F-78-R-5
F-78-R-6
F-113-R-1
Region 4

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION

STATE: MONTANA

FEDERAL AID PROJECT NUMBER: F-78-R-5
F-78-R6
F-113-R1

PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

JOB TITLE:

Hauser and Holter Reservoirs Fisheries Management

ANNAUL REPORT FOR 1998 and 1999

Abstract: Fisheries data were gathered on Hauser and Holter reservoirs to provide information needed to: 1) manage the fishery of the two reservoirs; 2) evaluate impacts of reservoir operations on the sport fishery; and 3) evaluate the success of the hatchery stocking program. This report summarizes data collected during the 1998 and 1999 field seasons.

Hauser Reservoir

In Hauser Reservoir, 1,033 anglers were surveyed during the 1998 summer creel and 1,016 in 1999 (April through October). Angler catch rates for kokanee remained low at 0.01 (1998 and 1999) fish per hour. Rainbow trout catch rates improved slightly from 0.08 (1998) to 0.12 (1999) fish per hour. Yellow perch fishing slowed from 0.12 (1998) to 0.06 (1999) fish per hour. Angler satisfaction (percentage of anglers indicating they were satisfied or very satisfied with the quality of fishing) increased from 40% in 1998 to 47% in 1999; (this compares with 12% in 1997). Fewer anglers [36% (1998) and 29% (1999)] said they were dissatisfied or very dissatisfied with fishing on Hauser reservoir. Satisfaction with size of fish remains high with 69% (1998) and 75% (1999) responding they are satisfied or very satisfied. Total combined harvest of kokanee and rainbow trout in Hauser was approximately 14,300 (1998) and 29,000 (1999), well below the long-term average of 67,400. Evidence suggests that the Hauser fishery continues to recover from flushing losses incurred during record high water runoff in 1995, 1996 and 1997.

Gillnetting efforts continue to illustrate significant species assemblage changes that have occurred in recent years in Hauser reservoir. Kokanee populations remain depressed with only one fish collected in the 1998 summer vertical series and two in 1999. However, in fall horizontal gillnets, 31 (four age 2; 27 age 3) kokanee were collected in 1998 and 16 (16 age 3) in 1999. Hatchery kokanee contributed little to the Hauser fishery with zero hatchery fish collected in 1998 and nine of 18 in 1999 (two fish from 1998 plant) in horizontal and vertical gillnets. Walleye outnumbered rainbow in spring and fall (combined sinking and floating nets) gillnets to become the most dominant game fish numerically in 1998 (51 to 45 respectively). In 1999 numbers were nearly identical at 33 walleyes and 34 rainbow trout. Poor growth of walleye indicates densities exceed the capacity of the depressed forage base. Trap netting was initiated in 1999 to determine the walleye spawning population. However, of the 178 walleyes that were collected with this passive sampling gear, all were sexually immature. Beach seine results indicate a modest rebound by the yellow perch population in 1998 however; a record number of

YOY walleyes were also collected in 1998. White and longnose suckers continued to dominate (>80%) both the spring and fall sinking gill net catch in 1998 and 1999. Hydroacoustic estimates of fish abundance in Hauser Reservoir for 1998 remained at 200,000 fish (s.d. 90,000) while 1999 estimates fell by half to 100,000 (s.d. 80,000). Estimates were completed for the area from Eldorado Bar to Hauser Dam including the lower half of the Causeway Arm.

Holter Reservoir

Holter Reservoir creel surveyed 929 anglers during the 1998 summer creel and 897 in 1999 (April through October). Angler catch rates for kokanee salmon throughout the summer declined from a low 0.01 (1998) to a nearly undetectable 0.002 (1999) fish per hour. Rainbow trout catch rates remained good at 0.10 (1998) and 0.14 (1999) fish per hour while yellow perch fishing success rebounded moderately from 0.10 (1998) to 0.23 (1999) fish per hour. Angler satisfaction (percentage of anglers indicating they were satisfied or very satisfied with the quality of fishing) improved from 1997 (13%) to 43% in 1998 and 54% in 1999. Conversely, 32% of anglers interviewed in 1998 and 27% in 1999 said they were dissatisfied or very dissatisfied with fishing on Holter reservoir. Satisfaction with fish size remains high with 70% (1998) and 88% (1999) responding they are satisfied or very satisfied. Total combined harvest of kokanee and rainbow trout in Holter was approximately 17,900 (1998) and 39,000 (1999). This compares with the long-term average combined harvest of 52,300 fish.

The conversion from Arlee to Eagle Lake rainbow trout in 1996 is starting to produce results. Spawning surveys on Beaver Creek in 1998 and 1999 indicate record numbers of fluvial rainbow trout moved into the creek to spawn however, due to low water and many large beaver dams, redd counts were well below the long-term average. Cottonwood and Willow Creeks were also surveyed in 1998 and 1999 for spawning rainbow trout. No fish were observed above the numerous, large beaver dams at the mouths of both creeks. Average length of rainbow in fall floating gillnets has steadily increased to reach an unprecedented high in 1999 of 19.2 inches and 2.9 pounds. Walleye numbers made a dramatic increase in both spring and fall sinking gillnets. In 1999, walleye catch rates in fall sinking nets reached a 14-year high at 9.5 fish per net. Conversely, perch collected in 1999 fall sinking gillnets reached a 14 year low of 0.3 fish per net. On a positive note, beach seine results indicate that two record year classes of perch were produced in 1998 and 1999. Kokanee salmon caught in spring and fall floating gill nets remained very low at one fish and the summer vertical gill net series mirrored this trend. July through September verticals collected only 4 in 1998 and 3 in 1999. Nearly all (86%) of the

kokanee were of hatchery origin from the 1997 and 1998 plant into Hauser. Suckers (white and longnose) dominated the catch in both spring and fall sinking gill nets during both 1998 and 1999 (Range = 79% to 86%). Trap nets were fished for 52 net nights capturing 64 walleye. Although trap-netting data suggests a decline in the abundance of spawning age walleyes in Holter, be aware that traps were fished in 1998 nearly exclusively for yellow perch and in 1999 were fished for only one week (versus two in the past). Hydroacoustic estimates of fish abundance in Holter Reservoir for 1998 increased from 1997 (200,000) to 900,000 fish (s.d. 790,000) while 1999 estimates tripled to 2.8 million fish (s.d. 2.4 million). Estimates were completed for the area from Cottonwood Creek flats to Holter Dam.

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PROCEDURES

The study area has been previously described by Rada (1974), Berg and Lere (1983) and MFWP (1985). A map of the two reservoirs is presented in Figure 1. Reservoir fish were sampled with floating and sinking 6 x 125-foot experimental gill nets (0.75 to 2-inch mesh). Nets were fished in each reservoir during the spring and fall at locations used between 1986-1997. Distribution of fish species by depth was determined by using a gang of six (only four; 0.75 through 1.5 inch are used for the trend series) vertical gill nets that are 150 feet deep and 12 feet wide (0.5, 0.75, 1, 1.25, 1.5 and 2.0 inch mesh). Vertical nets were set during July, August and September at permanent sampling stations located at the lower end of each reservoir (the Dam station on Hauser Reservoir and the Jackson station on Holter Reservoir). Single-lead trap nets (4 x 6 foot frame with either 1" or ½" mesh) were used to sample yellow perch and walleye on Hauser and Holter Reservoir in spring 1999 and 2000. A partial creel census was conducted on Hauser and Holter reservoirs from April through October. Procedures for this partial creel census are described in Lere (1987). An additional partial creel survey was conducted during ice covered months on the two reservoirs from January through March. Hydroacoustic methods used to estimate pelagic fish densities and total fish abundance are described in Skaar and Humphrey (1995). Starting in 1998 a new Hydroacoustics Technology Inc. (HTI) split beam digital echo sounder (200 kHz) was used to transmit and receive signals from a split beam system (boat mounted 15^0 circular transducer). Data was collected in digital format to an onboard computer using HTI Digital Echo Processor (DEP) software. HTI EchoView software was used to track acoustic targets. Beginning in 1998, volumetric estimates (versus areal) of pelagic fish abundance were completed for the lower portions of Hauser and Holter reservoirs using bathymetric data. Hauser population estimates include all waters downstream of Eldorado Bar and the lower half of the Causeway arm. Holter estimates include all waters downstream of Cottonwood flats. Attempts were made each year to complete hydroacoustic sampling during new-moon phases. In 1998, hydroacoustic surveys were completed between September 14 and 15 and in 1999, surveys were completed between September 21 and 24.

