	DY CD	FISH KEPT	FISH RELEASED	FISH CAUGHT	AD-RBT	RBT	LMB	PE	BC	CC	NP	PS
1	1	1	471	203	675	102	169	203	0	0	0	0	0
		2	110	37	147	55	55	0	0	0	0	0	0
Int 1 Tot:			581	240	822	157	224	203	0	0	0	0	0
+/- 95%CI:			446	75	589	166	277	341	0	0	0	0	0
1	2	1	1840	291	2132	478	231	126	0	983	0	0	0
		2	2499	981	3480	936	177	131	46	1027	0	0	0
Int 2 Tot:			4339	1272	5612	1414	408	257	46	2010	0	0	0
+/- 95%CI:			2390	664	3105	1073	316	302	31	1549	0	0	0
1	3	1	793	1906	2699	199	48	124	48	223	0	0	148
		2	1367	1562	2929	686	130	49	227	81	0	0	49
Int 3 Tot:			2160	3468	5628	885	178	173	275	304	0	0	197
+/- 95%CI:			747	703	2182	467	132	159	266	361	0	0	222
1	4	1	1938	956	2894	617	91	61	552	309	0	0	61
		2	4113	2078	6191	894	71	0	2402	345	71	0	208
Int 4 Tot:			6051	3034	9085	1511	162	61	2954	654	71	0	269
+/- 95%CI:			3697	562	4418	689	152	103	2822	927	111	0	222
1	5	1	6998	2705	9703	1704	83	0	4459	83	0	0	331
		2	1724	3213	4942	536	57	14	1461	105	0	0	311
Int 5 Tot:			8722	5918	14645	2240	140	14	5920	188	0	0	642
+/- 95%CI:			6664	1160	7340	1293	168	3	6867	217	0	0	496
1	6	1	1234	851	2085	603	28	0	28	411	28	0	108
		2	302	607	909	177	26	0	26	0	0	0	26
Int 6 Tot:			1536	1458	2994	780	54	0	54	411	28	0	134
+/- 95%CI:			1057	376	1583	489	55	0	55	840	8	0	238
1	7	1	1487	7162	8645	0	0	0	677	0	0	0	134
		2	72	72	144	0	0	0	0	0	0	0	0

Idaho Department of Fish and Game
Creel Survey System
Summary for Harvest by Section and Interval

Body .ter: HAUSER LAKE Year of Census: 1993 EPA Number: 0000000000000000

SEC NUM	INT	DY CD	FISH KEPT	FISH RELEASED	FISH CAUGHT	AD-RBT	RBT	LMB	PE	BC	CC	NP	PS
Int 7 Tot:			1559	7234	8789	0	0	0	677	0	0	0	134
+/- 95%CI:			1447	3203	14380	0	0	0	1327	0	0	0	263
1	8	1	0	0	0	0	0	0	0	0	0	0	0
		2	0	0	0	0	0	0	0	0	0	0	0
Int 8 Tot:			0	0	0	0	0	0	0	0	0	0	0
+/- 95%CI:			0	0	0	0	0	0	0	0	0	0	0
Sec 1 Tot:			24948	22624	47575	6987	1166	708	9926	3567	99	0	1376
+/-95% CI:			8231	3606	17246	1945	499	493	7546	2035	111	0	686
Seasn Tot:			24948	22624	47575	6987	1166	708	9926	3567	99	0	1376
+/-95% CI:			8231	3606	17246	1945	499	493	7546	2035	111	0	686

End o. .port.

1993 ANNUAL PERFORMANCE REPORT

State of: Idaho | Program: Fisheries Management F-71-R-18

Project I: Surveys and Inventories | Subproject I-A: Panhandle Region

Job: b^2 Chinook/Kokanee Evaluations | Title: Coeur d'Alene Lake Investigations

Contract Period: July 1, 1993 to June 30 1994

ABSTRACT

The estimated number of kokanee salmon *Oncorhynchus nerka kennerlyi* in Coeur d'Alene Lake in 1993 was the highest since 1987. The increase in kokanee abundance was due to the high number of age 0 and age 1 kokanee. The low number of age 3 kokanee, 480,000, appeared to be strongly influenced by lost egg production in March 1990 during construction of Interstate 90. Mean length of kokanee spawners increased to 271 mm and 253 mm for male and female kokanee, respectively.

The number of natural chinook salmon *O. tshawytscha* continued to increase. The percentage of natural chinook salmon in anglers catch during the derbies held in 1993 ranged from 66% to 84%. The number of chinook salmon redds counted in the Coeur d'Alene and St. Joe rivers in 1993 totaled 121. No chinook salmon were stocked in 1993 because of the weak year class of age 3+ kokanee and the potential to depress the second generation of kokanee resulting from this weak year class.

Authors :

Jim Davis
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

INTRODUCTION

Coeur d'Alene Lake is located in north Idaho adjacent to the town of Coeur d'Alene and only 50 km from the major population center of Spokane, Washington (Figure 1). It currently supports approximately 200,000 angler hours, or about 20 h/ha (Horner et al. 1988).

Kokanee salmon *Oncorhynchus nerka kennerlyi* have provided a very popular fishery in Coeur d'Alene Lake since their introduction in 1937. In 1979, anglers harvested an estimated 578,034 kokanee and expended an estimated 282,837 h of fishing effort (Rieman et al. 1980). Enhancement of shoreline spawning habitat and the lack of a fish predator led to an overpopulation of kokanee. Length of kokanee declined and the kokanee fishery collapsed. Fall chinook salmon *O. tshawytscha* were introduced in 1982 to reduce the kokanee population and restore better growth. A popular trophy fishery for chinook also developed.

Natural reproduction of chinook salmon in addition to hatchery stocking has resulted in expansion of the predator population beyond what the kokanee prey base can support on a sustained basis. Continued intensive management of the chinook salmon population and monitoring of kokanee abundance is necessary to maintain the predator-prey balance. The goal for the program is to provide a limited chinook salmon trophy fishery and a high yield kokanee fishery by limiting the number of natural and hatchery chinook salmon fry entering the lake annually to approximately 72,000.

OBJECTIVES

1. To determine kokanee stock status in Coeur d'Alene Lake.

2. To evaluate changes in the kokanee population caused by chinook salmon predation (chinook population abundance).

3. To make predictions about future kokanee fisheries based on year class strength and potential egg deposition.

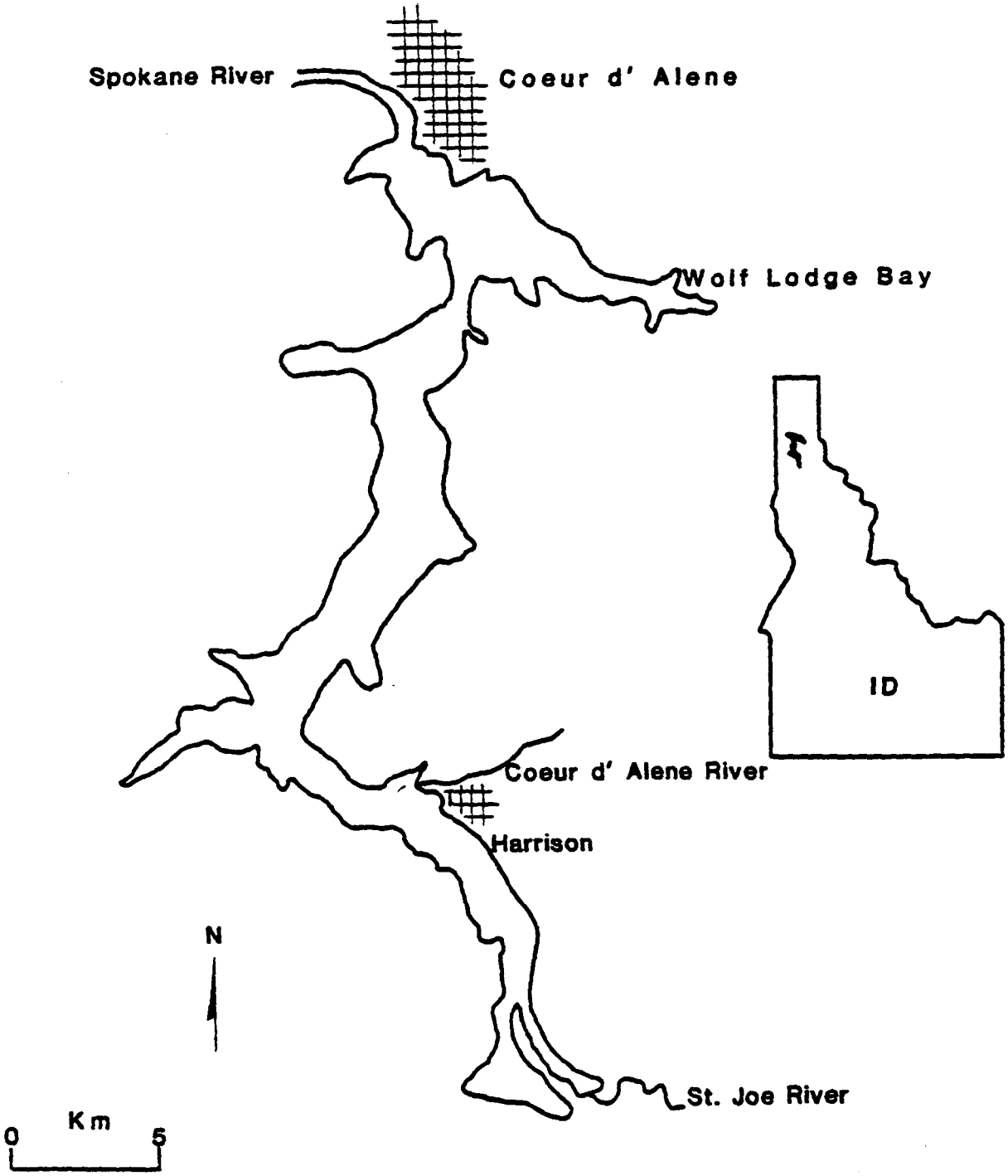


Figure 1. Map of Coeur d'Alene Lake, Idaho.

METHODS

Kokanee

Abundance

Midwater trawling was used to obtain population estimates for kokanee in Coeur d'Alene Lake as described by Bowler et. al. (1978), Rieman and Meyers (1990), and Maiolie and Davis (1995). The number of transects surveyed was increased from 13 in 1992 to 24 in 1993 (Figure 2).

Length at Spawning

Total lengths (mm) of 200 kokanee spawners were recorded from kokanee collected in gill nets set along the Coeur d'Alene Lake shoreline near Blue Creek Bay on December 13, 1993. Mean length for each sex was calculated.

Fecundity

The average number of eggs produced per female kokanee was calculated using the mean length and the following formula:

$$Y = -947 + 5.26x$$

Where: x = mean length of female kokanee spawners (mm)

Y = mean number of eggs per female

Potential egg deposition was estimated using the following formula:

$$x = [.5(y)]z$$

Where: x = potential egg deposition

y = estimated population of age 3 kokanee

z = estimated eggs/female kokanee

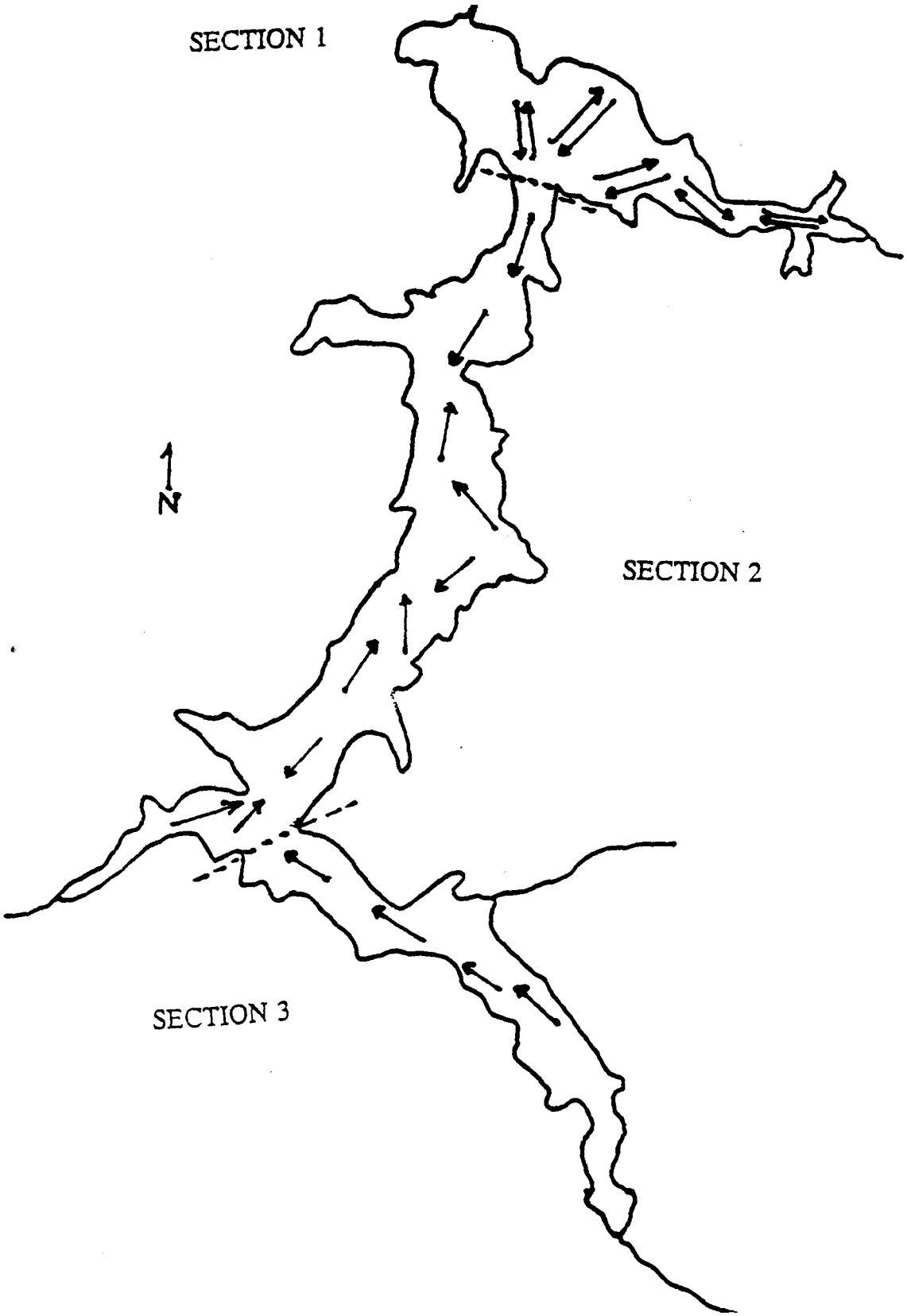


Figure 2. Location of 24 trawler transects to estimate kokanee population abundance in Coeur d'Alene Lake, Idaho, 1993.

Chinook Salmon

Stocking

No chinook salmon were stocked in 1993 (Table 1).

Natural Chinook Abundance

Department personnel conducted chinook salmon redd counts (via helicopter) on the Coeur d'Alene River, North Fork Coeur d'Alene River, the lower end of the South Fork Coeur d'Alene River, and the St. Joe River on October 18, 1993. Observations were not made in the Little North Fork Coeur d'Alene River.

Natural chinook salmon abundance was calculated from these redd counts. Biologists estimated 4,500 chinook salmon eggs per redd and assumed a 10% egg-to-smolt survival. Sixty-five redds were needed to produce the desired number of chinook salmon smolts based on these assumptions (29,250 smolts). All redds in excess of 65 were destroyed. A high pressure stream of water was used to wash the eggs out of the gravel. A Pacific Mark 3 water pump with 150 psi and 62 gpm, 25 feet of discharge hose, and 10 feet of intake hose were floated downriver in a driftboat.

RESULTS

Kokanee

Abundance

The estimated total number of kokanee in Coeur d'Alene Lake, in 1993, increased to its second highest level since 1987 (Table 2). The increase was due to the abundance of age 0 and age 1 kokanee (Table 3). Age 3 and older kokanee abundance was the lowest since 1979 (Table 2). The density of age 3 and older kokanee was 51 fish/ha (Table 4).