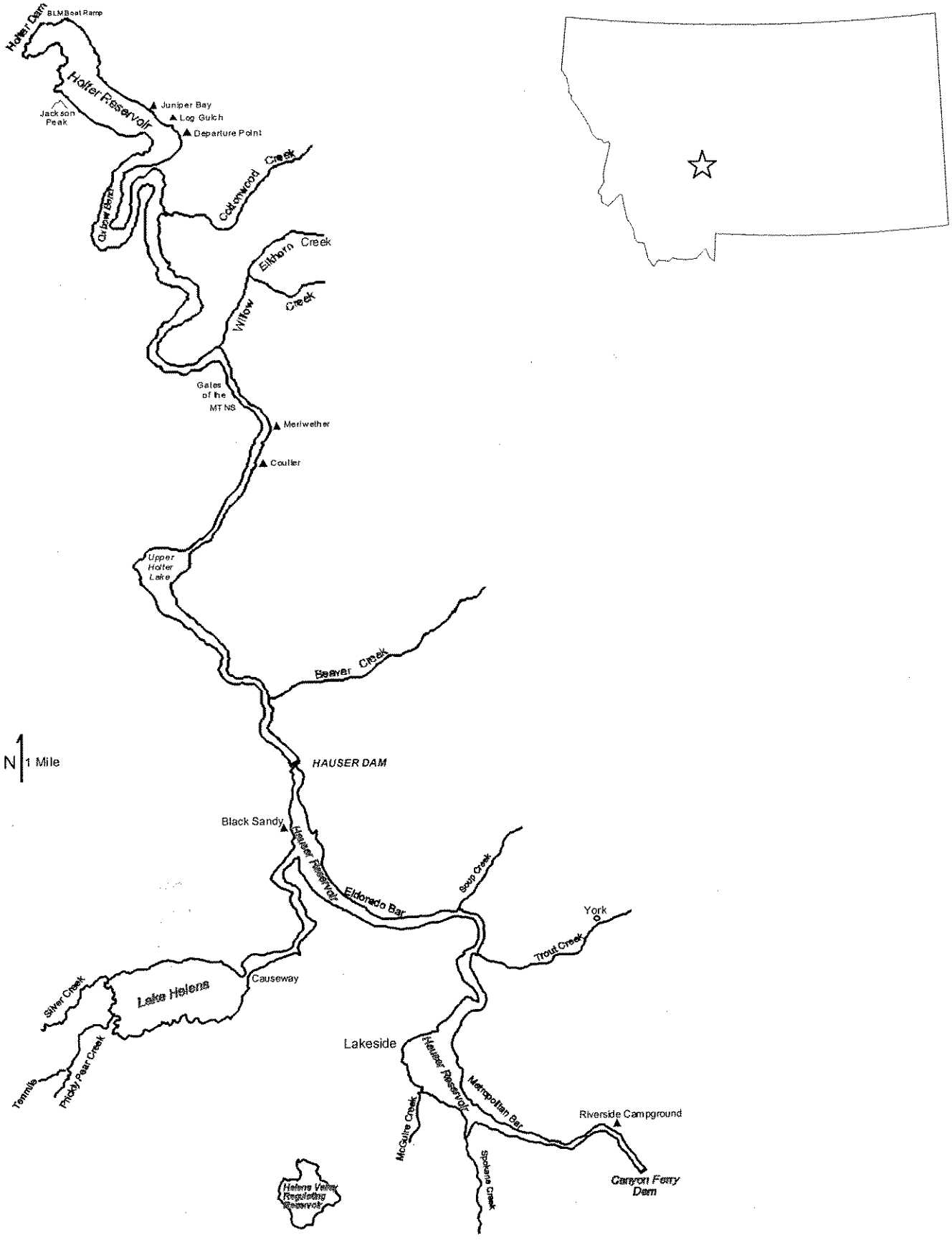

Figure 1. Map of Hauser, Holter and the Helena Valley Regulating Reservoirs.

Hauser Reservoir

Creel Surveys

Summer Creel : In 1998, 1,033 anglers were interviewed and 1,016 in 1999 during the weekend summer creel on Hauser Reservoir. For 1998, the average time spent fishing was 4.0 hours for shore anglers (71 interviews) and 4.7 hours for boat anglers (344 interviews). In 1999, the average shore trip was 3.6 hours (68 interviews) and 4.8 hours for a boat based trip (324 interviews). Total catch for 1998 included 287 rainbow trout, 441 yellow perch, 45 kokanee, 141 walleye and 2 brown trout. Total catch for 1999 recorded a record 506 walleye, 439 rainbow trout, 209 yellow perch, 38 kokanee, and 25 brown trout. Total number of walleyes caught in 1999 surpassed rainbow, yellow perch and kokanee as the most popular game fish. Walleye catch rates showed a dramatic jump from 1998 to 1999 with the highest catch rate recorded in July of 1999 at 0.35 fish an hour. However, only 33% of these fish were actually kept due to small average size (13.6 inches, 0.9 pounds).

Rainbow trout catch rates nearly doubled from 0.08 (1998) to 0.12 (1999) fish per hour accompanied by an increase in average size to 17.4 inches (1999) to remain well above the long-term average (15.8 inches) (Table 1). Total harvest of rainbow trout in 1999 (26,500) reached near record levels attained only in the late 1980's when an average 220,000 rainbows were stocked annually. Curiously, only 115,000 rainbows have been stocked annually since 1990. Beginning in 1999, the number of Arlee rainbow planted into Hauser was increased to 174,000 in an effort to compensate for the sagging kokanee salmon fishery. The proportion of wild rainbow trout collected in spring floaters remained near the long-term average (10%) at 11% in 1998 and 9% in 1999 (Appendix J).

Kokanee salmon densities, based on gill net catch rates and hydroacoustics estimates, remained extremely low in 1998 and 1999 even though a hatchery augmentation program was initiated in 1997. Catch rates during the 1998 and 1999 summer season remained at record lows of 0.01 fish per hour. Summer vertical netting in 1998 and 1999 remained well below the long-term average (43.7) at 0.3 and 0.7 fish per net night. On a positive note, average size of kokanee in 1999 summer creel showed a marked increase to 19.1 inches including a new state record kokanee weighing 6.03 pounds. In response to the declining fishery, 153,000 kokanee were planted in 1997. However, extremely high water in 1997 likely had an adverse impact on survival of these fish. In 1998, 121,800 fry and 220,000 fingerlings were planted into Lake Helena and Hauser reservoir respectively. In 1999, 86,400 fry were again planted into Lake Helena and 221,700 fingerlings were planted into Hauser. All fish to date have been single tetracycline marked in the

hatchery prior to planting. Survival from these plants has been poor with only one kokanee collected during the summer vertical series in 1998 and two in 1999. Vertical gillnets run in addition to the summer series (April, May, June and October) collected 18 total kokanee of which 50% were of hatchery origin in 1999.

Table 1. Summer catch rates, mean size, and harvest of selected species in Hauser Reservoir. Harvest estimates include winter ice fishing.

	RAINBOW			KOKANEE			YELLOW PERCH			WALLEYE		
Year	Catch rate (fish/hr)	Mean Size (inches)	Harvest (X 1000)	Catch rate (fish/hr)	Mean Size (inches)	Harvest (X 1000)	Catch rate (fish/hr)	Mean Size (inches)	Harvest (X 1000)	Catch rate (fish/hr)	Mean Size (inches)	Harvest (X 1000)
1986	0.25	13.5	-	0.10	16.6	-	0.13	8.6	-	0.00	N/A	-
1987	0.24	14.2	-	0.13	15.6	-	0.12	9.7	-	0.00	N/A	-
1988	0.24	15.8	-	0.24	16.3	-	0.06	9.6	-	0.00	N/A	-
1989	0.12	13.7	25.5	0.42	14.6	101.4	0.10	7.7	27.2	0.00	N/A	N/A
1990	0.10	14.9	27.8	0.22	15.7	60.9	0.17	8.9	38.9	0.00	N/A	N/A
1991	0.02	15.3	7.8	0.46	14.7	141.3	0.08	8.1	36.8	0.00	N/A	N/A
1992	0.05	15.1	13.0	0.22	15.8	78.4	0.16	9.0	55.4	0.0005	*	*
1993	0.05	16.3	16.5	0.22	16.0	89.3	0.05	9.0	49.4	0.00	N/A	N/A
1994	0.02	16.6	4.2	0.15	14.8	37.1	0.15	10.6	38.2	0.00	N/A	N/A
1995	0.05	17.5	11.5	0.11	17.0	29.1	0.16	8.9	23.2	0.002	*	*
1996	0.05	17.5	14.8	0.10	14.1	17.4	0.31	9.4	35.0	0.002	*	*
1997	0.08	16.9	13.9	0.03	16.8	7.4	0.07	8.4	19.0	0.001	*	*
1998	0.08	16.4	12.0	0.01	16.3	2.3	0.12	9.8	31.6	0.04	16.4	5.9
1999	0.12	17.4	26.5	0.01	19.1	2.5	0.06	9.2	14.5	0.14	13.6	7.9
Mean	0.11	15.8	15.8	0.17	16.0	51.6	0.17	16.0	51.6	0.013	15.0	1.0

Harvest estimates for 1986 - 88 were not estimated because creel surveys were not completed during winter months.
* Insufficient sample size.

Winter Creel: A total of 197 and 255 ice fishermen were interviewed in 1998 and 1999 respectively (Table 2). With the significant decline in the kokanee harvest, total number of fish recorded during both years was well below the long-term average of 653. Brown trout and kokanee were scarce in the creel while rainbow trout catch rates were near average in 1998 at 0.05 and near record levels in 1999 at 0.17 fish per hour. The average size of the rainbows in the 1999 creel was 16.8 inches (range = 11.5 to 22.7 inches) with 48% of these fish being greater than 18 inches. Winter walleye fishing on Hauser was legitimized in a big way in 1999 with a 0.02 fish per hour catch rate. This was the first year since 1989 that sufficient numbers of walleye were recorded in the winter creel to register a positive catch rate. However, average size was 13.2 inches (range = 9.3 to 17.0 inches). Yellow perch catch rates remained well below the long-term average of 0.40 perch per hour for 1998 (0.21) and 1999 (0.13). Average size of perch remained good at 8.7 inches in 1998 and 9.2 inches in 1999.

Table 2. Total catch, number of interviews and angler catch rates for the principal game species from winter creel surveys on Hauser Reservoir.