Table 1. Number, weight and lengths of fall chinook salmon released into Coeur d'Alene Lake, Idaho, 1982-1993.

Release date	Release site	Number released	Weight released (kg)	Length (mm) Mean	Length (mm) range	Rearing hatchery	Stock of fish	Mark
07-19-82	MR'	28,700	767	137	125-150	HAGERMAN	BONNEVILLE	NONE
10-05-82	I-90	5,700	273	150	130-170	HAGERMAN	BONNEVILLE	NONE
Total 82	34,400	1,040						
08-09-83	I-90	30,100	289	109	80-130	MACKAY	BONNEVILLE	NONE
10-26-83	I-90	30,000	637	124	80-150	MACKAY	BONNEVILLE	NONE
Total 83	60,100	926						
10-29-84	I-90	10,500	373	150	80-190	MACKAY & MULLAN	LAKE MICHIGAN	NONE
10-16-85	I-90	11,100	409	136	--	MACKAY & MULLAN	LAKE MICHIGAN	LEFTVENTRAL
10-17-85	I-90	7,400	273	143	--		LAKE MICHIGAN	ADIPOSE
Total 85	18,500	682						
07-02-86	I-90	29,500	375	114	81-145	MACKAY	LAKE MICHIGAN	RIGHIVENTRAL
07-01-87	1-90	59,400	900	119	62-155	MACKAY	LAKE MICHIGAN	ADIPOSE
07-16-88	I-90	44,600	977	133	95-180	MACKAY	LAKE COEUR d'ALENE	LEFTVENTRAL
07-06-89	I-90	35,000"	636	126	100-165	MACKAY	LAKE COEUR d'ALENE	RIGHTVENTRAL
07-10-90	MR	35,700	626	123	80-145	MACKAY	LAKE COEUR d'ALENE	ADIPOSE
07-10-90	MR	650	11	123	80-145	MACKAY	LAKE COEUR d'ALENE	ADIPOSE/RIGHT VENTRAL
Total 90	36,350	637						
07-09-91	MR	41,600	750	129	75-151	MACKAY	LAKE COEUR d'ALENE	LEFTVENTRAL
07-09-91	MR	1,050'	16	129	75-151	MACKAY	LAKE COEUR d'ALENE	ADIPOSE/LEFT VENTRAL
Total 91	42,650	766						
07-07-92	MR	10,000	500	132	115-150	MACKAY	LAKE COEUR d'ALENE	RIGHT VENTRAL
1993		0			No hatchery chinook were stocked			

'MR = Mineral Ridge boat ramp.
'Sterile triploid fish from heat-shocked eggs.

93DJ.TBL

Table 2. Estimates of the abundance of kokanee by year-class (1975-1992) made by midwater trawl in Coeur d'Alene Lake, Idaho, 1979-1993. Estimates are in millions of kokanee.

Class	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979
1992	5.57														
1991	5.23	3.02													
1990	1.42	0.81	4.86												
1989	.48	0.51	0.54	3.00											
1988		0.98	1.82	0.59	3.04										
1987			1.28	2.48	0.75	3.42									
1986				1.32	3.95	3.06	6.88								
1985					0.94	2.81	2.38	2.17							
1984						0.61	2.92	2.59	4.13						
1983							0.89	1.83	0.86	0.70					
1982								0.72	1.86	1.17	1.51				
1981									2.53	1.89	1.91	4.53			
1980										0.80	1.25	2.36	2.43		
1979											0.81	1.38	1.75	1.86	
1978												0.93	1.71	1.68	1.50
1977													1.06	1.95	2.29
1976														1.06	1.79
1975															0.45
TOTAL	12.70	5.32	8.50	7.39	8.68	10.90	13.07	7.31	9.37	4.56	6.48	9.20	6.94	6.50	6.04
TOTAL Age 1 & older	7.13	2.30	3.64	4.39	5.64	7.48	6.19	5.14	5.24	3.86	4.97	4.67	4.51	4.69	4.54
Number /ha	1,316	551	881	766	900	1,123	1,353	757	970	472	671	953	719	678	6.25

[a]Year eggs were deposited.

Table 3. Kokanee population estimates (in millions) and 90% confidence intervals for each age class in each section of Coeur d'Alene Lake, Idaho, July 16 - 21, 1993.

Section	Age 0	Age 1	Age 2	Age 3	TOTAL
1	5.07	1.02	0.43	0.08	6.6
	±108%	±29%	±23%	±22%	±88%
2	0.48	3.02	0.73	0.29	4.5
	±46%	±20%	±39%	±16%	±12%
3	0.02	1.2	0.29	0.12	1.6
	±17%	±73%	±67%	±122%	±88%
TOTAL	5.57	5.24	1.45	0.49	12.75[a]
	±107%	±23%	±25%	±34%	

'Rounding error difference from Table 1.

Table 4. Kokanee density (fish/ha) estimates for each age class in each section of Coeur d'Alene Lake, Idaho, July 16-21, 1993.

Section	Age 0	Age 1	Age 2	Age 3	TOTAL
1	2,373	477	201	37	3,089
2	83	524	127	50	781
3	11	686	167	68.6	915
WHOLE LAKE	577	543	150	51	1,322[a]

'Rounding error difference from Table 1.

Fecundity and Potential Egg Deposition

Biologists estimated 480,000 age 3 and older kokanee in Coeur d'Alene Lake in 1993. Mean lengths of female and male kokanee spawners were 253 mm (n = 40) and 271 mm (n = 224), respectively. Estimated number of eggs per female was 384. The estimated potential egg deposition in 1993 was 92 million (Table 5).

Chinook Salmon

Spawning

Technicians installed a fish weir and trap in Wolf Lodge Creek on September 2, 1993 and removed it October 28, 1993. A total of 58 chinook salmon were trapped. Hatchery personnel spawned 16 females and 11 males. Hatchery fish comprised 78% of the trapped fish. Age 3 chinook salmon (adipose-clipped) dominated the Wolf Lodge Creek run (Table 6). Natural chinook salmon comprised 22% of the salmon trapped.

Redd Counts

The number of chinook redds observed in major tributaries to Coeur d'Alene Lake continued to increase. Biologists counted a total of 121 chinook salmon redds in the Coeur d'Alene, North Fork Coeur d'Alene, and St. Joe rivers on October 18, 1993 (Table 7). No chinook salmon redds were observed in the lower 10 km of the South Fork Coeur d'Alene River.

Management objectives called for only 65 redds. A total of 55 redds were destroyed in the Coeur d'Alene River between the confluence of the South Fork Coeur d'Alene River downstream to the I-90 bridge at Cataldo, Idaho, October 22-26, 1993. Biologists observed eyed eggs in several redds.

Abundance of Natural Chinook Salmon

Data from angler diaries and three chinook salmon derbies indicated a high percentage of naturally produced salmon in the catch; 66 %-84% .

Table 5. Estimates of female kokanee spawning escapement, potential egg deposition, fall abundance of kokanee fry, and their subsequent survival rates in Coeur d'Alene Lake, Idaho, 1979-1993.

Year	Estimated female spawning escapment	Estimated potential number of eggs ($x10^6$)	Fall fry estimate the following year ($x10^6$)	Percent survival from egg deposition to fall fry
1979	256,716	86	1.86	2.20
1980	501,492	168	2.43	1.45
1981	550,000	184	4.54	2.46
1982	358,200	120	1.51	1.25
1983	441,376	99	0.70	0.71
1984	316,829	106	4.13	3.90
1985	530,631	167	2.17	1.29
1986	368,633	103	6.89	6.68
1987	377,746	126	3.42	2.71
1988	362,000	119	3.04	2.55
1989	516,845	155	3.00	1.94
1990	657,777	204	4.86	1.96
1991	631,500	167	3.03	1.81
1992	488,438	198	5.57	2.81
1993	240,000	92	--	--

Table 6. The number and percent of hatchery and wild chinook salmon trapped in Wolf Lodge Creek, Coeur d'Alene Lake, Idaho, 1984-1992.

		Natural fish trapped						Hatchery fish trapped						Year hatchery	Age	
		M		F		Total		M		F		Total		fish	when	Fin
Year trapped		No.	%	No.	%	No.	%	No	%	No.	%	No.	%	stocked	trapped	clip
1984		No natural fish return yet						22	63	13	37	35	100	1982	2	--
1985		No natural fish return yet												1982	3	--
1986		Unknown natural run hatchery fish not clipped						19	41	27	59	46	100	1983	3	--
1987		3 year old fish from 1984 release were not marked						27	79	7	21	34	100	1984	3	--
														1985	2	AD & LV
1988		3 year old fish from 1984 release were not marked						15	29	37	71	52	--	1985	3	AD
								3	100	0	0	3	--	1985	3	LV
								5	83	1	17	6	--	1986	2	RV
	Total	25	56	20	44	45	42	23	38	62	61	58				
1989								3	33	6	67	9	--	1986	3	RV
								46	64	26	36	72	--	1987	2	AD
	Total	22	42	31	58	53	40	49	60	32	40	81	60			
1990								16	28	43	72	59	--	1987	3	AD
								23	80	5	20	28	--	1988	2	LV
	Total	40	46	43	54	83	49	39	44	48	56	87	51			
1991								1	14	6	86	7	--	1987	4	AD
								41	41	60	59	101	--	1988	3	LV
								64	61	41	39	105	--	1989	2	RV
	Total	50	60	34	40	84	28	106	50	107	50	213	72			
1992								2	40	3	60	5	--	1988	4	LV
								33	39	51	61	84	--	1989	3	RV
								22	88	3	12	25	--	1990	2	AD
	Total	36	52	33	48	69	37	57	50	57	114	63				
1993								1	50	1	50	2	--	1989	4	RV
								18	**46**	21	54	39	--	1990	3	AD
								3	75	1	25	4	--	1991	2	LV
	Total	6	46	7	54	13	22	22	48	23	52	45	78			

Table 7. Counts of fall chinook salmon redds in the Coeur d'Alene and St. Joe rivers, Lake and Fighting creeks, Coeur d'Alene Lake, Idaho, 1989-1993.

	Survey Date				
Location	9/29/89	11/1/90	10/31/91	10/20/92	10/18/93
Coeur d'Alene River					
Cataldo Mission to S.F. Cd'A River	--	41	11	29	80
S.F. Cd'A River to N.F. Cd'A River	--	10	0	5	11
N.F. Cd'A River to Steamboat Creek	--	4	2	3	6
Steamboat Creek to steel bridge	--	--	--	1	0
Subtotal	52	55	13	38	97
St. Joe River					
St. Joe City to Calder	--	4	0	18	20
Calder to Huckleberry CG	--	3	1	1	4
Huckleberry CG to Marble Cr.	--	3	0	2	0
Marble Creek to Avery	--	0	0	0	0
Subtotal	0	10	1	21	24
Lake Creek	--	5	--	3	--
Fighting Creek	--	0	--	1	--
GRAND TOTAL	52	70	14	63	121

Nine Coeur d'Alene Lake chinook salmon anglers recorded catch data for their boat for an entire year. They recorded the number of poles used, number of hours fished, number of fish caught (kept and released), and fin clips. The best catch rate occurred during the winter; November, December, January, and February (Table 8). The average catch rate in 1993 on these nine boats was 17.3 h/fish. The highest fishing effort for these nine boats occurred in August when the "Big One Derby" was held. Natural and hatchery chinook salmon comprised 74% and 26% of the annual catch for these nine boats, respectively.

Three chinook salmon derbies were held in 1993. The first was held in June. The catch rate was 20 h/fish. The catch was comprised of 66% natural and 34% hatchery chinook salmon. The second derby, the "Big One Derby," was held in August. During this derby, 67% of the chinook salmon weighed-in were natural, 23% were hatchery, and 10% were not identified. At the weigh-in stations on the northern end of the lake, 65 % and 35 % of the chinook salmon weighed-in were natural and hatchery, respectively. At the weigh-in stations on the southern end of the lake, 76% and 24% of the chinook salmon weighed-in were natural and hatchery, respectively. The third derby was held in December. The catch rate was 12 h/fish, and 84% of the chinook salmon weighed-in were natural and 10% were hatchery.

The percentage of natural chinook salmon in the catch during the "Big One Derby" from 1984 to 1991 ranged 24% to 47% (Figure 3). The increase of natural chinook salmon in the catch indicated the number of natural chinook salmon in the lake has increased (Figure 4).

DISCUSSION

One of the major goals of the chinook salmon program in Coeur d'Alene Lake was to reduce kokanee abundance (density) to a level where we would see a corresponding increase in their growth. A goal of a 250 mm long kokanee in the angler creel was set. Average kokanee spawner lengths in December exceeded 250 mm during 1991, 1992, and 1993 (Figure 5). However, the length of age 3 and older kokanee caught in the trawl during July has yet to average 250 mm. Mean length in 1991, 1992, and 1993 was 218 mm, 238 mm, and 242 mm, respectively. The challenge is to use chinook salmon to control kokanee population abundance at a level that will produce a 250 mm long kokanee in July, while maximizing the chinook salmon fishery.

Rieman and Meyer (1990) theorized that a density of 50 age 3 and older kokanee/ha would produce a 250 mm fish (Figure 6). In 1993 the density of age 3 and older kokanee/ha in Coeur d'Alene Lake was estimated to be 51 fish/ha, and mean length of age 3 kokanee in the July trawl was 242 mm.

Rieman and Maiolie (1995) reported that catch rates, yield, and angler effort for kokanee appeared be to maximized when age 3 and older kokanee density reached 50 fish/ha (Figure 7).

Table 8. Summary of hours fished, fish caught and catch rates, by month, from nine chinook salmon anglers fishing Coeur d'Alene Lake, Idaho, 1993.

Month	Hours fished	Fish caught	Catch rate (fish/h)
January	18.5	13	1.4
February	103.5	20	5.2
March	19.0	1	19.0
April	345.5	9	38.4
May	184.5	12	15.4
June	591.5	29	20.4
July	306.0	19	16.1
August	1,230.5	36	34.2
September	126.0	6	21.0
October	22.0	1	22.0
November	220.5	23	9.6
December	493.0	42	11.7
TOTAL	3,660.5	211	17.3

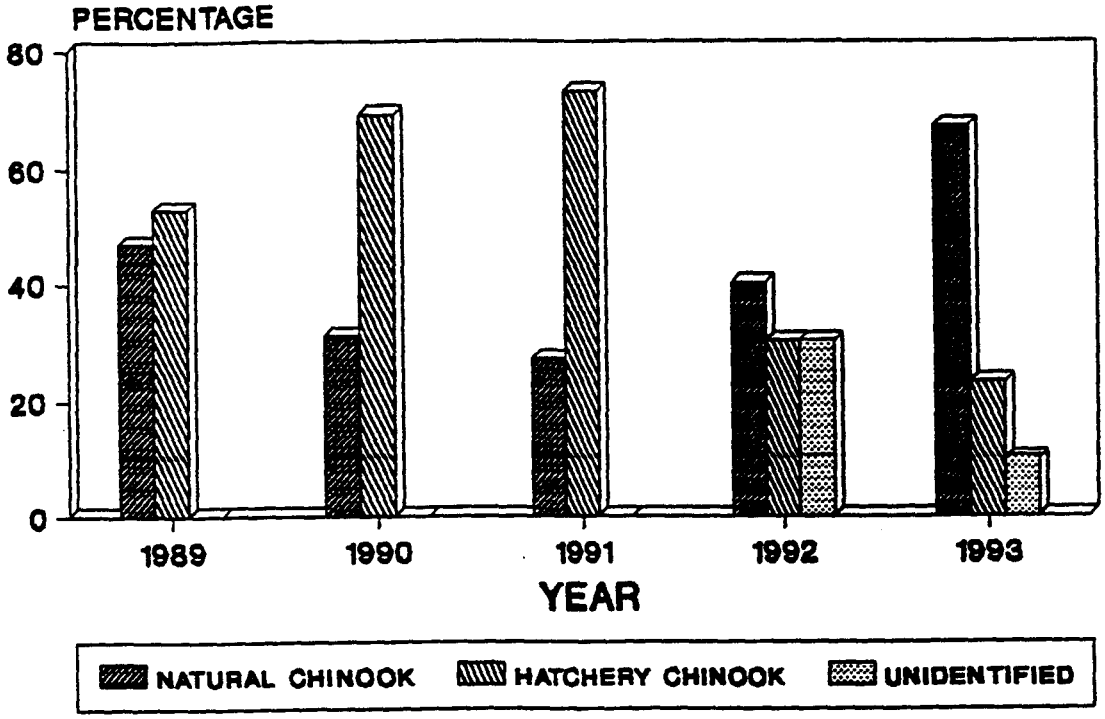


Figure 3. Percentage of hatchery, natural, and unidentified chinook salmon weighed in during the "Big One" derby, Coeur d'Alene Lake, Idaho, 1989-1993.