			Catch Rates (fish per hour)				
Year	**# of Interviews**	**Total Fish**	**Rainbow**	**Brown**	**Kokanee**	**Perch**	**Walleye**
1989	573	882	0.18	0.01	0.23	0.2	0.00
1990	300	337	0.11	<0.01	0.18	0.2	0.00
1991	451	723	0.08	0.01	0.18	0.6	0.00
1992	566	1177	0.02	<0.01	0.30	0.45	0.00
1993	635	2234	0.04	0.01	0.47	0.88	0.00
1994	197	457	0.01	0.02	0.03	0.76	0.00
1995	323	624	0.04	<0.01	0.06	0.45	0.00
1996	247	141	0.04	<0.01	<0.01	0.15	0.00
1997	297	281	0.08	0.00	0.01	0.34	0.00
1998	197	115	0.05	0.00	0.00	0.21	0.00
1999	255	207	0.17	<0.01	<0.01	0.13	0.02
Mean	367	653	0.07	<0.01	0.13	0.40	<0.01

Trend Netting and Hydroacoustic Estimates of Fish Abundance

Floating Gill Nets: Species composition collected in spring and fall floating horizontal gillnets are shown in Appendix A - B. Rainbow trout catch rates in spring gillnets fell to 0.7 (1998) and 0.9 (1999) fish per net, which is well below the long-term average of 3.1 (Figure 2). Fall gillnetting results were also below the long-term average of 5.0 at 3.5 (1998) and 2.1 (1999) rainbow trout per net. However, catch rates in 1998 and 1999 are comparable to years with similar stocking rates. Average catch rates from 1991 to 1999 (two years following the reduction in stocking rate from approximately 200,000 to 100,000 rainbow; Appendix J) are 2.2 in spring

nets and 3.0 in fall nets. Rainbow trout classified as wild in spring and fall floaters accounted for 11% in 1998 and 9% in 1999 remaining near the average since 1988 of 10% (Appendix J). Further indications of the dramatic changes that have occurred in Hauser reservoir include the total number of fish collected in both spring and fall floating nets. A record low of only 65 and 18 fish were collected during spring netting in 1998 and 1999 respectively which compares to historic highs of 448 (1986) and 383 (1987). Much of this decline is attributed to the decline in kokanee abundance that accounted for nearly 90% of the catch in spring of 1990 (Appendix A).

***Sinking Gill Nets*:** Species composition collected in spring and fall sinking horizontal gillnets are shown in Appendix C-D. Walleye catch rates increased to an unprecedented level of 17.7 per spring sinking net in 1998 followed by a decline to 0.8 per net in 1999. High walleye catch rates in the spring continued in fall nets were record highs were recorded in 1998 (4.7) and 1999 (3.9) (Figure 2). The majority of the walleye collected during 1998 and 1999 were products of the 1997-year class. In 1998, 88% of the walleyes were age 1 and 9% were age 2. Average size of walleyes collected in 1998 was 11.3 inches and 0.48 pounds increasing slightly in 1999 to 12.6 inches and 0.67 pounds.

Sucker (both white and longnose) catch rates in sinking gillnets have declined since initial netting surveys in 1986. The combined catch of white and longnose suckers has fallen from a record high of 1108 in 1987 to 516 and 482 in 1998 and 1999 respectively. White suckers, which comprises the majority (>70%) of the sucker catch on any given year, have seen the most substantial decline. White sucker catch rates have declined from the record highs of 864 in 1987 to record lows of 367 (1998) and 321 (1999), a 57% and 63% decline respectively.

***Vertical Gill Nets*:** Kokanee catch rates in summer vertical gillnets (July through September) fell to nearly undetectable levels in 1998 (0.3 fish per night) and 1999 (0.7 fish per night) (Appendix I). The statues of the Hauser kokanee fishery remains in a depressed state as the relic population of wild kokanee aged out of the system in 1999 combined with poor survival from hatchery plants since 1997.

***Beach Seine*:** Walleye captured in beach seines on Hauser in 1997 were the highest ever recorded (Table 3). Possible explanations for this anomaly are that transplanted Canyon Ferry walleye (Appendix M) or resident Hauser walleye were successful in spawning. In addition, young-of-the-year walleye may have flushed from Canyon Ferry during the record high water of 1997. Numbers of yellow perch collected reached the second highest number on record in 1998 at 670.4 per seine haul (Table 3) however these numbers returned to near average in 1999 at

191.1. Suckers captured in beach seining in 1998 remained near the long-term average of 410.3 per haul at 361.1. However in 1999, sucker number plummeted to a record low catch of 63.5 per haul. Although 1997 was the second lowest year for suckers per seine haul, this year was likely heavily influenced by flushing losses. Although beach-seining data fluctuates dramatically from year to year, one must take note of the record low collected in 1999 and question the relationship between record high walleye levels and the degree of predation on young of the year suckers.

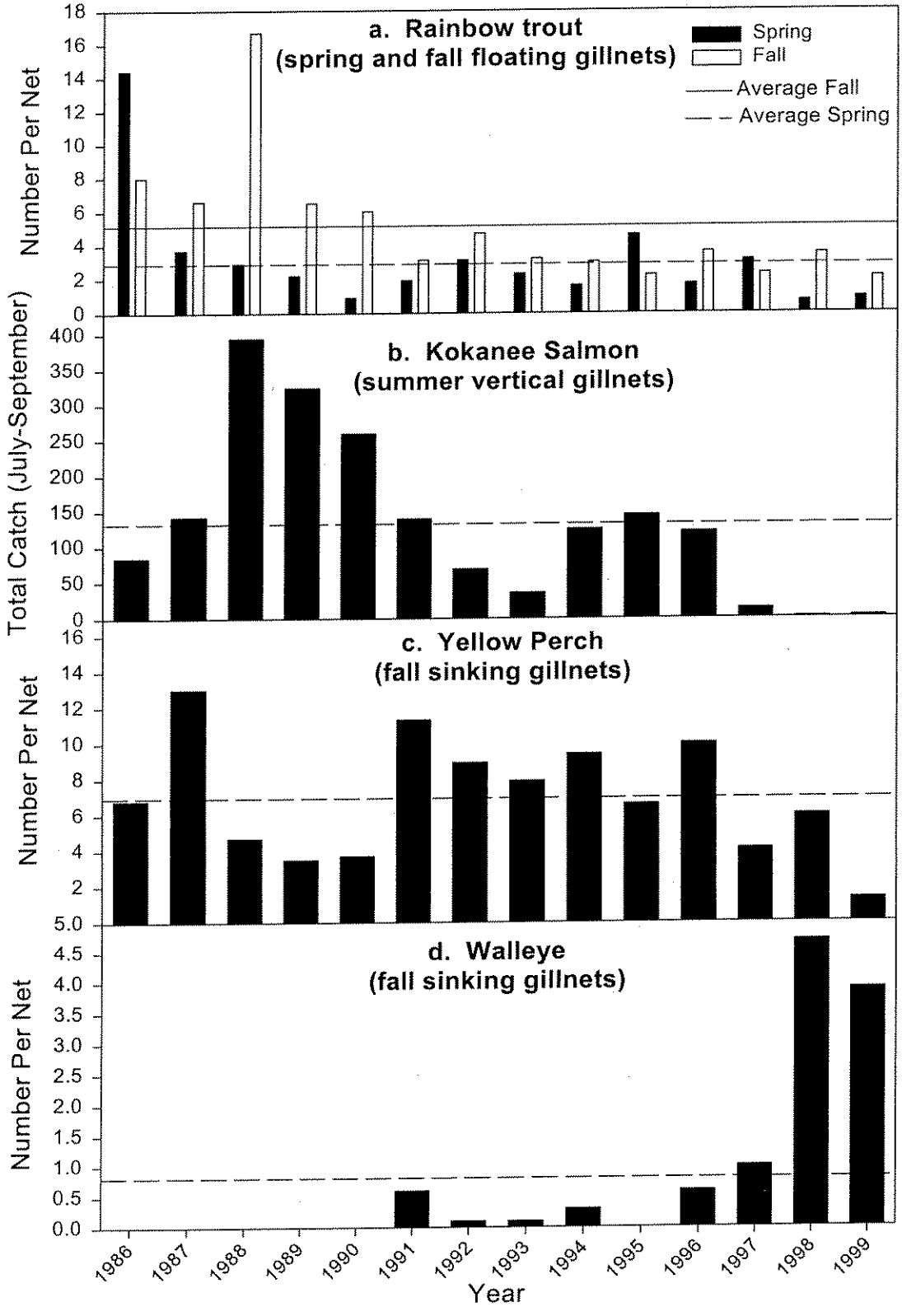

Figure 2. Hauser Reservoir gillnetting trends for the principal game species. Species trends are for the period 1986 through 1999. Dashed lines represent average catch rate for the period 1986 through 1999.

Table 3. Number of fish per beach seine in Hauser Reservoir 1990-1999.

		Number per Tow		
Year	Number of Tows	Yellow Perch	Suckers	Walleye
1990	2	15.5	---	0.0
1991	20	36.6	---	0.0
1992	20	1153.1	107.6	0.0
1993	20	145.0	1105.9	0.0
1994	20	52.8	729.6	0.0
1995	20	47.0	187.5	0.1
1996	19	232.0	573.6	0.0
1997	20	58.0	81.5	2.7
1998	19	670.4	361.1	3.3
1999	20	191.1	63.5	1.3
Mean	18	260.2	401.3	0.7

Hydroacoustic Estimates of Kokanee Abundance:

Hauser reservoir hydroacoustic transects were esonified from Eldorado Bar downstream to the Dam including the lower half of the Causeway Arm to estimate total fish abundance (areas described are shown in Figure 1). Upper sections of the reservoir were excluded from analysis due to shallow water depth. Vertical gillnets were set concurrent with acoustic sampling allowing apportioning of acoustic targets by species.

Fish population estimates in 1998 were zero kokanee, 157,000 rainbow trout, 10,000 walleye and 42,000 suckers (walleye and suckers are generally not considered pelagic). A total population of 210,000 fish (±93,000) or 183 fish per acre was estimated. Of this, 40% were encountered from 1 to 5.9 meters below the surface, 34% from 6 to 10.9 meters and 26% from 11 to 16 meters. The two transects nearest Hauser dam recorded the highest fish densities at nearly 7.5 fish/m^3. A transect in the main reservoir, upstream of the Causeway recorded the lowest density at 1.6 fish/m^3.