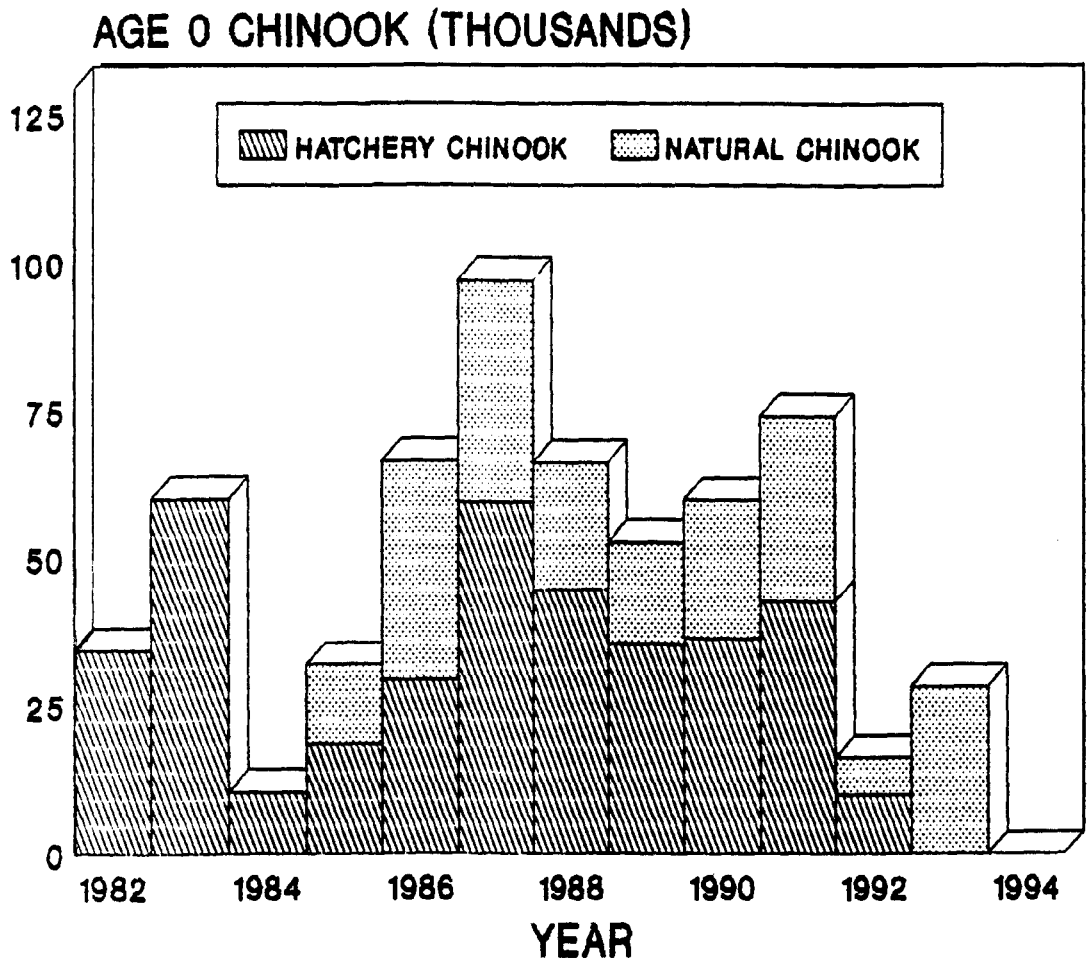


Figure 4. The estimated abundance of hatchery and natural age 0 chinook salmon entering Coeur d'Alene Lake, Idaho, 1982-1993.

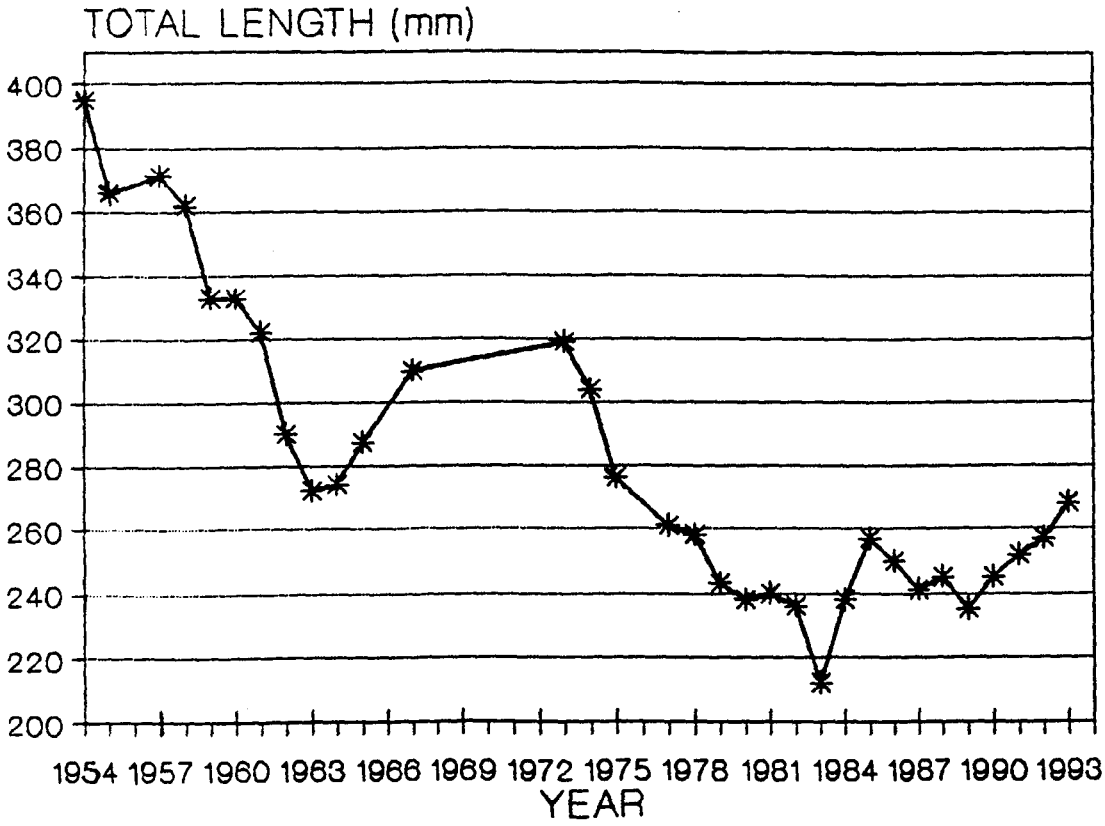


Figure 5. Mean length of kokanee spawners from Coeur d'Alene Lake, Idaho, 1954-1993.

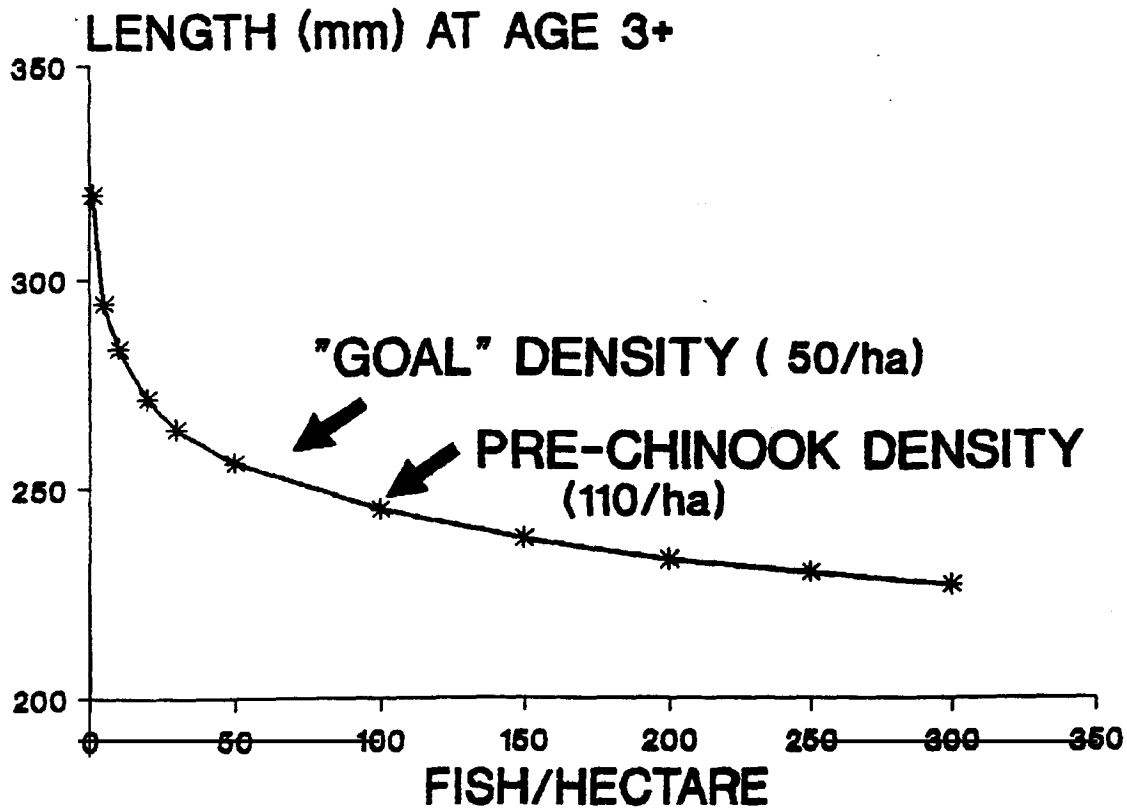


Figure 6. Theoretical relationship between length and density of age 3 kokanee (Rieman and Meyer 1990).

We will manage for a density of 50 age 3 and older kokanee/ha in Coeur d'Alene Lake to maximize both the kokanee and chinook salmon fisheries.

We have attempted to determine how chinook salmon abundance corresponded to kokanee abundance, but this relationship has not been clear. The estimated abundance of different age groups of kokanee in Coeur d'Alene Lake has been fluctuating wildly since the introduction of chinook salmon in 1982 (Figure 8) indicating that unknown compensatory responses in the kokanee population have been occurring. Stocking of hatchery chinook salmon has varied considerably over the years (Figure 4). Natural reproduction of chinook salmon has been established and now seems to be increasing based on increases in the number of redds counted and the percentages of natural chinook salmon in the angler creel. The predatory impact of age 0 natural chinook salmon on the age 0 kokanee population probably differs from that of hatchery age 0 chinook salmon due to the size, time, and location natural chinook salmon enter the lake. The chinook salmon fishery on Coeur d'Alene Lake has been changing annually and is likely influencing chinook salmon mortality, and therefore their predatory impact on kokanee. The direct predator/prey mechanisms that occur between chinook salmon and kokanee in Coeur d'Alene Lake are extremely complex, dynamic, and not easily understood.

We believe the best management approach, given these uncertainties, is to hold chinook salmon abundance at a relatively stable level that will result in a density of age 3 and older kokanee of 50 fish/ha. This "level" is determined by past results and would be achieved through a combination of both hatchery and natural chinook salmon production.

As we would expect, there appears to be an inverse relationship between kokanee abundance and chinook salmon abundance (Figure 9) (comparing the density of age 3 and older kokanee to the density of age 1-4 chinook salmon in the same year). Prior to 1987, the relationship is not obvious because the abundance of natural chinook salmon was just beginning to increase. Between 1987 and 1992, an inverse relationship is more obvious.

In 1993, the kokanee population was much lower than what we expected from the estimated chinook salmon abundance. The low abundance of age 3 kokanee in 1993 may have resulted from lost egg production in March 1990 during road construction along Interstate 90 (Maiolie and Davis 1995). It was estimated that 20% of the entire kokanee spawning area for Coeur d'Alene Lake was destroyed by the construction project and that the destroyed spawning area may have held a much higher percentage of the deposited eggs.

From Figure 9, it appeared that densities of 3.0 to 3.5 age 1-4 chinook salmon/ha resulted in densities of age 3 and older kokanee ranging from 60 to 130 fish/ha. Density of age 1-4 chinook salmon was calculated by assigning a survival rate of 25 % age 0-1, 50% age 1-2, 50% age 2-3, and 50% age 3-4. It appears that a target goal of 3.5 age 1-4 chinook salmon/ha may achieve our desired goal of 50 age 3 and older kokanee/ha.

To achieve the desired level of chinook salmon abundance in the lake, a "stocking" level of 72,000 age 0 chinook salmon would be required assuming the above referenced survival

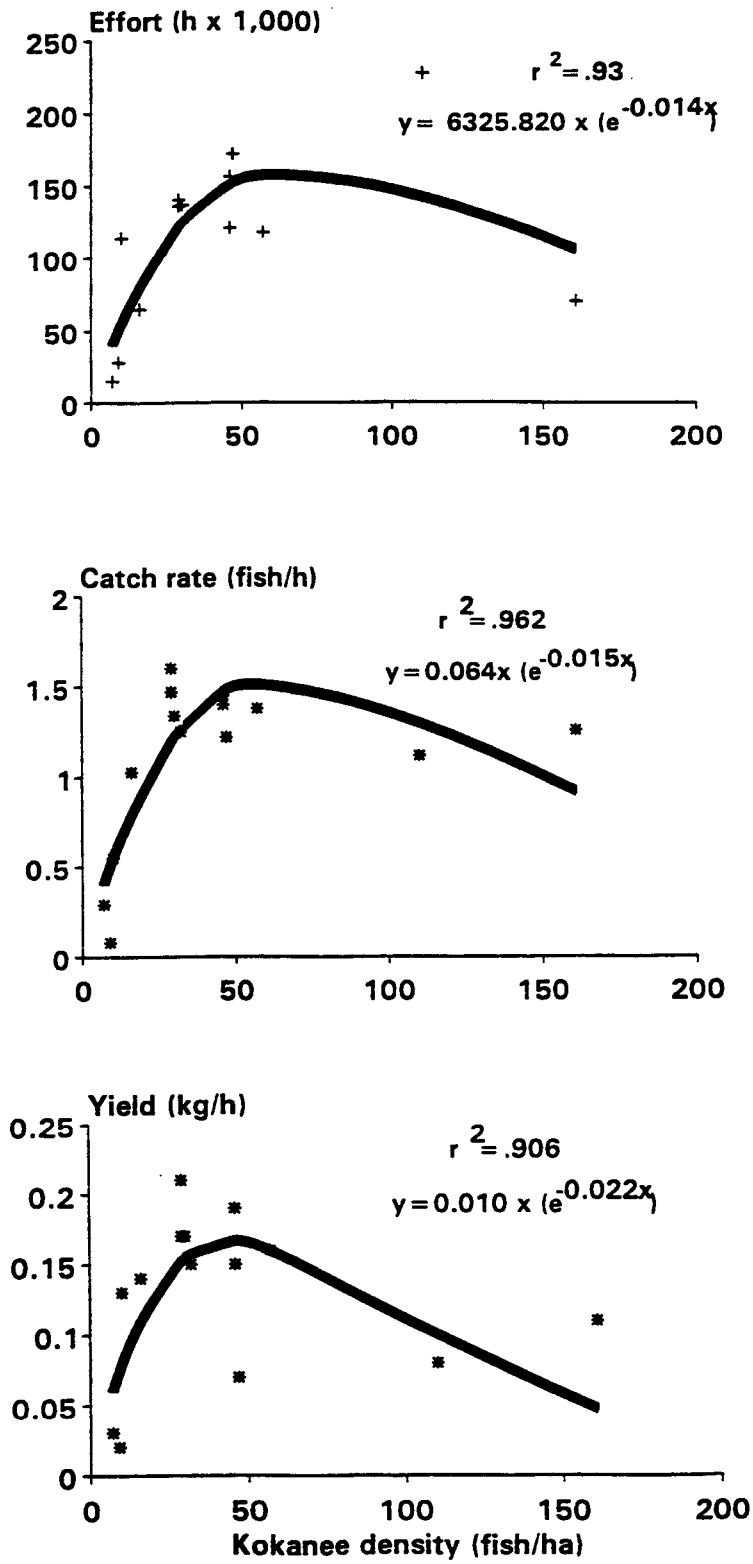


Figure 7. Relationship between kokanee density (fish/ha) and angler effort, catch rates (fish/h), and yield (kg/h) from kokanee lakes in Idaho and Odell Lake, Oregon (Rieman and Maiolie, 1995).