Fish population estimates in 1999 declined from 210,000 fish in 1998 to 110,000 (±81,000) or 96 fish per acre. Population estimates by species include; kokanee salmon (4,000), rainbow trout (19,400), walleye (11,300), suckers (35,000) and brown trout (11,3000); (walleye, suckers and brown trout are generally not considered pelagic). Vertical distribution of fish in the water column, based on acoustic target distributions revealed that approximately 35% were encountered from 6 to 10.9 meters below the surface, 42% from 11 to 16 meters and 23% from 16 to 20 meters. Oddly, no fish were encountered in the upper stratum (1 meter to 5.9 meters).

Longitudinal fish distribution at the time of acoustic surveys was dramatically different than 1998 in that roughly 92% of all fish encountered were in the Causeway. The two transects in the main reservoir, upstream of the Causeway recorded the remaining fish (8% of total). No fish were encountered in the two near-dam transects.

Table 4. Angler satisfaction with total catch and size of fish caught in Hauser Reservoir 1998 and 1999. Satisfaction with size of fish dealt only with anglers possessing fish.

	Number of Fish		Size of Fish	
	1998	1999	1998	1999
Very satisfied	1.5%	2.4%	2.3%	5.4%
Satisfied	38.7%	44.4%	66.4%	70.0%
No strong Opinion	23.8%	24.6%	7.3%	8.7%
Dissatisfied	34.8%	27.6%	22.9%	15.5%
Very Dissatisfied	1.2%	1.1%	1.1%	0.3%

Miscellaneous Fisheries Management Activities

Trap Netting:

Spring trap netting was conducted in Hauser reservoir in 1999 in an effort to determine the spawning population of walleyes. A total of 178 walleyes were collected (primarily in the Causeway arm) of which all were sexually immature with an average length of 11.0 inches (Table 6). All walleyes were hand tagged with Visible Implant Fluorescent Elastomer (VIE) tags in the left postorbital tissue. Fluorescent orange was used to differentiate from Holter walleyes where fluorescent blue was used. No VIE tags were recovered during the summer or winter angler creel surveys or gillnetting efforts.

Table 5. Numbers and species of fish captured in trap nets in Hauser Reservoir. (IM = sexually immature)

			WALLEYE				PERCH		RAINBOW
			Total Catch		Mean Length (in)				
Year	Dates	Nets	♂	♀	♂	♀	Total	# of Clips	Total
1999	4/27-4/30	23	IM = 178		IM = 11.0		124	0	14
2000	4/25-4/27	19	2	IM=27	12.7	IM=13.8	56	0	4
AVE		▶	1	IM=103	12.7	IM=11.4	90	0	9

HOLTER RESERVOIR

Creel Surveys

Summer Creel: A total of 929 and 897 anglers were interviewed during the weekend summer creel on Holter Reservoir in 1998 and 1999 respectively. The majority of anglers were fishing from a boat (65% in 1998 and 60% in 1999) and were targeting rainbow trout (43% in 1998 and 41% in 1999). Most of the anglers (62% in 1998 and 55% in 1999) traveled from Great Falls. Total creeled catch was 319 rainbow trout, 33 kokanee salmon and 310 yellow perch in 1998 and 445 rainbow trout, 7 kokanee, 767 yellow perch and 2 brown trout in 1999.

Total walleye recorded in the summer creel took a dramatic jump from the long-term average of 26 to 115 (1998) and 159 (1999). Walleye catch rates (includes all anglers, not just anglers targeting walleyes) were 0.04 in 1998 and 0.05 fish per angler hour in 1999; well above the long-term average of 0.01. Average size of walleyes in the summer creel has decreased due to the dominant 1996 and 1997 year classes. Average length in 1998 was 15.5 inches and 14.1 inches in 1999 compared to the long-term average of 17.1 inches (Table 5).

Rainbow catch rates remain below the long-term average rate of 0.21 rainbow trout per hour at 0.10 (1998) and 0.14 (1999). However, average length of rainbow remained impressive at 15.5 inches in 1998 and a 14-year record 18.0 inches in 1999. Percent wild rainbow collected in floating gill nets has varied considerably through the years ranging from 12% in 1998 and 66% in 1994. Wild percentages increased in 1999 to 25% of all rainbow trout collected, which compares to an average of 35% since 1988. Eagle Lake rainbow continued to be planted in 1998 and 1999 following the conversion from Arlee rainbow in 1996. Since 1996, the study plan has called for alternating year plants between young of the year and overwintered Eagle Lakes. Approximately 141,500 overwintered fish ranging in size from 6.05 to 8.31 inches were stocked in 1998 and 400,700 age zero fish, ranging in size from 3.44 to 4.04 inches were stocked in 1999 (Appendix K). Evaluation of this stocking scenario has been difficult due to suspected high flushing rates in 1996 and 1997.

Yellow perch catch rates increased in 1998 to 0.10 and 0.23 perch per hour in 1999. This increase comes after three years of poor perch fishing in Holter and approaches the 14-year average of 0.31 perch per hour. Perch harvest rates remain a fraction of the long-term average of 210,200 with 57,600 and 61,000 perch harvested in 1998 and 1999 respectively. Kokanee salmon continue their downward trend with record low catch and harvest rates. An estimated

2,200 (1998) and 500 (1999) salmon were harvested compared to the long-term average of 12,700.

Results from the angler satisfaction survey showed an increase in the number of anglers that were satisfied with both number and size of fish caught. In 1998, 43% of respondents said they were satisfied or very satisfied with the number of fish. This compares with 54% in 1999. Nearly 70% were generally satisfied with the size of fish in 1998 compared to 88% in 1999. The number of anglers that were generally dissatisfied with both number and size of fish decreased from approximately 33% in 1998 to 27% in 1999. Concurrently, anglers were less dissatisfied with the size of fish such that roughly 24% were generally dissatisfied in 1998 and only 7% in 1999 (Table 9).

Table 5. Summer catch rates, mean size, and harvest of selected species in Holter Reservoir. Harvest estimates include winter ice fishing.

	RAINBOW TROUT			KOKANEE SALMON			YELLOW PERCH			WALLEYE		
Year	Catch rate (fish/hr.)	Mean Size (in)	Harvest (x1000)	Catch rate (fish/hr.)	Mean Size (in)	Harvest (x1000)	Catch rate (fish/hr.)	Mean Size (in)	Harvest (x1000)	Catch rate (fish/hr.)	Mean Size (in)	Harvest (x1000)
1986	0.34	13.9	---	0.01	16.9	---	0.16	---	---	0.002	15.0	---
1987	0.37	13.8	---	0.01	16.7	---	0.39	8.8	---	0.02	16.1	---
1988	0.32	13.7	---	0.01	16.8	---	0.37	---	---	0.01	17.4	---
1989	0.27	14.5	57.1	0.01	16.1	2.1	0.85	9.0	330.0	0.004	20.3	0.9
1990	0.26	14.2	59.2	0.11	16.1	24.3	0.53	9.2	297.2	0.003	17.9	0.3
1991	0.27	12.6	62.3	0.10	15.2	22.4	0.40	8.6	237.7	0.005	16.4	0.5
1992	0.22	14.1	53.2	0.09	16.6	20.4	0.52	8.9	492.9	0.001	20.4	0.5
1993	0.14	15.9	33.7	0.06	16.1	12.0	0.22	9.1	313.2	0.001	18.6	0.1
1994	0.03	14.7	10.4	0.06	16.2	13.4	0.34	9.5	336.9	0.01	19.5	N/A
1995	0.16	14.1	20.1	0.03	15.7	4.3	0.08	9.5	108.6	0.003	*	0**
1996	0.21	13.8	47.4	0.16	14.1	32.1	0.04	9.5	50.3	0.02	13.2	1.8
1997	0.11	15.5	38.4	0.02	16.9	5.8	0.07	7.8	26.8	0.01	17.7	1.6
1998	0.10	15.5	15.7	0.01	16.8	2.2	0.10	9.7	57.6	0.04	15.5	6.4
1999	0.14	18.0	38.5	0.002	15.6	0.5	0.23	8.3	61.0	0.05	14.1	5.6
Mean	0.21	14.6	39.6	0.05	16.1	12.7	0.31	9.0	210.2	0.01	17.1	1.8

Harvest estimates for 1986 - 88 were not estimated because creel surveys were not completed during winter months. *Insufficient sample size **All fish were released.

Winter Creel: A total of 139 (1998) and 136 (1999) anglers were interviewed during the two ice-fishing seasons on Holter Reservoir. Rainbow trout catch rates were 0.11 and 0.29 in 1998 and 1999 respectively. The 1999 winter rainbow catch rate of 0.29 fish per hour was an 11-year high. Yellow perch catch rates continue their lethargic trend with 1.3 and 0.95 fish per hour in 1998 and 1999 respectively. Yellow perch catch rates have significantly declined in recent years averaging 2.4 fish per angler hour (1989 through 1999). Perch fishing peaked in 1992 at 5.6 perch per angler hour (Table 6). Reasons for the decline are unknown, however, overharvest does not appear to be a major factor. MFWP examined the potential for overharvest and determined that a very small percentage (generally less than 4%) of anglers were harvesting more than 25 perch. It is more likely that flushing (and other biotic variables associated with short water retention times), predation and variable year class strength have played a larger role in determining recruitment of this perch population.

Table 6. Anglers catch rates on Holter Reservoir during the ice-fishing season. Catch rates for walleye and brown trout were less than 0.01 for all years.