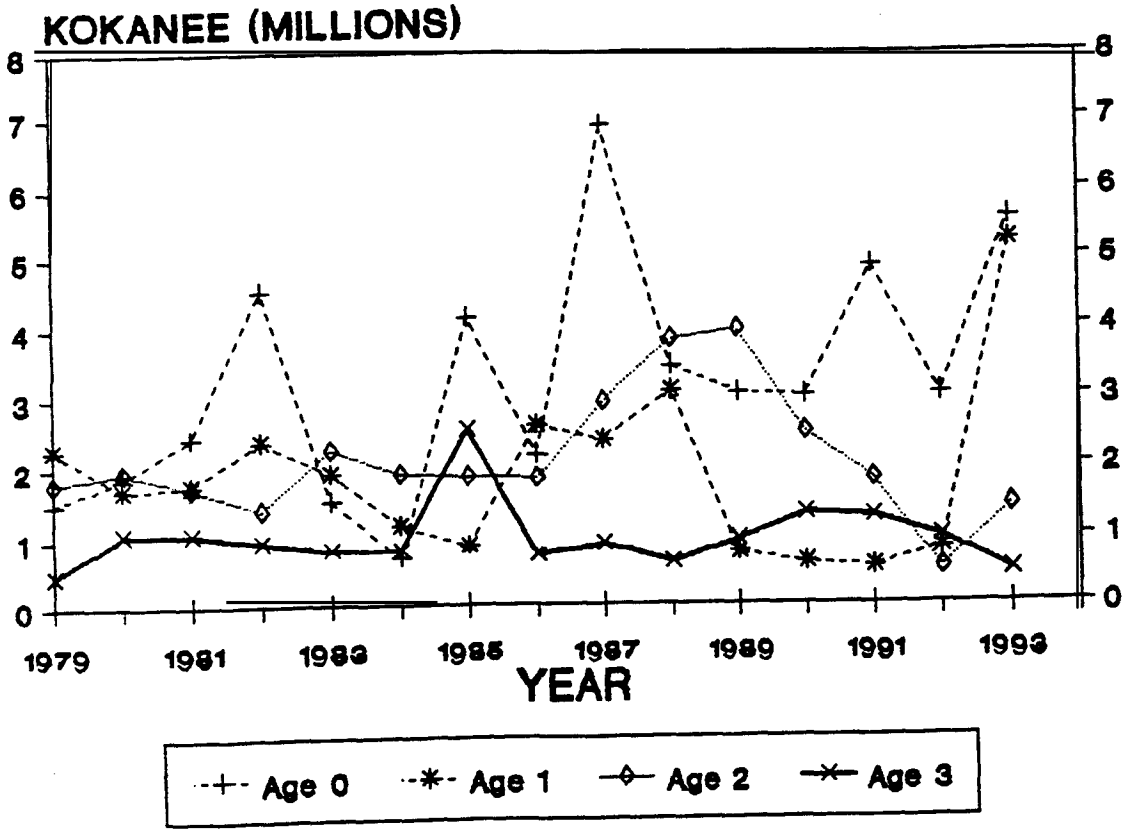


Figure 8. Estimated abundance of age 0-3 kokanee captured by trawling in Coeur d'Alene Lake, Idaho, 1979-1993.

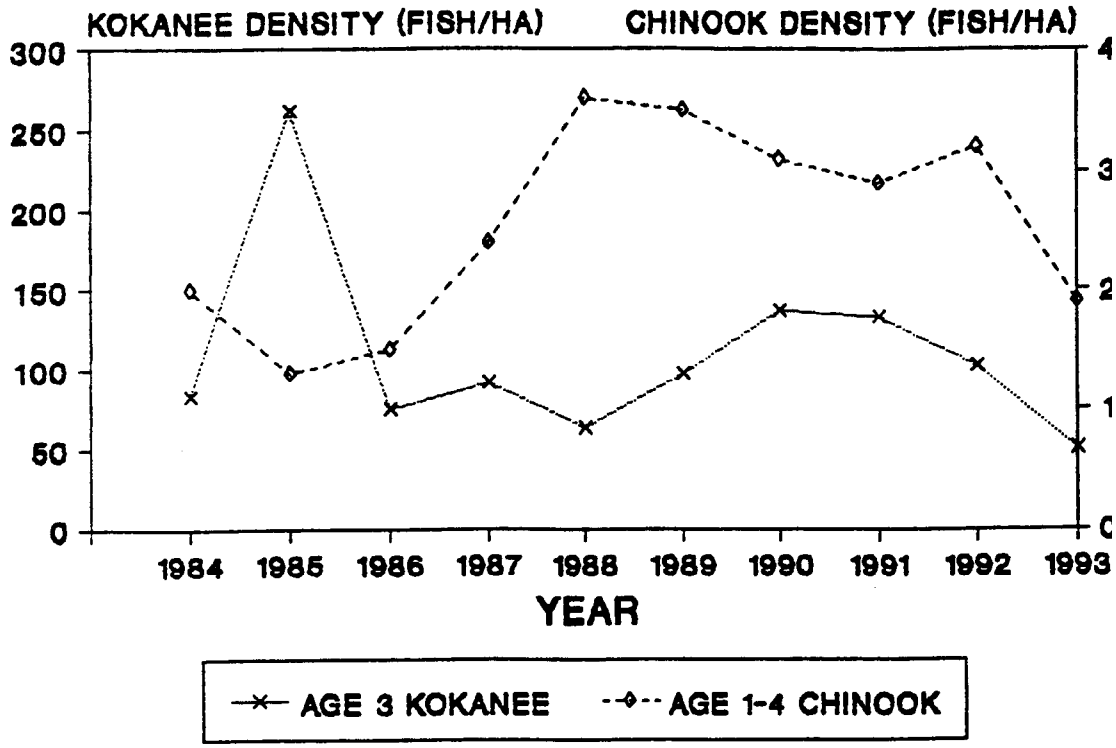


Figure 9. Density of age 3 and older kokanee and age 1-4 chinook salmon for a given year in Coeur d'Alene Lake, Idaho, 1984-1993.

estimates are correct. Stocking 72,000 age 0 chinook salmon would equal 18,000 age 1, 9,000 age 2, 4,500 age 3 and 2,250 age 4 for a total of 33,750 age 1-4 chinook salmon, divided by 9,648 ha equals 3.5 age 1-4 chinook salmon/ha.

We have chosen to utilize both hatchery and natural chinook salmon production to "stock" the lake. A stocking of 30,000 age 0 hatchery smolts in the northern end of the lake will provide a marked group of fish to compare to natural recruitment, will better insure a fishery for the northern end of the lake, will reduce some of the variability inherent in reliance on natural production alone, and will provide a source of chinook salmon eggs to maintain this program and others if the need arises.

The remaining 42,000 smolts would be provided by natural production and their abundance managed through control of redd numbers. We are currently assuming chinook fecundity at 4,500 eggs/female and an egg to smolt survival rate of 10%. Using these assumptions, 93 redds would achieve a stocking rate of about 42,000 smolts (93 redds x 4,500 eggs x 10% survival = 41,850 smolts).

Due to the complex, dynamic interactions between chinook salmon, kokanee, natural environmental conditions, and angler harvest. We do not expect to quantify all the assumptions used for these predictions. More realistically, we intend to manage chinook salmon at a target level for four years and monitor the response of the kokanee population. Ideally, this adaptive approach will allow us to "fine tune" the program and maximize both the kokanee and chinook salmon fisheries.

Realistically, we will not be able to start the four year cycle until 1995 at the earliest. Anticipated release of hatchery chinook salmon in 1994 will total about 15,000 fish and redd control in 1993 reduced natural smolt recruitment to about 30,000 fish. Reductions in hatchery stocking (10,000 in 1992 and none in 1993) may also limit our ability to implement the hatchery portion of the plan due to fewer fish returning to Wolf Lodge Creek in 1995 through 1997.

RECOMMENDATIONS

1. Monitor kokanee population abundance and size of age 3 and older fish with trawling to determine the effect of chinook salmon predation.

2. Trap and spawn chinook salmon in Wolf Lodge Creek to provide eggs for the stocking program.

3. Stock no more than 30,000 smolts annually in Wolf Lodge Bay.

4. Count redds in St. Joe and Coeur d'Alene river drainages and eliminate redds in excess of 93.

5. Survey Coeur d'Alene Lake chinook salmon anglers to collect data on catch rates, length frequencies, hatchery and natural composition (including derbies).

6. Survey kokanee anglers to determine catch rates and length of fish in the creel.

7. Put together a proposal to conduct a 12-month creel survey on Coeur d'Alene Lake in 1996 or 1997.

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1993 ANNUAL PERFORMANCE REPORT

State of: Idaho | Program: Fisheries Management F-71-R-18

Project I: Surveys and Inventories | Subproject I-A: Panhandle Region

Job: c | Title: Rivers and Streams Investigations

Contract Period: July 1. 1993 to June 30. 1994

ABSTRACT

Westslope cutthroat trout *Oncorhynchus clarki lewisi* densities estimated from snorkeling transects in the catch-and-release sections of the North Fork Coeur d'Alene, Little North Fork Coeur d'Alene, and St. Joe rivers were 29, 3, and 203 trout/ha, respectively. In the catch-and-keep sections of the same streams, densities were 36, 18, and 22 trout/ha, respectively.

The population of westslope cutthroat trout estimated by electrofishing 2 km of the catch-and-release section of the North Fork Coeur d'Alene River was 217 +/- 93 or 42 fish/ha.

A total of 529 bull trout *Salvelinus confluentus* redds were counted in the six index streams in the Lake Pend Oreille drainage. This was an 8.4% increase over the 10-year average of 486 redds.

A total of 18 bull trout redds were counted in the Upper Priest Lake drainage in 1993, and a total of 71 bull trout redds were counted in the upper St. Joe River drainage in 1993.

The number of kokanee salmon O. *nerka kennerlyi* spawners counted in Smith, Boundary, Long Canyon, and Parker creeks in 1993 was 15, 10, 0, and 4, respectively.

Authors:

Jim Davis
Regional Fishery Biologist

Lance Nelson
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

OBJECTIVES

1. Estimate the westslope cutthroat trout *Oncorhynchus clarki lewisi* density in selected snorkeling transects in the Little North Fork Coeur d'Alene and North Fork Coeur d'Alene rivers and the St. Joe River. Compare trends with previously collected data.

2. Estimate population abundance of trout in the Little North Fork Coeur d'Alene and North Fork Coeur d'Alene rivers by electrofishing.

3. Compare densities in Little North Fork Coeur d'Alene and North Fork Coeur d'Alene rivers and the St. Joe River in relation to condition of the fish habitat in the respective rivers.

4. Assess the status of bull trout *Salvelinus confluentus* populations in the Pend Oreille Lake, Priest Lake, and St. Joe river drainages based on abundance of bull trout redds in selected tributaries.

5. Monitor the abundance of spawning kokanee in selected tributaries of the Kootenai River.

METHODS

Cutthroat Trout Densities

Snorkeling

Biologists snorkeled previously established transects in the North Fork Coeur d'Alene River (NFCDAR), Little North Fork Coeur d'Alene River (LNFCDAR) (Lewynsky 1986) (Figure 1), and the St. Joe River (SJR) (Rankel 1971) (Figure 2). There were 28, 10, and 35 transects surveyed in NFCDAR, LNFCDAR, and SJR, respectively. The numbers of trout by species and length group, greater than 300 mm or less than 300 mm, were recorded for each transect. Mountain whitefish *Prosopium williamsoni* were counted as adults and juveniles. Squawfish *Ptychocheilus oregonensis* and suckers *Catostomus sp.* were enumerated.

Personnel measured the length (m) and width (m) of each transect to determine area (m^2). Trout density was reported as fish/m^2 and fish/100 m^2.

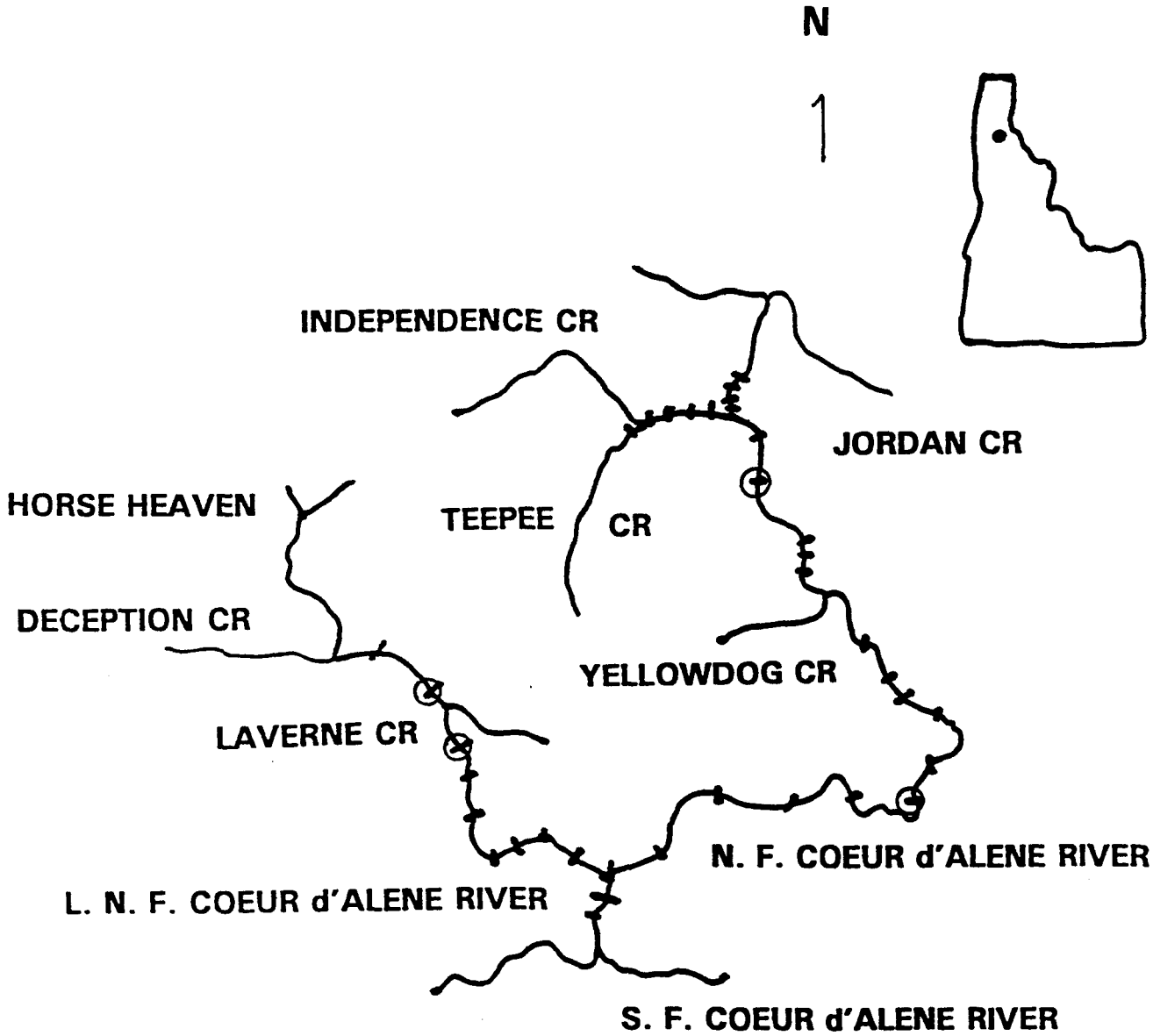

Figure 1. General locations of snorkeling (-) and electrofishing (o) transects in the North Fork and Little North Fork Coeur d'Alene rivers, Idaho, 1993.