			Catch Rates (fish per hour)		
Year	**# of Interviews**	**Total Catch**	**Rainbow**	**Kokanee**	**Perch**
1989	493	4708	0.23	<0.01	2.95
1990	346	3597	0.24	<0.01	3.05
1991	547	6162	0.27	0.02	3.57
1992	166	2930	0.23	<0.01	5.60
1993	486	4487	0.09	<0.01	2.73
1994	349	4519	0.07	<0.01	3.79
1995	121	624	0.06	0.00	1.69
1996	160	403	0.25	0.00	0.65
1997	283	476	0.24	0.00	0.38
1998	139	630	0.11	<0.01	1.31
1999	136	547	0.29	0.00	0.95
Mean	297	2644	0.19	<0.01	2.42

Trend Netting and Hydroacoustic Estimates of Fish Abundance

Floating Gill Nets: Species composition for spring and fall horizontal gillnets are shown in Appendix E - H. Total numbers of fish collected during netting operations remained low. A total of only 58(1998) and 23(1999) fish were collected in spring floating gillnets. These catch rates represent the lowest (23) and third lowest (58) number of fish collected on record (Appendix E). Fall floating gillnets mirrored the low spring catch rates with 1999 registering a record low catch of only 42 fish (Appendix F).

Rainbow trout catch rates in spring and fall floaters showed further decline after near average 1998 catch rates (Figure 3a). The reason for the 1999 decline appears to be due in large part to extremely poor survival from the 1998 plant (142,000 age 1+ Eagle Lakes). Although numbers

of rainbow remain low, average size has shown marked increased from 13.9" (1996) to 15.9' (1997), 15.8" (1998) and 19.2" in 1999. Numbers of rainbow caught in the 1998 fall floaters were above the 14-year average (7.4/net) while 1999 catch rates fell to 3.9/net. The fall catch was dominated by large, age 4+ Eagle Lake rainbow; products of the original 1996 plant (106,249 age 1+)

Holter kokanee densities remained low with fall floating catch rates of 0.1 and 0.0 fish per net in 1998 and 1999 respectively (Figure 3b). It appears that the strong 1993-year class (observed as age 2+ in 1995) did not spawn successfully or what limited production may have occurred was vulnerable to flushing and/or predation.

Sinking Nets

Holter yellow perch catch rates remain well below average with 1.3 fish/net in 1998 and a record low 0.3 fish/net in 1999 (Appendix H). Walleye diet analysis from Holter reservoir indicates that with the banner perch production of 1998 and 1999 recorded during beach seining (Table 7), predation also increased. Recruitment of these fish will remain in question until fall netting of 2001 when they will be large enough to recruit to sampling gear.

Vertical Gill Nets: Following the record high kokanee catch rates in 1996 and 1997, total number of kokanee caught through summer (July through September) were significantly below average in 1998 and 1999 (Figure 3b). A puzzling lack of spawning and recruitment was observed from the strong 1993 year class. However, it appears evident that the Holter kokanee population is highly dependent on production and flushing out of Hauser reservoir as evidenced by survival of hatchery kokanee in Holter that were planted in Hauser. Of the seven kokanee collected in summer verticals in 1998 and 1999, 86% were hatchery fish planted into Hauser.

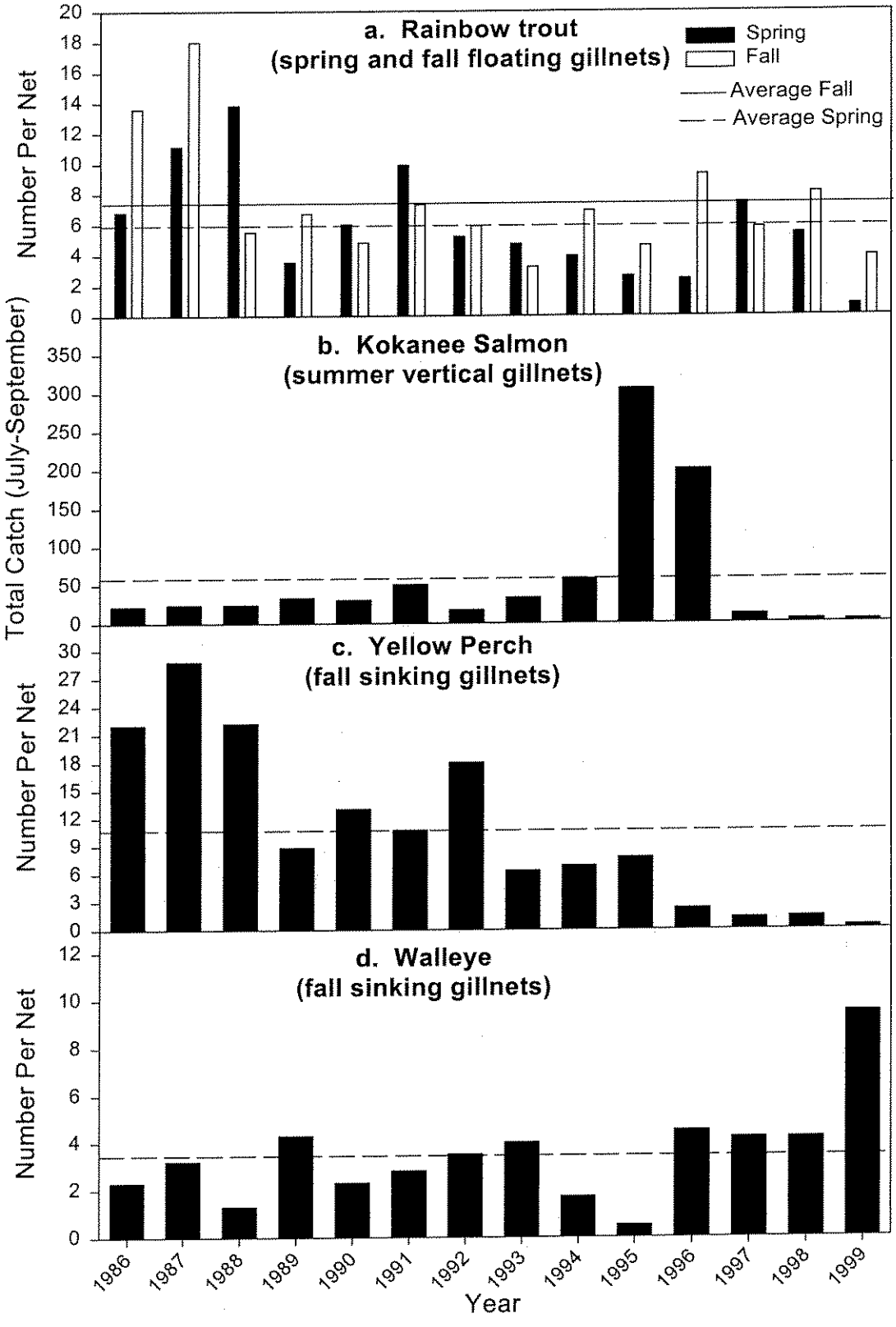

Figure 3. Holter Reservoir gillnetting trends for the principal game species. Species trends are for the period 1986 through 1999. Dashed lines represent average catch rate for the period 1986 through 1999.

Beach Seine: Beach seine results are shown in Table 7. Yellow perch collected in 1998 and 1999 were an astounding 2906 and 3006 per haul. This phenomenon is largely unexplainable, however, one theory is that during years with prolific development of rooted aquatic vegetation, perch survival is enhanced as YOY perch, following hatch, have abundant hiding cover and are able to better avoid predation. Obviously other factors are at large such as abundance of spawning aged fish in the population and low flushing rates during low runoff years. Sucker and walleye collected in beach seining in 1998 and 1999 were also the highest on record (Table 7). Increase in YOY walleye collections can be attributed, in part, to flushing from upstream Canyon Ferry and Hauser reservoirs. These increases in Holter walleye mirror changes observed in Missouri River electrofishing estimates below Holter dam (MFWP Data Files).

Table 7. Beach seine results (number of fish per tow) in Holter Reservoir (1990-1999).

		Number per Tow		
Year	Number of Tows	Yellow Perch	Suckers	Walleye
1990	7	125.1	---	0.0
1991	20	274.2	---	2.5
1992	20	622.2	147.2	0.0
1993	20	38.0	52.5	<0.1
1994	19	169.7	288.6	0.0
1995	16	80.3	120.9	1.0
1996	19	32.4	385.5	0.6
1997	20	32.0	327.4	0.6
1998	20	2906.2	962.3	4.2
1999	19	3005.7	616.5	4.4
Mean	18	728.6	362.6	1.3

Hydroacoustic Estimates of Fish Abundance: Hydroacoustic fish estimates continued in 1998 and 1999 for the area from Oxbow Bend to the Holter dam. Total fish abundance in 1998 was estimated at 879,000 (± 790,000) fish. Individual species estimates (based on vertical gillnet catch run concurrent with acoustics) were kokanee 400,000, walleye 400,000 and rainbow 79,000. Longitudinal fish distribution revealed that fish densities were higher in mid-reservoir (Oxbow) transects and decreased downstream with the two near dam transects failing to record any fish. Approximately 77% of the acoustic targets were recorded in water between 11 and 26 meters in depth. Few fish were recorded in the upper stratum (1-5.9 meters).

Acoustics estimates conducted in 1999 increased significantly from 1998 levels to 2.8 million fish (± 2.4 million) or 973 per acre. Species estimates shifted dramatically from 1998 with zero kokanee, 2.6 million rainbow trout, 80,000 walleye and 160,000 mountain whitefish. Longitudinal fish distributions followed the 1998 trend with fish densities decreasing as surveys continued downstream. Fish were more evenly distributed throughout the water column in 1999

however, approximately 67% of the acoustic targets remained in water between 11 and 26 meters in depth. Roughly 7.5% of targets were recorded in the upper water stratum (1-5.9 meters).

Trap Netting: Trap net results are shown in Table 8. Trap nets were fished from 4 May to 7 May 1999 and 2 May to 5 May in 2000. Netting efforts focused on maximizing the number of tagged walleyes in an effort to determine angler exploitation and strength of spawning aged walleye in Holter reservoir. A total of 13 and 17 female walleye were netted in 1999 and 2000 respectively. Average length for these fish was 27.0" (1999) and 26.0" (2000) with all females collected being greater than the 20" minimum of the current slot limit regulation on Holter reservoir.