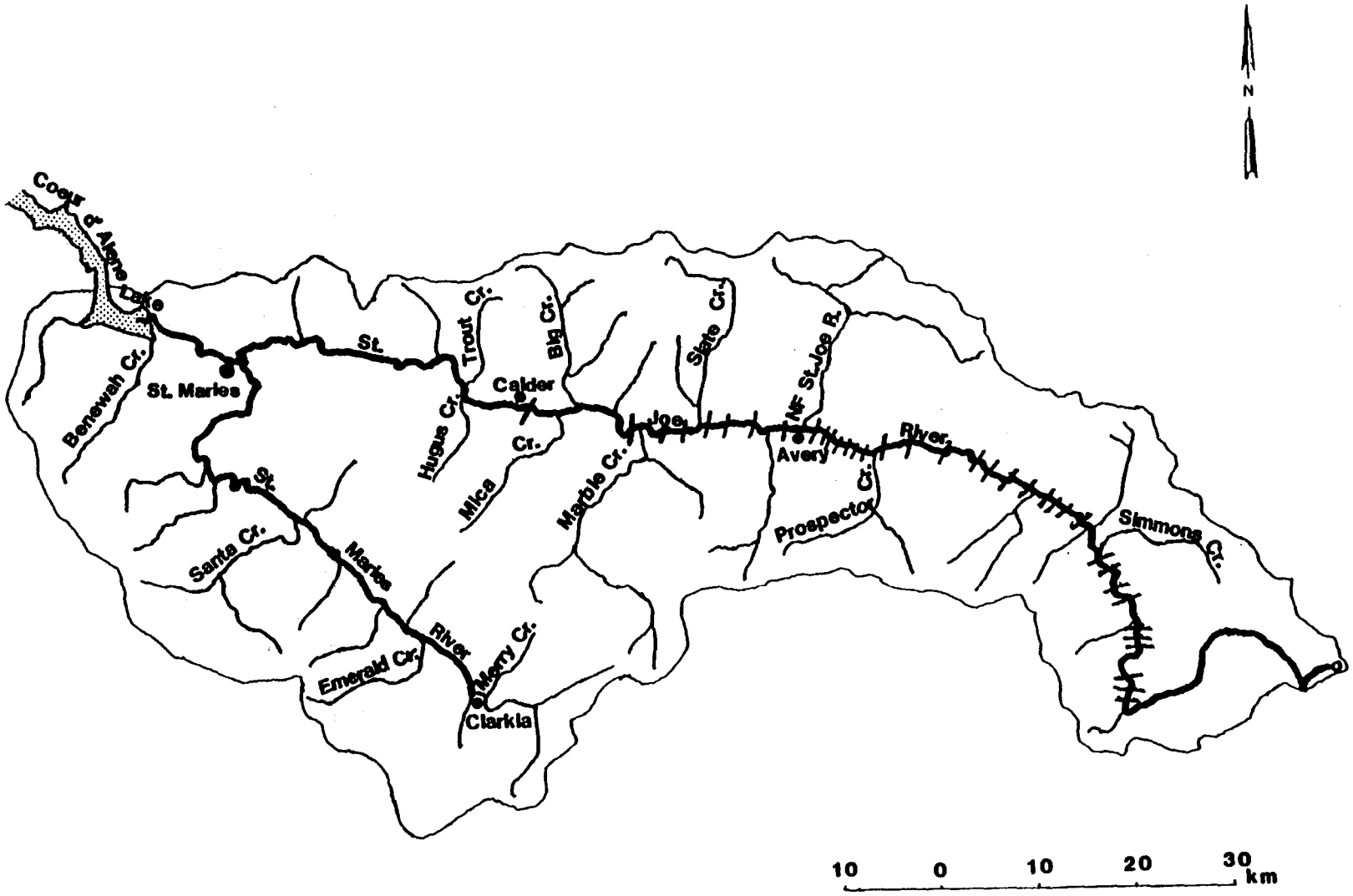

Figure 2. General locations of snorkeling transects on the St. Joe River, Idaho, 1993.

Electrofishing

Fishery personnel selected two transects, one in the catch-and-release section and one in the catch-and-keep section in the LNFCDAR and NFCDAR (Figure 1), as test sites to develop the best procedure for determining a population estimate. Biologists used two methods of electrofishing to collect fish. In shallow water, fishery personnel waded and used a canoe to float the electrofishing equipment. This method required a minimum of five people; two netters, two for the electrodes, and one person to control the canoe and safety switch. A driftboat was used in deeper water. The boat was equipped with booms for the electrodes and required two people; one netter and one oarsman. Electrofishing equipment included a VVP15 Coffelt variable voltage pulsator and 5,000-watt gasoline-powered generator. A two-pass Peterson mark/recapture estimate was made. The first was the marking run. All fish collected were measured (total length [TL] mm) and marked with a hole punch in the caudal fin. The recapture run was conducted one week later. All fish collected were examined for a mark and lengths of fish were recorded.

The Peterson method was used to estimate the population size.

$$\hat{N} = \frac{MC}{R}$$

Where:

$\hat{N}$ = estimated population size

M = number of fish marked

C = number of fish collected in the second run

R = number of recaptured fish in the second run

In the NFCDAR, the transect in the catch-and-release section began at President's Creek Campground and ended at the first bridge, approximately 2 km downstream. This transect was a wading transect. The transect in the catch-and-keep section began at the mouth of Prichard Creek and ended at the mouth of Beaver Creek, approximately 4 km downstream. This was a driftboat transect (Figure 1).

In the LNFCDAR, the transect in the catch-and-release section began approximately 180 m downstream from Leiburg Creek. The section ended approximately 800 m downstream. The transect in the catch-and-keep section began approximately 1.6 km below Laverne Creek and ended approximately 1 km downstream. Both of these transects were wading transects (Figure 1).

Bull Trout Redd Counts

Bull trout redd counts have been conducted in the Pend Oreille drainage since 1983 (Horner et al., 1996) and in the Priest Lake and St. Joe River drainages since 1992 for the purpose of population trend information. In 1993, 17 streams were surveyed for the presence of bull trout spawning activity in the Pend Oreille drainage (Table 1), 12 streams in the Priest Lake drainage (Table 2), and 23 streams in the St. Joe River drainage (Table 3). Survey techniques and identification of bull trout redds followed methodology as described by Pratt (1984). Idaho Department of Fish and Game personnel conducted all reported surveys in the Lake Pend Oreille drainage in 1993 and assisted U.S. Forest Service personnel and volunteers survey the Priest Lake and St. Joe River drainages. The reporting of "possible" redds in the Priest Lake and St. Joe River data indicates that the observer was unsure if the bright area or cleaned gravel was actually the result of bull trout spawning activity. "Possible" redd numbers were not used in calculating spawning escapement estimates. The numbers of bull trout redds observed in Trestle Creek from 1988 through 1993 were adjusted in 1993 to eliminate redds counted in the lower 1.6 km of the stream due to the possible confusion of kokanee redds as bull trout redds. The expansion factor of 3.9 adult bull trout/redd used in previous years reporting was corrected in 1993 to 3.2 fish/redd (Fraley et al. 1981, K.L. Pratt, independent consultant, personal communication). All surveys were conducted at a time that was deemed most appropriate to observe the maximum number of redds.

RESULTS AND DISCUSSION

Cutthroat Trout Densities

North Fork Coeur d'Alene River

Snorkeling-Biologists estimated the density of westslope cutthroat trout to be 29 fish/ha and 36 fish/ha in the catch-and-release and the catch-and-keep sections, respectively (Table 4). The summary of fish observed and fish densities per transect are displayed in Appendices A and B. The density of trout larger than 300 mm was higher in the catch-and-release section than in the catch-and-keep section where a one cutthroat trout, 14-inch minimum size regulation was in effect (Table 4).

Electrofishing-Biologists estimated the westslope cutthroat trout population in the 2 km catch-and-release transect to be 217 ± 93, or 42 fish/ha. An estimate for the 4 km catch-and-keep transect could not be made because biologists did not recover the minimum number of marked fish. Catch per unit effort was higher in the catch-and-release section than compared

Table 1. Description of bull trout redd survey locations including distance surveyed and survey date, Lake Pend Oreille drainage, Idaho, 1993.

Stream	Survey		
	Section description	Distance (km)	Survey date
CLARK FORK RIVER	Cabinet Gorge Hat. fish ladder to Cabinet Gorge Dam - south side	1.6	10/20/93
Lightning Creek	Quartz Cr. to Rattle Cr.	3.2	10/19/93
East Fork	Thunder Cr. to Savage Cr.	5.0	10/19/93
Savage Creek	Trail 61 crossing to mouth	2.0	10/19/93
Char Creek	Falls to mouth	1.2	10/19/93
Porcupine Creek	South Fork to mouth	3.2	10/20/93
Wellington Creek	Falls to mouth	0.5	10/19/93
Rattle Creek	Falls by upper bridge to mouth	5.7	10/19/93
Johnson Creek	Falls to mouth	1.5	10/18/93
Twin Creek	South river road culvert to mouth	1.5	10/18/93
NORTHERN SHORE			
Trestle Creek	Falls, 0.5 km up from Road 275 switchback to 1.6 km upstream from the mouth.	10.4	10/05/93
Pack River	Cascades, 0.4 km down from W. Branch, to Road 231 bridge near McCormick Cr.	2.8	10/13/93
Grouse Creek	End of Road 280 (2.4 km beyond gate) to Flume Cr.	6.5	10/12/93
EASTERN SHORE			
Granite Creek	Road 278 bridge (sec. 29) to mouth	6.4	10/14 &11/5/93
Sullivan Springs	Mouth upstream 0.4 km	0.4	10/14/93
North Gold Creek	Falls to mouth	1.2	10/14/93
Gold Creek	0.2 km upstream from West Gold to mouth.	2.4	10/14/93

Table 2. Description of bull trout redd survey locations including transect description, distance surveyed and survey date, Priest Lake drainge, Idaho, 1993.

Stream	Survey		
	Section description	Distance (km)	Survey date
Upper Priest River	Mouth of Rock Cr. downstream to F.S. trail 317 crossing	0.3	9/28-29
	Mouth of Lime Cr. downstream to the mouth of Snow Cr.	3.2	9/16
	Togo Gulch to the mouth	0.8	9/27
Rock Creek	Mouth upstream to F.S. trail 308 crossing.	0.5	9/28-29
Lime Creek	Mouth upstream approximately 0.8 km	0.8	9/16 & 28-29
Cedar Creek	Mouth upstream approximately 1.6 km	1.6	9/28-29
Ruby Creek	Mouth upstream to a barrier waterfall upstream from F.S. road 655	2.0	9/28-29
Hughes Fork	North end of Hughes Meadows upstream to F.S. trail 312 crossing	2.0	9/15
	Foot bridge on F.S. trail 311 downstream to F.S. road 622 bridge	2.4	9/16
	F.S. road 622 downstream to the mouth	8.0	9/28-29
Bench Creek	Mouth upstream approximately 0.8 km	0.8	9/15
Jackson Creek	Mouth upstream to F.S. trail 311 crossing.	1.6	9/28-29
Gold Creek	Mouth upstream approximately 2 km	2.0	9/28-29
Boulder Creek	Mouth upstream approximately 1.6 km to a barrier waterfall	1.6	9/28-29
Trapper Creek	Mouth upstream to approximately 0.8 km upstream from East Fork	3.2	9/27
Caribou Creek	Mouth upstream to old road crossing	1.6	9/27

Table 3. List of tributary streams surveyed for bull trout redds in 1993, St. Joe River drainage, Idaho. Standardized survey transects have not been established.

St. Joe River from Bean Creek to Heller Creek
St. Joe River from Heller Creek to St. Joe Lake
Bacon Creek
Bean Creek
Beaver & Bad Bear Creeks
California Creek
Gold Creek
Heller Creek
Indian Creek
Medicine Creek
Red Ives Creek
Ruby Creek
Sherlock Creek
Simmons Creek
Washout, Redwood, & Goat Creeks
Goat & Wampus Creeks
North Fork Simmons Creek
Timber Creek
Wisdom Creek
Yankee Bar Creek

Table 4 Summary of westslope cutthroat densities counted by snorkeling transects in the North Fork Coeur d'Alene, Little North Fork Coeur d'Alene and the St. Joe rivers, Idaho, July and August 1993.

North Fork Coeur d'Alene River

	Fish Size	Cutthroat counted	Transect length (km)	Number counted/ km	Area (ha)	No counted/ ha
Catch-and-keep	< 300 mm	239	3.5	68	8.1	30
	> 300 mm	45	3.5	13	8.1	6
				81		36
Catch-and-release	< 300 mm	50	1.2	42	2.4	21
	> 300 mm	19	1.2	16	2.4	8
				58		29

Little North Fork Coeur d'Alene River

	Fish Size	Cutthroat counted	Transect length (km)	Number counted/ km	Area (ha)	No counted/ ha
Catch-and-keep	< 300 mm	18	0.84	21	1.5	12
	> 300 mm	9	0.84	11	1.5	6
				32		18
Catch-and-Release	< 300 mm	0	.19	0	0.33	0
	> 300 mm	1	.19	5	0.33	3
				5		3

Table 4. Continued St.

Joe River

	Fish Size	Cutthroat counted	Transectien gth (km)	Number counted/ km	Area (ha)	No. counted/ ha
Catch-and-Keep	≤ 300 mm	131	1.9	69	7.1	18
	> 300 mm	28	1.9	15	7.1	4
				84		22
Catch-and- Release	≤ 300 mm	441	1.9	232	3.4	130
	> 300 mm	299	1.9	131	3.4	73
				363		203

to the catch-and-keep section indicating that more fish were sampled in the catch-and-release transect compared to the catch-and-keep transect (Table 5).

The lack of recaptures could be attributed to sampling efficiency, not enough fish were marked during the marking run, and/or emigration may have occurred. Use of the driftboat may have effected sampling efficiency. The driftboat used in the catch-and-keep section was confined to the deep water channel and could not survey some of the shallower areas. The speed of the drift was too fast to net the stunned fish because the fish surfaced behind the driftboat.

The second possible reason for the lack of recaptures may be that not enough fish were marked in the first run. A second or third pass may be necessary to mark more fish.

The third possibility for lack of recaptures may be due to emigration. Westslope cutthroat trout continue to migrate upstream until mid-August (Joel Hunt, MS Thesis, University of Idaho, in progress). The electrofishing was conducted the first week in August 1993. The electrofishing may be conducted a week later to alleviate this problem.

Little North Fork Coeur d'Alene River

Snorkeling-Biologists estimated the density of westslope cutthroat trout to be 3 fish/ha and 18 fish/ha in the catch-and-release and the catch-and-keep sections, respectively (Table 4). The density of cutthroat trout larger than 300 mm was 3 fish/ha and 6 fish/ha in the catch-and-release and the catch-and-keep sections, respectively (Table 4). Appendix C displays the number of fish observed and the density per transect.

Electrofishing-No population estimates were calculated because no recaptures were collected. There appeared to be more fish in the catch-and-release transect compared to the catch-and-keep transect. Catch per unit effort was higher in the catch-and-release transect compared to the catch-and-keep transect of the LNFCDAR (Table 5).

The lack of recaptured trout could be attributed to the same reasons as mentioned above. These transects were walk and wade, and sampling efficiency was a problem due to the low conductivity which affects the electrical field necessary to stun the fish. Low density of fish also appeared to be a big factor in the number of fish marked and the lack of fish recaptured.

St. Joe River

Biologists estimated the density of westslope cutthroat trout to be 202 fish/ha and 22 fish/ha in the catch-and-release and the catch-and-keep sections of the SJR, respectively (Table

Table 5. Summary of catch per unit effort for electrofishing in the North Fork and Little North Fork Coeur d'Alene rivers, Idaho 1993.