Table 8. Numbers and species of fish captured in trap nets in Holter Reservoir.

			WALLEYE				PERCH		RAINBOW
			Total Catch		Mean Length (in)				
Year	Dates	Nets	♂	♀	♂	♀	Total	# of Clips	Total
1995	4/26-5/12	52	250	59	22.4	26.6	3,281	1,251	84
1996	4/25-5/17	69	181	60	22.9	26.0	1,558	1,100	350
1997	4/29-5/13	45	66	29	22.3	25.5	2,025	1,638	247
1998	4/28-5/8	52	32	11	19.2	26.3	1,890	1,478	124
1999	5/4-5/7	24	59	13	21.4	27	1,007	0	159
2000	5/2-5/5	28	86	17	18.9	25.9	291	0	53
AVE	⟶		112.33	31.56	21.18	26.2	1,675	911	170

Walleye tagging: In an effort to estimate angler harvest, walleye caught in trend and trap net operations have been tagged with dangler and more recently monel (jaw tags). From 1988 through 1999 a total of 176 of 1242 tags (14%) implanted into Holter reservoir walleye have been returned. One-year tag return percentages have ranged from 4% in 1997 to 36% in 1990. Tag returns from 1998 and 1999 were 9% and 7% respectively. Tags recovered in the Missouri River below Holter have accounted for up to 78% (1995) of a given years returns. Missouri river tag returns in 1998 were 28% and 13% in 1999 falling above and below the long-term average of 20% since 1986. Annual tagging and return data are presented in Appendix L.

Table 9. Angler satisfaction with total catch and size of fish caught in Holter Reservoir for 1998 and 1999. Satisfaction with size of fish dealt only with anglers possessing fish.

	Number of Fish		Size of Fish	
	1998	1999	1998	1999
Very Satisfied	0.1%	2.8%	0.3%	5.5%
Satisfied	42.8%	51.5%	69.6%	82.5%
No Strong Opinion	24.9%	19.0%	5.8%	4.9%
Dissatisfied	30.3%	25.2%	23.3%	7.1%
Very Dissatisfied	1.9%	1.6%	0.9%	0.0%

APPENDICES

Appendix A. Number per net (percent composition) by species for spring floating gillnet catches in Hauser Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
RB	14.4(29.0)	3.7(9.7)	2.9(17.7)	2.2(13.2)	0.9(5.4)	1.9(7.8)	3.1(12.7)	2.3(17.2)	1.6(7.0)	4.6(39.0)	1.7(9.5)	3.1(19.2)	0.7(10.8)	0.9(50)
LL	0.1(0.2)	0.5(1.3)	0.1(0.6)	0.3(2.0)	0.3(1.6)	0.2(0.7)	0.7(3.0)	0.2(1.6)	0.5(2.0)	0.1(1.0)	0.3(1.9)	0.1(0.7)	0.1(1.5)	0.1(5.6)
KOK	1.4(2.9)	13.8(36.0)	11.7(71.3)	12.4(74.2)	14.9(88.6)	21.1(85.6)	11.6(47.6)	9.2(68.0)	12.5(56.1)	6.8(58.1)	12.9(73.4)	6.8(41.8)	1.1(16.9)	0
MWF	0.1(0.2)	0.0	0.2(1.2)	0.0	0.0	0.1(0.4)	0.0	0.0	0.0	0.0	0.0	0.0	0	0
WE	0.0	0.0	0.0	0.0	0.0	0.0	0.3(1.1)	0.0	0.1(0.4)	0.0	0.0	0.1(0.7)	0	0
YP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1(0.8)	0.1(0.4)	0.0	0.0	0.0	0	0
LNSU	26.3(52.9)	13.7(35.8)	1.0(6.1)	0.9(5.3)	0.3(1.6)	0.5(1.8)	2.6(10.9)	0.3(2.5)	4.6(20.9)	0.1(1.0)	0.8(5.7)	3.0(18.5)	2.5(38.6)	0.6(33.3)
WSU	6.9(13.8)	6.3(16.4)	0.5(3.1)	0.9(5.3)	0.5(2.7)	0.4(1.5)	5.9(24.3)	1.2(9.0)	2.8(12.7)	0.1(1.0)	1.4(9.5)	3.1(19.2)	2.1(32.3)	0.2(11.1)
CARP	0.2(0.5)	0.0	0.0	0.0	0.0	0.0	0.1(0.4)	0.0	0.0	0.0	0.0	0.0	0	0
U.CHUB	0.2(0.5)	0.3(0.8)	0.0	0.0	0.0	0.6(2.2)	0.0	0.1(0.8)	0.1(0.4)	0.0	0.0	0.0	0	0
TOT #	448	383	164	151	185	271	267	122	244	105	158	146	65	18
# NETS	9	10	10	9	11	11	11	9	11	9	9	9	10	10

Appendix B. Number per net (percent composition) by species for fall floating gillnet catches in Hauser Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
RB	8.0(31.3)	6.6(44.2)	16.7(42.0)	6.5(20.9)	6.0(16.5)	3.1(8.1)	4.7(15.0)	3.2(17.7)	3.0(17.0)	2.2(13.1)	3.6(17.5)	2.3(44.6)	3.5(44.2)	2.1(46.0)
LL	0.6(2.5)	0.2(1.2)	0.6(1.4)	0.3(0.9)	0.2(0.5)	0.3(0.7)	0.1(0.3)	0.1(0.5)	0.2(1.0)	0.4(2.2)	0.3(1.3)	0.4(7.1)	0.1(1.2)	0.2(4.0)
KOK	14.6(57.3)	3.7(25.1)	19.1(47.9)	22.6(73.2)	28.9(79.3)	26.7(70.0)	25.6(81.5)	13.7(76.3)	9.2(52.1)	13.5(81.4)	15.5(74.6)	2.1(41.1)	2.6(32.6)	1.5(32.0)
MWF	1.1(4.3)	0.0	0.4(0.9)	0.1(0.3)	0.3(0.7)	0.2(0.5)	0.2(0.6)	0.0	0.1(0.5)	0.1(0.5)	0.0	0.0	0.0	0.0
WE	0.0	0.0	0.0	0.0	0.0	0.2(0.5)	0.0	0.0	0.0	0.0	0.4(1.8)	0.1(1.8)	1.0(12.8)	0.1(2.0)
YP	0.2(0.7)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LNSU	0.4(1.4)	1.9(12.9)	1.0(2.5)	0.3(0.9)	0.1(0.2)	0.0	0.1(0.3)	0.0	2.5(13.9)	0.0	0.2(0.9)	0.1(1.8)	0.09(1.2)	0.2(4.0)
WSU	0.3(1.1)	2.4(16.0)	0.2(0.5)	0.1(0.3)	0.1(0.2)	0.0	0.3(0.9)	0.2(1.0)	2.1(11.9)	0.4(2.2)	0.4(1.8)	0.2(3.6)	0.4(5.8)	0.5(10.0)
CARP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1(0.4)	0.0	0.0	0.0
U.CHUB	0.4(1.4)	0.1(0.6)	1.9(4.8)	1.1(3.5)	0.9(2.5)	7.7(20.2)	0.5(1.4)	0.8(4.5)	0.6(3.6)	0.1(0.5)	0.4(1.8)	0.0	0.18(2.3)	0.0
TOTAL #	281	163	438	339	401	420	346	198	194	183	228	56	86	49
# NETS	11	11	11	11	11	11	11	11	11	11	11	11	11	11

Appendix C. Number per net (percent composition) by species for spring sinking gillnet catches in Hauser Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
RB		0.2(0.2)	0.0	0.0	0.0	0.0	0.0	0.0	0.2(0.4)	0.0	0.0	0.3(0.4)	0	0.3(1.0)
LL		1.4(1.5)	0.8(1.2)	0.8(0.9)	0.7(0.7)	1.2(1.2)	0.2(0.2)	1.7(2.6)	1.3(3.0)	1.2(1.4)	1.0(1.4)	1.0(1.2)	0.67(1.6)	0.5(1.5)
KOK		1.0(1.1)	2.8(4.2)	1.7(1.7)	2.5(2.7)	3.3(3.1)	0.5(0.7)	7.5(11.5)	3.2(7.2)	1.5(1.9)	0.2(0.2)	0.5(0.6)	1.17(2.9)	0.0
MWF		3.6(3.8)	3.7(5.4)	2.3(2.4)	1.8(2.0)	3.2(3.0)	1.2(1.7)	1.3(2.0)	0.7(1.5)	2.2(2.7)	0.7(0.9)	0.5(0.6)	3.7(9.0)	0.0
WE		0.0	0.0	0.2(0.2)	0.0	0.0	0.5(0.7)	0.0	0.3(0.8)	0.0	0.0	0.3(0.4)	17.7(43.4)	0.8(2.5)
YP		4.4(4.7)	7.2(10.6)	5.5(5.8)	12.3(13.5)	14.5(13.7)	15.2(21.5)	11.2(17.1)	5.8(13.3)	2.5(3.1)	3.7(5.1)	4.7(5.5)	15.6(38.5)	2.7(8.0)
LNSU		21.8(23.0)	12.2(17.9)	21.3(22.3)	17.8(19.5)	22.2(20.9)	13.8(19.6)	15.3(23.5)	14.2(32.2)	15.0(18.6)	10.3(14.3)	33.8(40.0)	0.0	9.5(28.8)
WSU		62.0(65.5)	40.7(60.0)	63.2(66.0)	53.3(58.4)	59.0(55.7)	37.7(53.3)	26.7(40.8)	18.0(40.9)	57.0(70.7)	54.7(75.6)	42.5(50.3)	15.7(38.5)	17.5(53.1)
CARP		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8(1.0)	0.5(0.7)	0.0	0.0	0.0
U.CHUB		0.2(0.2)	0.3(0.5)	0.3(0.3)	2.8(3.1)	2.0(1.9)	0.0	0.5(0.8)	0.0	0.2(0.2)	0.0	0.0	0.0	0.0
BURBOT		0.0	0.2(0.2)	0.2(0.2)	0.0	0.3(0.2)	1.5(2.1)	1.2(1.8)	0.3(0.8)	0.33(0.4)	1.3(1.8)	0.8(1.0)	1.17(2.9)	1.7(5.1)
SM.BUFF		0.0	0.0	0.2(0.2)	0.0	0.2(0.3)	0.2(0.2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL #	0	473	407	574	548	635	424	392	264	484	434	434	244	198
# NETS	0	5	6	6	6	6	6	6	6	6	6		6	6