North Fork Coeur d'Alene River

		Cutthroat		Whitefish		Wild rainbow	
Transect	Effort (sec)	Number	Catch/effort	Number	Catch/effort	Number	Catch/effort
Catch-and-keep							
1st run	55.9	9	0.16	25	.45	2	0.04
2nd run	88.3	28	0.32	12	.14	9	0.1
Catch-and-release							
1st run	137	43	.31	21	1.5	0	0
2nd run	121	65	.54	12	1.0	0	0

Little North Fork Coeur d'Alene

		Cutthroat		Brook trout	
Transect	Effort(sec)	Number	Catch/effort	Number	Catch/effort
Catch-and-release					
1st run	54	19	0.35	1	0.02
2nd run	37	17	0.46	0	0
Catch-and-keep					
1st run	49	3	0.06	1	0.02
2nd run	62	13	0.21	7	0.11

4). The density of cutthroat trout greater than 300 mm was 73 fish/ha and 4 fish/ha in the catch-and-release and the catch-and-keep sections of the SJR, respectively. A summary of fish observed and estimated fish densities for each transect are displayed in Appendices D and E.

The number of cutthroat trout in the NFCDAR and the SJR have increased since the implementation of special regulations ('Tables 6 and 7). The number of trout in the LNFCDAR has not increased (Table 8). Special regulations have been in effect for a longer period of time in the NFCDAR and LNFCDAR than in the SJR (Tables 9 and 10). Yet, the number and density of cutthroat trout in the catch-and-release section of the NFCDAR and LNFCDAR were much less than in the catch-and-release section of the SJR.

Cross and Everest (1995) documented a decrease in residual pool volume in entered watersheds compared to unentered watersheds. They also reported a loss of pocket water and shift toward runs, riffles, and braided habitat in entered watersheds. Kappesser (1993) has documented a decrease in channel stability and an increase in the frequency and intensity of peak water flows in entered watersheds. The cumulative damage of all these factors in the headwater streams has begun to change habitat conditions in fifth order channels as well.

Bull Trout Redd Counts

Lake Pend Oreille Drainage

A total of 529 bull trout redds were counted in the six index streams (East Fork Lightning, Johnson, Trestle, Grouse, North Gold, and Gold creeks) in 1993. This number represents an increase of 8.4% from the previous ten-year average of 486 redds and an increase of 59% from the 1992 count of 333 redds (Table 11). The total number of bull trout redds counted in all 17 streams surveyed in 1993 was 656, a 47% increase from the 1992 counts and a 3% decrease from the previous six years these streams had been surveyed (1983 through 1987 and 1992) (Table 11). Based on the expansion factor of 3.2 fish/redd, an estimated 1,929 bull trout entered the six index streams to spawn in 1993. The total estimated spawning escapement for bull trout in the 17 Lake Pend Oreille tributaries surveyed in 1993 was 2,099.

Trestle Creek was the one system that accounted for the majority of the increase in 1993 over past years. The record high count of 304 redds was 127% over the 1992 count of 134 redds. This good news should be viewed with caution as the majority of the remaining stream systems surveyed in 1993 continued in their downward trend from previous counts. Trestle Creek, along with most of the other bull trout spawning streams in the Lake Pend Oreille drainage, are experiencing considerable stream channel instability from a combination of increased water yield, bedload movement, and loss of woody debris.

Table 6. Mean number of westslope cutthroat trout counted in snorkeling transects in the North Fork Coeur d'Alene River, Idaho, 1973, 1980-81, 1987-88, 1991, and 1993.

	Year						
River section	1973[a]	1980[b]	1981[a]	1987[b]	1988[c]	1991[d]	1993[e]
South Fork Cd'A River to Yellowdog Creek	2.4	0.5	0.9	--	1.4	7.5 ± 5.0	22 ± 10.4 (0.003 fish/m^2)
Yellowdog to Tepee Creek	11.2	6.8	5.7	25.4	27.3	28.4 ± 19.4	9 ± 9.2 (.004 fish/m^2)
Tepee Creek to Jordan Creek	6.0[e]	5.6[e]	5.7[e]	16.4	3.2	1.5 ± 3	2.7 ± 7.6 (003 fish/m^2)
Tepee Creek mouth to Independence Creek	0	1.6	3.9	2.2	1.2	2.6 ± 1.5	3.2 ± 4.5 (.002 fish/m^2)
South Fork Cd'A to Jordan Creek (including Tepee Creek)	4.6	3.2	3.4	--	10 ± 19	8.6 ± 4.3	14 ± 6.1 (.003 fish/m^2)

[a]Average value for July, August and September sampling
'August sampling
`July 20-24 sampling
'August sampling
`July 18 - August 4 sampling
[e]Fish per transect calculated for Tepee Creek to Cow Creek

93DJ.TBL

Table 7. Mean number of westslope cutthroat trout counted in snorkeling transects (fish/m^2) in the St. Joe River, Idaho, 1969-77, 1979-80, 1982, 1990 and 1993.

Year

' Densities for St. Joe River from St. Manes to Heller Creek.

Stream section	1969	1970	1971	1972	19	1974	1975	1976	1977	1979	1980	1982	1990	1993
Calder to Ruby Creek	28.88	19.5[a]	--	--	--	--	--	--	--	--	--	--	35 ± 10.3	24.3 ± 7.4
Calder to Prospector Creek	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	5.9 ± 4.2 (0.002)	11.4 ± 7.4 (0.0002)
Prospector to Ruby Creek	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	51.7 ± 10.6 (0.04)	32.9 ± 10.1 (0.02)
Calder to Avery	--	--	--	--	--		--	--	--	--	--	--	1.6 ± 1.6 (0.000.2)	4.4 ± 6.1 (0.001)
Avery to Prospector	0.5	0	2.0	0.5	0.6	4.0	3.4	--	2.0	3.3	4.7	1.1	12 ± 7.6 (0.0002)	21.3 ± 13.6 (0.005)
Prospector to Spruce Tree Campground	4.6	5.8	11.1	11.2	13.6	27.0	28.9	48.8	32.6	29.8	28.3	55.4	52.8 ± 13.1 (0.03)	40.3 ± 11.8 (0.02)
Spruce to Ruby Creek	22.8	22.3	23.5	31.8	30.8	59.0	74	22.8	55.8	38.0	17.6	40.0	49 ± 26 (0.03)	14 ± 10 (0.01)

93DJ.TBL

Table 8. Mean number of westslope cutthroat trout counted in snorkeling transects in the Little North Fork Coeur d'Alene River, Idaho, for 1973, 1980-81, 1988, 1991, and 1993.

	Year					
River section	1973	1980	1981	1988'	1991`	1993°
Mouth to Horse Heaven	5.6'	5.9'	7.5'	2.7	3.9	3.8 ± 4.6 (0.002 fishlm^2)
Mouth to Laverne Creek	--		0.8'	1.0	3.3 ± 4.8	3.3 ± 5.1 (0.002 fishlm)
Lavern to Deception Creek			3.8`'`	7.4[1]	1.5 ± 5.3	0.5 ± 9 (0.0003 fishlm^2)
Deception to Horse Heaven					5.3 ± 10.5	

'Average value for July, August and September sampling
"July 20 sampling `August
21-25 sampling
°July 29 sampling
`Average value for 1980-1981
'Densities from transects from Laverne Creek to Iron Creek

Table 9. Summary of fishing regulations on the North Fork Coeur d'Alene and Little North Fork Coeur d'Alene rivers, Idaho, 1974-1993.

Year	Season	General regulation trout	Special regulations
1974	Last Sat. of May to October 31	7 lb. or 1 fish Max 10 trout	None
1975	Last Sat. of May to October 31	7 lb. or 1 fish Max 10 trout	Trout - limit 3 - 13" minimum NFCDAR above Yellow Dog Creek LNFCDAR above Laverne Creek
1976	Last Sat. of May to October 31	10 trout, 5 over 12" 2 over 18	Trout - limit 3 - 13" minimum NFCDAR above Yellow Dog Creek LNFCDAR above Laverne Creek
1977-1984	Last Sat. of May to October 31	6 fish, only 2 over 16"	Trout - limit 3 - 13" minimum NFCDAR above Yellow Dog Creek LNFCDAR above Laverne Creek
1985	Last Sat. of May	6 fish, only 2 over 16"	NFCDAR above Yellow Dog Creek Catch-and-Release LNFCDAR above Laverne Creek Trout limit 3 - 13" minimum
1986-1987	Last Sat. of May to October 31	6 fish, only 2 over 16"	NFCDAR above Yellow Dog Creek Catch-and-Release LNFCDAR above Laverne Creek Trout limit 3 - 13" minimum
1988-1989	Last Sat. of May to November 30	6 fish, only 2 over 16" Only 1 cutthroat must be over 14"	NFCDAR above Yellow Dog Creek LNFCDAR above Laverne Creek Catch-and-Release
1990-1993	Last Sat. of May to November 30	6 fish Only 1 cutthroat must be over 14"	NFCDAR above Yellow Dog Creek LNFCDAR above Laverne Creek Catch-and-Release

Table 10. Summary of fishing regulations on the St. Joe River, Idaho, 1969-1993.

Year	River section	Fishing season	Bag limit
1969-1970	St. Joe River	First weekend May to November 30	15 trout
1971	St. Manes to Prospector Creek	Memorial weekend to December 31	15 trout
	Prospector Creek upstream	Memorial weekend to December 31	3 trout > 13"
1972-1975	St. Manes to Prospector Creek	Memorial weekend to December 31	10 trout
	Prospector Creek upstream	Memorial weekend to December 31	3 trout > 13"
1976	St. Manes to Prospector Creek	Memorial weekend to December 31	10 trout, only 5 > 12"
	Prospector Creek upstream	Memorial weekend to December 31	3 trout, > 13"
1977	St. Manes to Prospector Creek	Memorial weekend to December 31	6 trout, only 2 > 16"
	Prospector Creek upstream	Memorial weekend to December 31	3 trout > 13"
1978	St. Manes to Prospector Creek	Memorial weekend to October 31	6 trout, only 2 > 16"
	Prospector Creek upstream	Memorial weekend to October 31	3 trout > 13"
1979	St. Manes to Prospector Creek	Memorial weekend to October 31	6 trout, only 2 > 16"
	Prospector Creek upstream	Memorial weekend to October 31	3 trout > 13"
1980	St. Manes to Prospector Creek	Memorial weekend to November 30	6 trout, only 2 > 16"
	Propector Creek upstream	Memorial weekend to November 30	3 trout > 13"
1981-1987	St. Manes to Prospector Creek	Memorial weekend to November 30	6 trout, only 2 > 16"
	Prospector Creek upstream	Memorial weekend to November 30	3 trout > 13"
1988-1993	St. Manes to Prospector Creek	Memorial weekend to November 30	6 trout, only 1 cutthroat > 14"
	Prospector Creek	Memorial weekend to November 30	Catch-and-release

Table 11. Number of bull trout redds counted per stream in the Lake Pend Oreille, Idaho drainage, 1983-1993.

Area	Total Redds Counted										
Stream	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
CLARK FORK RIVER	-	-	-	-	-		-				8
Lightning Creek	28	9	46	14	4		-	-		11	2
Spring Creek	0	-	0		-	-	-	-		-	-
East Fork	110	24	132	8	59	79	100	29		32	27
Savage Creek	36	12	29	-	0	-	-	-	-	1	6
Char Creek	18	9	11	0	2			-		9	37
Porcupine Creek	37	52	32	1	9			-		4	6
Wellington Creek	21	18	15	7	2	-	-	-		9	4
Rattle Creek	51	32	21	10	35	-	-	-	-	10	8
Johnson Creek	13	33	23	36	10	4	17	33	25	16	23
Twin Creek	7	25	5	28	0		-			3	4
NORTHERN SHORE											
Trestle Creek	298	272	298	147	230	236	217	274	220	134[d]	304
				(244)[f]	(217)[f]	(281)[f]	(243)[f]	(145)[f]	(306)[f]		
Pack River	34	37	49	25	14		-		-	65	21
Rapid Lightning Creek	-	0	-	0	-	-	-	-	-	-	-
Grouse Creek	2	108	55	13	56	24	50	48	33[b]	17	23
Hellroaring Creek	0	-	0	-	-		-	-	-		-
Jeru Creek	0	-	0	-		-		-	-	-	
EASTERN SHORE											
Granite Creek	3	81	37	37	30	-		-	-	0	7
Sulivan Springs	9	8	14	-	6	-	-	-	-	0	24
North Gold Creek	16	37	52	8	36	24	37	35	41	41	32
Gold Creek	131	24	111	78	62	111	122	84	104	93	120
Total 6 index streams	570	598	671	290	453	478	543	503	423`	333	529
Total all streams	814	881	930	412	555	-	-		-		656

4
4
7

1983 and 1984 data reported by Pratt (1985).
1985 and 1986 data reported by Hoelscher and Bjornn (1989).
[a] Not surveyed in 1991 due to early snow fall.
[b] Upper section not surveyed, count is from Chute Creek downstream.
[c] Represents only a partial count due to early snow fall.
[d] Lower section of Trestle Creek (mile 3 - P.S. rosd 275 to mouth) resurveyed 10/27/92, 41 redds counted for a stream total of 141. Initial survey on 10/7/92 yielded only 24 redds in the lower section for a stream total of 128.
[e] Clark Fork River added to survey streams in 1993.
[f] Survey numbers adjusted to account for kokanee redds in lower 1.6 km of Trestle Creek that may have been mistaken for bull trout redds.

RSTABLES

Priest Lake Drainage

In the Priest Lake drainage, a total of 18 definite and 8 possible bull trout redds were observed in 1993 (Table 12). With the expansion factor of 3.2 fish/redd, an estimated 58 bull trout comprised the spawning escapement in the surveyed streams in 1993.

Results of the surveys in the Priest Lake drainage indicated the depressed status of the bull trout in this system. Overharvest concerns were first addressed in 1973 when the tributary streams to Upper Priest Lake and Priest Lake were closed to fishing for bull trout. Both lakes were closed to harvest of bull trout in 1984. While competition and predation from lake trout *S. namaycush* in the lower lake may forever preclude bull trout from reestablishing, the upper lake does not appear to hold this constraint. For whatever reason, lake trout have not established at the same level of abundance in Upper Priest Lake and bull trout are still persisting. Stream habitat in the Upper Priest Lake drainage is not considered to be in as degraded condition as most of the streams in the Lake Pend Oreille or St. Joe River drainages. Differences in hydrology, geology, and land management intensity may be contributing to better spawning and rearing conditions in tributary streams. Protection of these tributary streams is of major importance to preserve and enhance the bull trout population in this system.

St. Joe River Drainage

In the upper St. Joe River drainage, a total of 71 definite and 74 possible bull trout redds were observed in 1993 (Table 13). Expanding the number of definite redds observed by 3.2 fish/redd, an estimated 227 bull trout spawned in the surveyed reaches of the upper St. Joe River in 1993.

The results from the 1992 and 1993 surveys of the upper St. Joe River drainage indicated that bull trout population levels remain depressed. The problems in the St. Joe River drainage, as with the Lake Pend Oreille drainage, are primarily due to habitat degradation. Angler harvest of bull trout has been closed in this drainage since 1988. Protection and enhancement of bull trout habitat in the St. Joe River drainage, as with other bull trout systems in north Idaho, is considered a major priority.

Kootenai River Kokanee Spawning Ground Counts

Early spawning kokanee from Kootenay Lake, British Columbia, Canada, utilize tributaries of the Kootenai River in Idaho for spawning. The Kootenay Lake South Arm stocks have been declining for many years. Several tributary streams were closed to kokanee fishing in 1984 in response to the declining runs. Estimates of the number of spawning kokanee in four

Table 12. Description of bull trout redd survey locations including transect description, distance surveyed, number of redds (and possible redds) observed, and survey date, Priest Lake, Idaho drainage 1993. Number of bull trout redds observed in the 1992 survey are also presented, although survey transects were not always the same.