Appendix D. Number per net (percent composition) by species for fall sinking gillnet catches in Hauser Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
RB	1.0(0.7)	2.0(1.4)	0.5(0.5)	1.8(1.8)	0.3(0.3)	0.7(0.7)	0.7(0.7)	0.1(0.2)	0.6(0.4)	0.3(0.3)	0.3(0.4)	0.4(0.8)	0.0	0.0
LL	1.4(1.0)	0.5(0.4)	0.5(0.5)	0.0	0.7(0.7)	0.4(0.4)	1.1(1.0)	0.7(1.0)	1.1(0.9)	0.4(0.5)	1.1(1.4)	0.1(0.5)	0.0	0.1(0.3)
KOK	0.6(0.4)	5.8(4.2)	9.8(9.1)	18.3(18.3)	10.7(11.1)	20.7(20.6)	8.1(7.7)	5.0(6.8)	5.1(4.0)	15.6(18.9)	1.4(1.8)	0.4(0.8)	0.7(1.0)	0.0
MWF	5.0(3.6)	3.2(2.3)	2.8(2.6)	0.5(0.5)	2.0(2.1)	1.7(1.7)	1.3(1.2)	1.1(1.6)	1.1(0.9)	0.3(0.3)	0.6(0.7)	0.1(0.5)	0.6(0.8)	0.0
WE	0.0	0.0	0.0	0.0	0.0	0.6(0.6)	0.1(0.1)	0.1(0.2)	0.3(0.2)	0.0	0.6(0.7)	1.0(1.8)	4.7(6.5)	3.9(7.5)
YP	6.8(4.9)	13.0(9.3)	4.7(4.3)	3.5(3.5)	3.7(3.8)	11.3(11.2)	8.9(8.1)	7.9(10.7)	9.4(7.4)	6.6(8.0)	10.0(12.5)	4.1(7.3)	6.0(8.3)	1.3(2.5)
LNSU	40.4(28.9)	22.5(16.1)	26.0(24.1)	14.7(14.7)	15.5(16.1)	16.7(16.6)	20.0(18.3)	13.7(18.7)	15.3(12.0)	14.9(18.1)	17.1(21.4)	10.0(17.7)	21.3(29.4)	14.9(28.7)
WSU	84.8(60.5)	92.3(66.0)	63.0(58.3)	59.3(59.4)	61.0(63.4)	45.3(45.0)	64.9(59.3)	42.0(57.3)	57.6(45.1)	41.6(50.5)	47.7(59.4)	34.7(61.4)	39.0(53.8)	30.9(59.7)
CARP	0.0	0.0	0.0	0.2(0.2)	0.0	0.0	1.1(1.0)	0.0	38.1(29.1)	0.1(0.2)	0.0	0.0	0.0	0.1(0.3)
U.CHUB	0.0	0.2(0.1)	0.2(0.1)	1.3(1.3)	2.2(2.3)	1.7(1.7)	2.0(1.8)	1.4(1.4)	0.9(0.7)	0.3(0.3)	0.3(0.4)	0.0	0.0	0.1(0.3)
BURBOT	0.0	0.0	0.0	0.3(0.3)	0.2(0.2)	0.4(0.4)	0.7(0.7)	0.9(1.2)	0.3(0.2)	2.3(2.8)	1.1(1.4)	5.3(9.3)	0.14(0.2)	0.4(0.8)
SM.BUFF	0.0	0.3(0.2)	0.5(0.5)	0.0	0.0	1.1(1.1)	0.0	0.7(1.0)	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL #	700	839	648	600	577	705	765	513	902	576	562	396	507	362
# NETS	5	6	6	6	6	7	7	7	7	7	7	7	7	7

Appendix E. Number per net (percent composition) by species for spring floating gillnet catches in Holter Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
RB	6.8(25.5)	11.1(47.1)	13.8(64.3)	3.5(25.0)	6.0(61.5)	9.9(34.5)	5.2(39.2)	4.7(26.1)	3.9(34.0)	2.6(63.9)	2.4(36.7)	7.4(53.6)	5.4(84.5)	0.7(21.7)
LL	0.0	0.4(1.6)	0.3(1.2)	0.0	0.1(1.3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KOK	0.2(0.6)	0.6(2.6)	0.4(1.7)	0.4(2.7)	2.8(28.2)	13.4(46.9)	1.6(11.7)	1.1(6.2)	3.4(30.1)	0.6(13.9)	3.4(51.7)	1.1(8.0)	0.0	0.0
MWF	0.7(2.5)	0.4(1.6)	0.3(1.2)	0.1(0.9)	0.0	0.3(1.2)	0.4(3.3)	0.0	0.1(1.0)	0.0	0.0	0.0	0.11(1.7)	0.0
WE	1.3(5.0)	1.8(7.4)	0.9(4.1)	0.3(1.8)	0.5(5.1)	4.0(13.9)	0.1(0.8)	0.7(3.7)	0.7(5.8)	0.1(2.8)	0.1(1.7)	0.2(1.6)	0.0	0.4(13.0)
YP	0.0	4.8(20.1)	4.0(18.7)	1.3(8.9)	0.0	0.0	5.1(38.3)	5.3(29.8)	1.7(14.6)	0.0	0.0	0.0	0.0	0.7(21.7)
LNSU	10.8(40.4)	2.4(10.1)	0.9(4.1)	5.4(38.4)	0.1(1.3)	0.1(0.4)	0.0	1.4(8.1)	0.9(7.8)	0.1(2.8)	0.3(5.0)	1.7(12.0)	0.33(5.2)	0.0
WSU	6.7(24.8)	1.9(7.9)	0.8(3.5)	3.1(22.3)	0.3(2.6)	0.8(2.7)	0.8(5.8)	4.7(26.1)	0.6(4.9)	0.7(16.7)	0.3(5.0)	3.4(24.8)	0.56(8.6)	1.4(43.4)
CARP	0.3(1.2)	0.4(1.6)	0.3(1.2)	0.0	0.0	0.1(0.4)	0.1(0.8)	0.0	0.2(1.9)	0.0	0.0	0.0	0.0	0.0
U.CHUB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL #	161	189	171	112	78	258	120	161	103	36	60	125	58	23
# NETS	6	8	8	8	8	9	9	9	9	9	9	9	9	7

Appendix F. Number per net (percent composition) by species for fall floating gillnet catches in Holter Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
RB	13.6(77.2)	18.0(76.6)	5.5(41.5)	6.7(52.1)	4.8(34.7)	7.3(53.7)	5.9(35.3)	3.2(42.0)	6.9(42.5)	4.6(20.0)	9.3(39.1)	5.8(64.2)	8.1(55.3)	3.9(83.3)
LL	0.1(0.8)	0.5(2.2)	0.3(1.9)	0.1(0.9)	0.0	0.3(1.9)	0.2(1.3)	0.0	0.1(0.7)	0.0	0.1(0.5)	0.3(3.7)	0.1(0.8)	0.0
KOK	0.9(4.9)	1.1(4.8)	2.9(21.7)	4.2(33.0)	7.8(56.5)	5.4(39.8)	4.8(28.6)	3.8(49.3)	7.6(46.6)	17.4(76.5)	13.0(54.4)	0.8(8.6)	0.1(0.8)	0.0
MWF	0.6(3.3)	0.0	0.4(2.8)	0.1(0.9)	0.2(1.6)	0.4(2.8)	0.0	0.0	0.2(1.4)	0.0	0.0	0.2(2.5)	0.0	0.11(2.4)
WE	1.7(9.7)	0.1(0.5)	0.0	0.3(2.6)	0.0	0.0	0.1(0.7)	0.2(2.9)	0.0	0.4(2.0)	1.3(5.6)	1.6(17.3)	0.22(1.5)	0.22(4.8)
YP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LNSU	0.6(3.3)	1.6(6.9)	1.6(12.3)	0.9(7.0)	0.9(6.5)	0.1(0.9)	3.3(20.0)	0.1(1.4)	0.4(2.7)	0.2(1.0)	0.0	0.0	1.78(12.1)	0.11(2.4)
WSU	0.1(0.8)	2.1(9.0)	2.6(19.8)	0.3(2.6)	0.1(0.8)	0.1(0.9)	2.3(14.0)	0.3(4.3)	1.0(6.2)	0.1(0.5)	0.1(0.5)	0.2(2.5)	4.33(29.5)	0.22(4.8)
CARP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.11(2.4)
U.CHUB	0.0	0.0	0.0	0.1(0.9)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1(1.2)	0.0	0.0
TOTAL #	123	188	106	115	124	108	150	69	146	205	215	81	132	42
# NETS	7	8	8	9	9	8	9	9	9	9	9	9	9	9