Stream	Survey Section description	Survey Distance (kin)	Survey date	No. of redds 1993	No. of redds 1992	No. live fish 1993
Upper Priest River	Mouth of Rock Cr. downstream to F.S. trail 317 crossing	0.3	9/28-29	2	-	0
	Mouth of Lime Cr. downstream to the mouth of Snow Cr.	3.2 ,.	9/16	3	-	0
	Togo Gulch to the mouth	0.8'	9/27	0	-	2
Rock Creek	Mouth upstream to F.S. trail 308 crossing	0.5	9/28-29	(1)	-	0
Lime Creek	Mouth upstream approximately 0.8 km	0.8	9/16 & 28-29	0	-	0
Cedar Creek	Mouth upstream approximately 1.6 km	1.6	9/28-29	0	-	0
Ruby Creek	Mouth upstream to a barrier waterfall upstream from F.S. road 655	2.0	9/28-29	0	-	0
Hughes Fork	North end of Hughes Meadows upstream to F.S. trail 312 crossing	2.0	9/15	3 (1)	7	0
	Foot bridge on F.S. trail 311 downstream to F.S. road 622 bridge	2.4	9/16	(3)	2 (4)	0
	F.S. road 622 downstream to the mouth	8.0	9/28-29	1	-	2
Bench Creek	Mouth upstream approximately 0.8 km	0.8	9/15	2	0	0
Jackson Creek	Mouth upstream to F.S. trail 311 crossing	1.6	9/28-29	(1)	4	0
Gold Creek	Mouth upstream approximately 2 km	2.0	9/28-29	2 (2)	5	0
Boulder Creek	Mouth upstream approximately 1.6 km to a barrier waterfall	1.6	9/28-29	0	0	0
Trapper Creek	Mouth upstream to approximately 0.8 km upstream from East Fork	3.2	9/27	4	-	0
Caribou Creek	Mouth upstream to old road crossing	1.6	9/27	1	-	0

Possible bull trout redds not included in total redd count number.

Table 13. The number of bull trout redds and adult bull trout seen in *the* upper St. Joe River drainage, Idaho, October 3, 1992 and September 25, 1993.

Stream	Number of redds seen 1992	Number of redds seen 199	Number of adult fish seen 199	Number of adult fish seen 1993
St. Joe River from Bean Creek to Heller Creek	0	0	(1)[a]	0
St.Joe River from Heller Creek to St. Joe Lake	10	14 (29)[a]	1	0
Bacon Creek	0	0	0	0
Bean Creek	14	0	0	0
Beaver & Bad Bear Creek	2	2	0	0
California Creek	2 (3)[a]	4 (1)[a]	0	0
Gold Creek	-	2 (4)[1]	-	0
Heller Creek	0	0	0	0
Indian Creek		0		0
Medicine Creek	11	33 (1)[a]	0	13
Red Ives Creek	-	0		0
Ruby Creek	0	1 (6)[a]	0	0
Sherlock Creek	0	3 (6)[a]	0	0
Simmons Creek		7 (21)[a]	-	0
Washout, Redwood, & Goat Creek		3	-	0
Goat & Wampus Creek		0	-	0
North Fork Simmons Creek		1 (4)[a]	-	0
Timber Creek	-	0		0
Wisdom Creek	1	1 (1)[a]	0	0
Yankee Bar Creek	1	0	0	0
Total	57	71 (74)[a]	1	13

[a] Possible redds and adult bull trout, identification was not positive.

Kootenai River tributaries have been made during a one-day count in mid-August to early September since 1983 (Horner et al., 1996). The number of spawning kokanee observed in Smith Creek in 1993 dropped considerably from 1992 counts of 75+ spawning fish to only 15 fish in 1993. Boundary Creek remained the same in 1993 with 10 fish observed. No spawning kokanee have been observed in Long Canyon Creek for the past seven years. Four kokanee were seen in Parker Creek in 1993 (Table 14).

The decline in the kokanee stocks utilizing Kootenai River tributaries can be attributed to both problems in Kootenay Lake and habitat constraints in the tributary streams. The productivity of Kootenay Lake has dropped dramatically as a result of nutrients being trapped in Libby Reservoir several hundred kilometers upstream in Montana. Canadian officials have attempted a massive artificial fertilization program in Kootenay Lake to prevent the total collapse of all kokanee stocks in the lake. Channelization of the lower reaches of spawning tributaries and the impacts of sediment fines and bedload from land management practices have degraded kokanee spawning habitat. The fishing closure will remain in effect in hopes that these remnant stocks can somehow recover.

RECOMMENDATIONS

1. Conduct annual snorkeling surveys in the LNFCDAR, NFCDAR, and SJR. Increase the number of transects in the catch-and-release section of the LNFCDAR from two to five to get a more representative density.

2. Conduct biennial electrofishing population estimates in the LNFCDAR, NFCDAR and the SJR.

    a. Increase the length of each electrofishing transect in the LNFCDAR to 1.6 km at a minimum.
    b. Make two or three marking passes in the electrofishing transects on the NFCDAR and LNFCDAR to mark more fish.
    c. Consider using only walk and wade transects for all electrofishing population estimates.

3. Survey all 17 bull trout spawning streams in 1994 that were surveyed in 1992 and 1993 to establish a three-year trend for the entire Lake Pend Oreille drainage. Consider reducing survey efforts to the six index streams in 1995.

4. Continue to assist the Forest Service with bull trout redd surveys in the Upper Priest Lake and St. Joe River drainages and continue to survey Priest Lake tributaries outside Forest Service lands.

Table 14. Estimates of spawning kokanee salmon in tributaries to the Kootenai River, Idaho, 1983-1993.

Stream	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Boundary	10	55	200	10	0	0	30	4	1	10	10
Long Canyon	300	17	650	400	0	0	0	0	0	0	0
Parker	100	70	75	10	6	0	0	0	0	0	4
Smith	150	13	1,500+	400	35	200+	75	40	10	75+	15

1983 counts made on August 15
1984 and 1991 counts made on August 31
1985 counts made on September 6 1986
counts made on September 4
1987 - 1990 and 1993 counts made on September 1
1992 counts made on August 30

5. Continue with increased enforcement efforts in the tributary streams during the period of late summer and early fall when adult bull trout are vulnerable to illegal harvest.

6. Post bull trout identification and regulation signs indicating harvest closures.

7. Actively oppose any and all land use activities that could detrimentally impact bull trout habitat and support activities that protect or recover critical habitat.

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APPENDICES

Appendix A. Summary of snorkeling observations in transects in the North Fork Coeur d'Alene River, Idaho, July 1993.

					Number of fish observed						
					Cutthroat		Wild rainbow				
Transect number	River section	Length (m)	Width (m)	Area (m^2)	<300 (mm)	>300 (mm)	<300 (mm)	>300 (mm)	Hatchery rainbow	Whitefish'	Other'
1	4	63.0	17.8	1,121.4	0	0	0	0	0	0	0
2	4	56.0	13.7	767.2	1	1	0	0	0	0	0
3	4	85.0	15.4	1,311.1	6	0	0	0	0	5	0
4	4	83.5	25.9	2,162.7	0	0	0	0	0	0	0
5	4	187.3	16.5	3,107.8	2	6	0	0	0	0	0
6	3	95.0	23.4	2,227.8	7	1	0	0	0	39	0
7	3	82.5	14.4	1,188.0	1	1	0	0	0	0	0
8	3	90.0	21.1	1,899.0	3	1	0	0	0	18	0
9	3	120.0	28.0	3,360.0	20	1	0	0	0	60	0
10	3	140.0	30.4	4,256.0	9	1	0	0	0	22	0
11	2	155.0	43.0	6,665.0	1	0	0	0	0	0	0
12	2	190.0	31.3	5,953.3	1	0	0	0	0	0	0
13	2	305.0	33.3	10,166.7	3	1	0	0	0	29	0
14	2	196.6	30.9	6,079.9	13	2	0	3	0	65	0
15	2	214.9	33.7	7,242.1	4	5	0	0	0	12	0
16	1	103.9	39.7	4,124.8	8	0	0	1	0	13	0
17	1	115.0	26.8	3,082.0	36	2	0	1	5	25	0
18	1	212.0	34.3	7,278.7	21	2	0	0	0	0	0
19	1	121.0	33.1	4,005.1	30	10	0	0	16	22	0
20	1	205.0	39.3	8,063.3	28	4	0	0	1	70	0
21	1	150.0	43.0	6,450.0	28	1	0	0	0	20	102
22	1	180.0	45.5	8,190.0	26	2	0	1	9	29	3
23	1	95.0	40.7	3,866.5	40	16	0	0	4	24	1
34	5	105.0	9.9	1,039.5	0	0	0	0	0	0	0
35	5	22.6	15.3	346.9	1	1	0	0	0	0	0
36	5	78.0	20.7	1,614.6	0	6	0	0	0	0	0
37	5	N/A									
38	5	N/A									

[a] Whitefish includes adults and juveniles.
[b] Other includes squawfish and suckers.

Appendix B. Densities of fish observed while snorkeling in transects in the North Fork Coeur d'Alene River, Idaho, July 1993.

Transect number	River section	Length (m)	Width (m)	Area (m^2)	Cutthroat		Wild rainbow		Hatchery rainbow	
					No/m^2	No/100 m^2	No/m^2	No/100 m^2	No/m^2	No/100 m^2
1	4	63.0	17.8	1,121.4	0	0	0	0	0	0
2	4	56.0	13.7	767.2	0.003	0.3	0	0	0	0
3	4	85.0	15.4	1,311.1	0.005	0.5	0	0	0	0
4	4	83.5	25.9	2,162.7	0	0	0	0	0	0
5	4	187.3	16.5	3,107.8	0.003	0.3	0	0	0	0
6	3	95.0	23.4	2,227.8	0.004	0.4	0	0	0	0
7	3	82.5	14.4	1,188.0	0.002	0.2	0	0	0	0
8	3	90.0	21.1	1,899.0	0.002	0.2	0	0	0	0
9	3	120.0	28.0	3,360.0	0.006	0.6	0	0	0	0
10	3	140.0	30.4	4,256.0	0.002	0.2	0	0	0	0
11	2	155.0	43.0	6,665.0	0.0002	0.02	0	0	0	0
12	2	190.0	31.3	5,953.3	0.0002	0.02	0	0	0	0
13	2	305.0	33.3	10,166.7	0.0004	0.04	0	0	0	0
14	2	196.6	30.9	6,079.9	0.002	0.2	0.0005	0.05	0	0
15	2	214.9	33.7	7,242.1	0.001	0.1	0	0	0	0
16	1	103.9	39.7	4,124.8	0.0002	0.02	0.0002	0.02	0	0
17	1	115.0	26.8	3,082.0	0.01	1.0	0.0003	0.03	0	0
18	1	212.0	34.3	7,278.7	0.003	0.3	0	0	0	0
19	1	121.0	33.1	4,005.1	0.01	1.0	0	0	0.004	0.4
20	1	205.0	39.3	8,063.3	0.004	0.4	0	0	0.0001	0.01
21	1	150.0	43.0	6,450.0	0.004	0.4	0	0	0	0
22	1	180.0	45.5	8,190.0	0.003	0.3	0.0001	0.01	0.001	0.1
23	1	95.0	40.7	3,866.5	0.01	1.0	0	0	0.001	0.1
34	5	105.0	9.9	1,039.5	0	0	0	0	0	0
35	5	22.6	15.3	346.9	0.006	0.6	0	0	0	0
36	5	78.0	20.7	1,614.6	0.004	0.4	0	0	0	0
37	5	N/A								
38	5	N/A								

Appendix C. Number and estimated densities of fish observed in snorkeling transects in the Little North Fork Coeur d'Alene River, Idaho, July 1993.

Transect number	River section	Length (m)	Width (m)	Area (m^2)	cutthroat <300	cutthroat >300	wild rainbow <300	wild rainbow >300	rainbow	Whitefish[a]	Other[b]	cutthroat No/m^2	cutthroat No/100 m^2	wild rainbow No/m^2	wild rainbow No/100 m^2	hatchery rainbow No/m^2	hatchery rainbow No/100 m^2
24	8	88	16.7	1,469.6	0	1	0	0	0	0	0	.0007	0.07	0	0	0	0
25	8	103.9	17.6	1,828.6	0	0	0	0	0	0	0	0	0	0	0	0	0
26	7	100.0	15.5	1,550.0	0	3	0	0	0	0	0	0.002	0.2	0	0	0	0
27	7	71.0	25.0	1,775.0	0	2	0	0	0	0	0	0.001	0.1	0	0	0	0
28	7	104.0	16.2	1,684.8	16	2	0	0	0	0	0	0.01	1.0	0	0	0	0
29	7	143.9	19.6	2,820.4	0	0	0	0	0	0	0	0	0	0	0	0	0
30	7	38.1	15.4	586.7	0	0	0	0	18	0	0	0	0	0	0	0.03	3.1
31	7	195.4	12.5	2,442.5	0	0	0	0	2	0	0	0	0	0	0	0.0008	0.08
32	7	130.0	18.1	2,353.0	0	1	0	0	10	0	0	0.0004	0.04	0	0	0.004	0.4
33	7	62.5	26.0	1,625.0	2	1	0	0	3	0	0	0.002	0.2	0	0	0.002	0.2

[a] Whitefish includes adults and juveniles.
[b] Other includes squawfish and suckers.

Appendix D. Summary of snorkeling observations in transects in the St. Joe River, Idaho, August 1993.

				Number of fish observed								
				Cutthroat		Bull trout		Wild rainbow		Hatchery rainbow	Whitefish'	Other'
Transect number	Length (m)	Width (m)	Area (m^2)	< 300 (mm)	> 300 (mm)	< 300 (mm)	> 300 (mm)	< 300 (mm)	> 300 (mm)			
1	100.0	37.6	3,760	0	0	0	0	0	0	0	0	0
2	204.0	28.4	5,798	10	4	0	0	0	0	3	30	17
3	67.0	12.5	838	33	2	0	0	2	0	2	0	0
4	76.2	12.8	975	32	1	0	0	0	0	0	25	0
5	135.0	25.1	3,389	2	2	0	0	0	0	0	10	15
6	243.0	34.7	8,432	20	10	0	0	0	0	25	30	20
7	134.0	32.1	4,301	10	2	0	0	0	0	12	14	0
8	114.0	20.5	2,337	50	20	0	0	4	0	0	100	0
9	95.0	26.5	2,518	50	30	0	0	0	0	0	75	6
10	178.0	20.3	3,613	40	25	0	0	0	0	0	65	83
11	732.2	26.1	1,691	32	10	0	0	0	0	0	10	0
12	68.3	24.2	1,653	23	14	0	0	0	0	0	30	20
13	79.0	21.6	1,706	27	12	0	0	0	0	0	32	0
14	114.6	20.9	2,383	19	3	0	0	0	0	0	75	0
15	170.0	16.0	2,720	12	6	0	0	0	0	0	13	0
16	125.0	15.0	1,875	18	10	0	0	0	0	0	25	0
17	128.0	15.0	1,920	22	11	0	0	0	0	0	35	0
18	50.0	16.0	800	47	25	0	0	0	0	0	60	0
19	53.0	18.8	996	17	8	0	0	0	0	0	3	0
20	86.0	17.3	1,488	25	12	0	0	0	0	0	30	0
21	29.8	14.2	423	13	0	0	0	0	0	0	16	0

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Appendix D. Continued.

				Number of fish observed								
				Cutthroat		Bull trout		Wild rainbow		Hatchery rainbow	Whitefish[a]	Other[b]
Transect number	Length (m)	Width (m)	Area (m^2)	<300 (mm)	> 300 (mm)	<300 (mm)	> 300 (mm)	< 300 (mm)	> 300 (mm)			
22	72.0	23.5	1,692	13	11	0	1	0	0	0	30	0
23	74.0	11.4	88	3	0	0	0	0	0	0	2	0
24	66.0	17.5	1,155	15	10	0	0	1	0	0	15	0
25	55.0	15.3	842	3	0	0	0	0	0	0	11	0
26	86.0	22.8	1,961	2	22	0	0	0	0	0	5	0
27	40.0	20.5	820	0	12	0	0	0	0	0	0	0
28	118.0	13.5	1,593	10	8	0	0	0	0	0	15	0
29	200.0	38.0	7,600	4	0	0	0	8	1	1	30	120
30	150.0	57.0	8,550	0	0	0	0	12	0	1	25	75
31	150.0	47.1	7,066	17	2	0	0	0	0	2	18	3
32	100.1	52.0	5,205	2	1	0	0	0	0	30	20	6
33	175.0	55.1	9,643	0	0	0	0	0	0	0	6	0
34	100.2	25.4	2,545	1	2	1	0	0	0	0	150	25
35	100.0	33.1	3,310	0	2	0	0	0	1	0	15	34

[a] Whitefish includes the number of juveniles and adults.
[b] Includes squawfish and suckers.

Appendix E. Densities for fish observed while snorkeling in transects in the St. Joe River, Idaho, August 1993.

Transect number	Cutthroat		Bull trout		Wild rainbow		Hatchery rainbow		Total salmonids	
	no/m^2	no/100 m^2	no/m^2	no/100 m^2	no/m^2	no/100 m^2	no/m^2	no/100 m^2	no/m^2	no/100 m^2
1	0	0	0	0	0	0	0	0	0	0
2	0.002	0.2	0	0	0	0	0.001	0.1	0.003	0.3
3	0.04	4.2	0	0	0.002	0.2	0.002	0.2	0.04	4.7
4	0.03	3.4	0	0	0	0	0	0	0.03	3.4
5	0.001	0.1	0	0	0	0	0	0	0.001	0.1
6	0.004	0.4	0	0	0	0	0.003	0.3	0.006	0.7
7	0.003	0.3	0	0	0	0	0.003	0.3	0.006	0.6
8	0.003	3.0	0	0	0.002	0.2	0	0	0.03	3.2
9	0.03	3.2	0	0	0	0	0	0	0.3	3.2
10	0.02	1.8	0	0	0	0	0	0	0.02	1.8
11	0.02	2.5	0	0	0	0	0	0	0.02	2.5
12	0.02	2.2	0	0	0	0	0	0	0.02	2.2
13	0.02	2.3	0	0	0	0	0	0	0.02	2.3
14	0.009	0.9	0	0	0	0	0	0	0.009	0.9
15	0.007	0.7	0	0	0	0	0	0	0.007	0.7
16	0.02	1.5	0	0	0	0	0	0	0.02	1.5
17	0.02	1.7	0	0	0	0	0	0	0.02	1.7
18	0.09	9.0	0	0	0	0	0	0	0.09	9.0
19	0.03	2.5	0	0	0	0	0	0	0.03	2.5
20	0.02	2.5	0	0	0	0	0	0	0.02	2.5
21	0.03	3.1	0	0	0	0	0	0	0.03	3.1
22	0.01	1.4	0.001	0.01	0	0	0	0	0.02	1.5
23	0.003	0.3	0	0	0	0	0	0	0.003	0.3
24	0.02	2.2	0	0	0.001	0.01	0	0	0.02	2.3

Appendix E. Continued.

Transect number	Cutthroat		Bull trout		Wild rainbow		Hatchery rainbow		Total salmonids	
	no/m^2	no/100 m^2	no/m^2	no/100 m^2	no/m^2	no/100 m^2	no/m^2	no/100 m^2	no/m^2	no/100 m^2
25	0.004	0.4	0	0	0	0	0	0	0.004	0.4
26	0.01	1.2	0	0	0	0	0	0	0.01	1.2
27	0.01	1.5	0	0	0	0	0	0	0.01	1.5
28	0.01	1.1	0	0	0	0	0	0	0.01	1.1
29	0.001	0.1	0	0	0.001	0.1	0.0001	0.01	0.002	0.2
30	0	0	0	0	0.001	0.1	0.0001	0.01	0.002	0.2
31	0.003	0.3	0	0	0	0	0.0002	0.02	0.003	0.3
32	0.001	0.1	0	0	0	0	0.006	0.6	0.006	0.6
33	0	0	0	0	0	0	0	0	0	0
34	0.001	0.1	0.0004	0.04	0	0	0	0	0.002	0.02
35	0.001	0.1	0	0	0.0003	0.03	0	0	0.001	0.01

1993 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management F-71-R-18

Project II: Technical Guidance

Subproject II-A: Panhandle Region

Contract Period: July 1, 1993 to June 30 1994

ABSTRACT

Panhandle Region Fisheries Management personnel provided private individuals, organizations, and state and federal agencies with technical review and advice on various projects and activities that affect the fishery resources in northern Idaho. Technical guidance also included numerous angler informational meetings, presentations, and letters, development of the Panhandle Region portion of the 1-800 ASK-FISH program, and fishing clinics.

Author:

Ned Horner
Regional Fishery Manager

OBJECTIVES

1. To furnish technical assistance, advice, and comments to other agencies, organizations, or individuals regarding projects that affect fishery resources in northern Idaho.

2. To promote the understanding of fish biology and fish habitat needs and the ethical use of the fishery resource through individual contact, club meetings, public presentations, informational brochures, and fishing clinics.

METHODS

Regional fisheries management personnel provided both written and oral technical guidance.

RESULTS

The technical guidance provided by Panhandle Region Fisheries Management personnel focused on activities that directly affected fishery resources or resource users in north Idaho. Numerous presentations and programs were made to civic and sportsmen's groups throughout the year. Letters were sent to numerous individuals and organizations in response to specific questions about the fisheries in north Idaho.

Fishing Clinics

Regional Fisheries Management personnel coordinated four Free Fishing Day fishing clinics in the region. Department sponsored clinics were held in Coeur d'Alene, Mullan, Bonners Ferry, and Round Lake State Park. We also provided fish and guidance for clinics at Priest Lake and St. Maries sponsored by the U.S. Forest Service. The clinics were geared toward teaching young anglers how to fish (casting, baiting hooks, etc.), fish identification, the reasons for regulations, fishing ethics, and how to clean fish. The emphasis was on education and not competition. Numerous regional personnel, people from other state and federal agencies, and sportsmen's groups assisted in making the clinics a big success.

1-800-ASK-FISH

The Regional Fishery Manager provided information on north Idaho fishing opportunities for the 1-800-ASK-FISH angler information program. Several tackle shops and local fishing experts were consulted biweekly to provide additional information on fishing activities.

Kootenai River Sturgeon and Burbot

The Regional Fishery Manager continued to participate in technical discussions with other Department personnel, Kootenai Tribal members, Bonneville Power Administration (BPA), U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service (USFWS), local, state and federal politicians, and other interested parties in an attempt to resolve problems with the aquatic ecosystem in the Kootenai River. A proposed rule listing Kootenai River white sturgeon *Acipenser transmontanus* as an endangered species under The Endangered Species Act was issued on July 7, 1993. Actual listing would not occur until July 7, 1994, however. Research on the depressed burbot population also began during 1993.

A flow test was conducted in the Kootenai River by the Corps of Engineers during June of 1993 in an attempt to stimulate sturgeon to spawn. About 20,000 cubic feet per second (cfs) was released for 14 days when water temperatures were deemed suitable for spawning. After 14,715 hours of sampling effort, three confirmed sturgeon eggs were collected. The Corps and BPA deemed the flow test successful, whereas the Department concluded these flows were inadequate for recruitment

The flow test scheduled for 1994 included additional measures to enhance spawning conditions for sturgeon, but maximum releases were still capped at 20,000 cfs at Bonners Ferry. Natural flows would be supplemented during May to provide 15,000 cfs. As water temperatures and fish activity indicated spawning was close, flows would be ramped up to 20,000 cfs and held for 35 days. Flows would then be ramped down to 11,000 cfs over three days and held for 28 days. No load following (power peaking) would occur during the entire test. Research on sturgeon and burbot life history and recruitment and aquatic ecosystem productivity continued in 1994.

Lake Pend Oreille Water Management

The Regional Fishery Manager continued to participate in efforts to change lake level management on Lake Pend Oreille. The proposal to reduce the existing 11.5 ft drawdown to a 6.5 ft drawdown has met with strong support from the public and equally strong opposition from the Corps of Engineers and electric utility industry.

The proposal received an endorsement from the Northwest Power Planning Council (NPPC) in their Phase 4 Resident Fish Amendment process. However, it took several months of discussions with a host of interested parties (BPA, Corps of Engineers, Washington Water Power, Pacific Northwest Utilities Conference Committee, University of Idaho, Kalispell Tribe, etc.) to develop a study plan that was submitted to NPPC in March 1994 for their rule making process. A key component to the study proposal is changing the winter pool level from elevation 2,051 to *2,055.5* for a period of three years and evaluating the response in the kokanee population. We had requested these levels in 1994, 1995, and 1996. Continued resistance from the Corps, utility companies, and others made the change in lake level management and subsequent study uncertain.

Bull Trout Conservation Plan

Bull trout were petitioned for listing as an endangered species in Idaho and five other western states in October 1992: The U.S. Fish and Wildlife Service had not developed a status review or issued a proposed rule for listing by the one-year deadline or even by January of 1994. Governor Andrus of Idaho directed state and federal agencies to develop a conservation plan for bull trout that would address the threats to bull trout and avoid the need for federal listing.

The Regional Fishery Manager participated in an interagency/interdisciplinary effort in February 1994 to develop a Conservation Agreement for bull trout. The agreement was based after federal efforts for listed anadromous stocks of Pacific salmon and utilized the metapopulation management concepts of Rieman and McIntyre (1993) and Frissell (1993) and the land management concepts endorsed by the Forest Ecosystem Management Assessment Team (1993) report.

As of April 1994, the USFWS had still not completed the status review or issued a proposed rifle. The original petitioners had sued the USFWS to force them to issue a ruling. The Idaho Conservation Agreement had been accepted by federal agencies (U.S. Forest Service, U.S. Bureau of Land Management), but was not considered mandatory for state or private lands.

Miscellaneous

The Regional Fishery Manager provided input on numerous information requests for bull trout as related to the petition to list bull trout under the Endangered Species Act. The Coeur d'Alene Indian Tribes proposal for fishing closures on four tributaries to Coeur d'Alene Lake were addressed in the regulation brochure. Several coordination meetings were held with hatchery, research, and enforcement personnel to insure management goals were achieved. Several minor fish kills were addressed. Data on the sport fishery of Lake Pend Oreille was submitted to the Outfitters and Guides Board to be considered in resolving the issue of how many fishing guides is enough on the big north Idaho lakes.

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1993 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management F-71-R-18

Project III: Habitat Management

Subproject III-A: Panhandle Region

Contract Period: July 1. 1993 to June 30 1994

ABSTRACT

Landowners adjacent to Hoodoo Creek were contacted and provided with technical information on how to improve stream and riparian habitat to enhance fish populations. Willow cuttings were also provided to landowners on Hoodoo Creek to plant adjacent to the stream course on their property.

In 1993, biologists designed and installed a fishway at the outlet of McArthur Reservoir to allow fish passage over the outlet dam.

Authors:

Lance Nelson
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

METHODS

Hoodoo Creek

The majority of landowners cooperating with the restoration of Hoodoo Creek are recent owners of the land who have contacted the Department for advice on managing their land and adjacent streams to enhance fish and wildlife populations. Biologists have provided landowners with technical information regarding stream and riparian restoration and have provided willow cuttings and other riparian vegetation and volunteer labor to assist landowners with riparian restoration or enhancement.

McArthur Reservoir Fishway

Biologists made a physical survey of the outlet of McArthur Reservoir to determine the required dimensions of a fishway to provide passage for migrating rainbow trout through McArthur Reservoir in tributary streams. Literature review and correspondence with engineers in Alaska that were involved with fishway construction led to the design of a temporary fishway that would provide fish passage. The fishway was constructed out of plywood and angle iron. The lower section of the ladder consisted of a Denil-type fishway to provide passage over a 42% slope with a run of 4.42 m (Figure 1). The upper section of the ladder, which provided passage over a flat 10 m section of concrete apron directly below the dam face (Figure 1), consisted of a typical pool/drop fishway with offset notch baffles.

RESULTS AND DISCUSSION

Hoodoo Creek

In 1993, two landowners were advised as to the potential for stream/riparian restoration. Mark Sauter has approximately 45 acres of land located near the mouth of Hoodoo Creek. The section of Hoodoo Creek running through Sauter's land is in an area that is relatively undisturbed and in good condition. Biologists recommended no direct habitat improvement on the property, but did suggest ways to minimize potential impacts due to road and bridge construction.

The second landowner, Dan Figuroa, purchased the old Dolstrom place, located south of the Vay store. This land holding consists of 16 ha with approximately 450 m of stream course on his ground. This section of Hoodoo Creek is typical of the majority of Hoodoo Creek which has been dredged in the past and has little if any riparian cover that would be of benefit to fish. Biologists furnished Mr. Figuroa with information which would improve the stream and

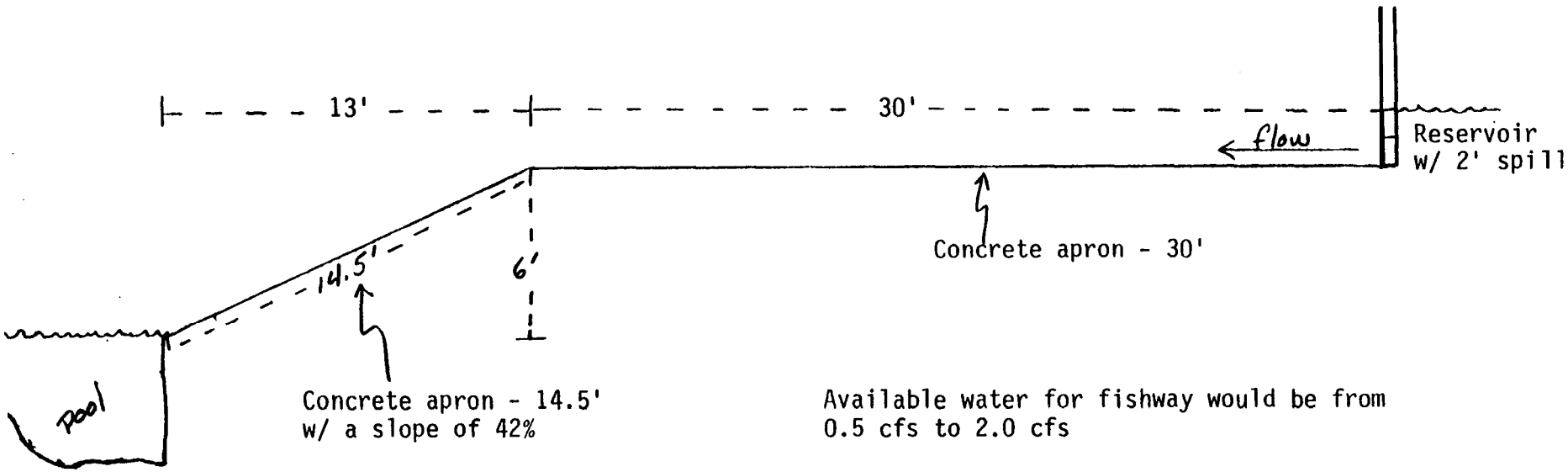

Figure 1. McArthur Reservoir spill apron and location for temporary fishway.

riparian habitat on his property and provided him with willow cuttings to plant along the stream banks. The degradation of Hoodoo Creek is so severe that the enhancement of vegetation along short sections of the stream is not the answer. I do not recommend that the Department abandon Hoodoo Creek, but I do think that the work here is better left to the Regional Habitat Biologists.

McArthur Reservoir Fishway

The fishway was installed and operational by the end of April 1993. Shortly after, fish were observed jumping at the mouth of the ladder and in the upper section of the ladder. While some fish were able to utilize the ladder and gain access to McArthur Reservoir, the ladder design does not provide acceptable passage for all fish. This structure was designed to provide a temporary solution to the long-standing problem of fish passage over the McArthur Reservoir Dam. Reconstruction of the south half of the McArthur Reservoir Dam and the installation of a permanent fishway was budgeted for the fall of 1994.

1993 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management F-71-R-18

Project IV: Population Management

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Contract Period: July 1. 1993 to June 30 1994

ABSTRACT

No lakes in the Panhandle Region were restored with rotenone during this contract period.

Author:

Ned Horner
Regional Fishery Manager

Submitted by:

Lance Nelson
Regional Fishery Biologist

Jim Davis
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Steven M. Huffaker, Chief
Bureau of Fisheries

Bill Hutchinson
State Fisheries Manager