Appendix G. Number per net (percent composition) by species for spring sinking gillnet catches in Holter Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
RB		1.6(0.9)	1.5(1.4)	1.0(1.1)	1.2(1.0)	1.0(0.7)	0.3(0.2)	0.5(0.4)	0.5(0.5)	2.0(2.3)	0.5(0.7)	0.7(0.8)	0.0	0.3(0.5)
LL		1.4(0.8)	0.2(0.2)	0.2(0.2)	0.8(0.7)	0.2(0.1)	0.2(0.1)	0.0	0.0	0.5(0.6)	0.3(0.5)	0.0	0.0	0.0
KOK		0.0	0.3(0.3)	0.0	0.0	0.8(0.6)	0.2(0.1)	0.2(0.1)	0.2(0.2)	0.8(1.0)	2.2(3.1)	0.0	0.0	0.0
MWF		3.0(1.7)	4.0(3.6)	4.7(5.1)	4.8(4.0)	8.7(5.8)	2.8(1.8)	1.8(1.5)	1.8(2.0)	0.8(1.0)	1.5(2.2)	1.0(1.1)	0.2(0.2)	0.2(0.2)
WE		2.6(1.6)	2.2(2.0)	2.5(2.8)	2.4(2.0)	2.2(1.4)	2.5(1.6)	2.3(1.9)	4.8(5.3)	1.0(1.2)	2.7(3.9)	3.0(3.4)	3.8(5.3)	7.5(10.4)
YP		95.8(57.2)	37.3(34.0)	26.8(29.5)	46.8(39.2)	75.2(50.4)	66.7(43.4)	52.3(42.3)	25.7(28.1)	26.5(30.9)	6.8(9.9)	5.0(5.7)	5.7(7.8)	3.2(4.4)
LNSU		27.6(16.5)	19.3(17.6)	10.2(11.2)	13.6(11.4)	17.7(11.9)	8.3(5.4)	12.8(10.4)	11.7(12.8)	5.17(6.0)	12.2(17.6)	11.5(13.0)	9.3(12.8)	5.3(7.4)
WSU		35.4(21.2)	44.7(40.7)	45.2(49.7)	49.4(41.4)	43.3(29.1)	72.0(46.9)	53.5(43.2)	46.7(51.0)	48.5(56.6)	42.5(61.6)	67.0(76.0)	53.8(73.9)	55.7(77.0)
CARP		0.2(0.1)	0.0	0.3(0.4)	0.0	0.0	0.5(0.3)	0.2(0.1)	0.2(0.2)	0.2(0.2)	0.3(0.5)	0.0	0.0	0.0
U.CHUB		0.0	0.2(0.2)	0.0	0.4(0.3)	0.0	0.0	0.2(0.1)	0.0	0.2(0.2)	0.0	0.0	0.0	0.0
BURBOT		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2(0.2)
TOTAL #	0	838	658	545	597	894	921	743	549	514	414	529	437	434
# NETS	0	5	6	6	5	6	6	6	6	6	6	6	6	6

Appendix H. Number per net (percent composition) by species for fall sinking gillnet catches in Holter Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
RB	4.0(4.3)	2.5(2.5)	2.7(2.6)	1.5(1.8)	2.5(3.1)	4.2(4.4)	0.7(0.8)	1.0(1.5)	1.8(2.7)	3.3(3.9)	1.3(1.8)	1.7(2.8)	0.5(1.0)	0.3(0.7)
LL	0.2(0.2)	0.3(0.3)	0.0	0.0	0.0	0.0	0.2(0.2)	0.2(0.2)	0.0	0.0	0.2(0.2)	0.0	0.0	0.0
KOK	0.3(0.4)	0.2(0.2)	0.5(0.5)	0.5(0.6)	1.5(1.9)	1.5(1.6)	1.2(1.4)	1.0(1.5)	0.8(1.2)	1.8(2.1)	4.8(6.4)	0.2(0.3)	0.0	0.2(0.3)
MWF	1.7(1.8)	2.0(2.0)	0.5(0.5)	1.5(1.8)	3.5(4.3)	1.2(1.3)	1.8(2.2)	1.0(1.5)	0.2(0.2)	0.5(0.6)	0.5(0.7)	0.8(1.4)	1.0(2.0)	0.0
WE	2.3(2.5)	3.2(3.1)	1.3(1.3)	4.3(5.2)	2.3(2.9)	2.8(3.0)	3.5(4.2)	4.0(6.0)	1.7(2.4)	0.5(0.6)	4.5(6.0)	4.2(7.0)	4.2(8.5)	9.5(19.1)
YP	22.0(24.0)	28.8(28.8)	22.2(21.8)	8.8(10.6)	13.0(16.0)	10.7(11.3)	18.0(21.5)	6.3(9.4)	6.8(10.0)	7.7(9.0)	2.2(2.9)	1.2(2.0)	1.3(2.7)	0.3(0.7)
LNSU	22.0(24.0)	21.5(21.5)	22.3(21.9)	17.0(20.4)	12.5(15.4)	19.2(20.3)	13.0(15.5)	11.3(17.0)	16.0(23.4)	11.0(12.9)	15.0(20.0)	10.2(17.2)	5.3(10.8)	8.7(17.4)
WSU	39.3(42.8)	41.7(41.6)	52.2(51.2)	49.7(59.6)	45.5(56.2)	54.8(58.1)	45.0(53.8)	41.7(62.3)	41.0(60.0)	59.8(70.0)	46.2(61.4)	41.0(69.3)	36.8(74.9)	30.8(61.9)
CARP	0.0	0.0	0.2(0.2)	0.0	0.2(0.2)	0.0	0.3(0.4)	0.3(0.5)	0.0	0.7(0.8)	0.5(0.7)	0.0	0.0	0.0
U.CHUB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BURBOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2(0.2)	0.0	0.0	0.0	0.0
TOTAL #	551	601	611	500	486	566	502	401	410	513	451	355	295	299
# NETS	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Appendix I. Creel survey results, harvest and gillnet trends for **kokanee salmon** in Hauser Reservoir.

Year	Summer Catch Rate (fish/hr.)	Winter Catch Rates (fish/hr.)	Ave. size (inches) Summer Creel	Harvest (X1000)	Spring Floaters (fish/net)	Fall Floaters (fish/net)	Summer Verticals (fish/night)
1986	0.10		16.6		1	15	28
1987	0.13		15.6		14	4	47
1988	0.24		16.3		12	19	131
1989	0.42	0.23	14.6	101.4	12	23	105
1990	0.22	0.18	15.7	60.9	15	29	86
1991	0.46	0.18	14.7	141.3	21	27	46
1992	0.22	0.30	15.8	78.4	12	26	23
1993	0.22	0.47	16.0	89.3	9	14	12
1994	0.15	0.03	14.8	37.1	13	9	41
1995	0.11	0.06	17.0	29.1	7	14	48
1996	0.10	0.00	14.1	17.4	13	16	40
1997	0.03	0.01	16.8	7.4	7	2	4
1998	0.01	0.00	16.3	2.3	1	3	0.3
1999	0.01	<0.01	19.1	2.5	0	2	0.7
Mean	**0.17**	**0.13**	**16.0**	**51.6**	**9.8**	**14.5**	**43.7**

Appendix J. Stocking records, creel survey results, harvest and gillnet trends for **rainbow trout** in Hauser Reservoir.

Year	Stocking (X1000)	Summer Catch Rates (fish/hr.)	Winter Catch Rates (fish/hr.)	Ave. size (inches) Summer Creel	Harvest (X1000)	Spring Floaters (fish/net)	Fall Floaters (fish/net)	% wild from Floaters
1986	212.6	0.25	N/A	13.5	N/A	14	8	
1987	212.8	0.24	N/A	14.2	N/A	4	7	
1988	211.8	0.24	N/A	15.8	N/A	3	17	4
1989	244.5	0.12	0.18	13.7	25.5	2	7	7
1990	154.0	0.10	0.11	14.9	27.8	1	6	4
1991	138.1	0.02	0.08	15.3	7.8	2	3	11
1992	126.4	0.05	0.02	15.1	13.0	3	5	11
1993	118.6	0.05	0.04	16.3	16.5	2	3	16
1994	105.1	0.02	0.01	16.6	4.2	2	3	
1995	106.7	0.05	0.04	17.5	11.5	5	2	
1996	94.2	0.05	0.04	17.5	14.8	2	4	
1997	98.7	0.08	0.08	16.9	13.9	3	2	15
1998	98.1	0.08	0.05	16.4	12.0	1	3	11
1999	174.3	0.12	0.17	17.4	26.5	1	2	9
Mean	**149.7**	**0.11**	**0.07**	**15.8**	**15.8**	**3**	**5**	**10**

%wild in 1986-87 were not estimated because hatchery fish were not marked before 1986.
%wild in 1994-96 were not estimated because hatchery fish were not marked in 1994.

Appendix K. Stocking records, catch rates, harvest and gillnet trends for **rainbow trout** in Holter Reservoir

Year	Stocking (X1000)	Summer Catch Rates (fish/hr.)	Winter Catch Rates (fish/hr.)	Ave. size (inches) Summer Creel	Harvest (X1000)	Spring Floaters (fish/net)	Fall Floaters (fish/net)	% wild from Floaters
1986	357.3	0.34	N/A	13.9	N/A	7	14	
1987	323.0	0.37	N/A	13.8	N/A	11	18	
1988	322.9	0.32	N/A	13.7	N/A	14	6	44
1989	366.8	0.27	0.23	14.5	57.2	4	7	37
1990	347.3	0.26	0.24	14.2	59.2	6	5	27
1991	420.1	0.27	0.27	12.6	62.3	10	7	37
1992	382.8	0.22	0.23	14.1	53.2	5	6	33
1993	361.0	0.14	0.09	15.9	33.7	5	3	42
1994	290.5	0.03	0.07	14.7	10.4	4	7	66
1995	317.5	0.16	0.06	14.1	20.1	3	5	52
1996	106.2	0.21	0.25	13.8	47.4	2	9	20

1997	371.4	0.11	0.24	15.5	38.4	7	6	29
1998	141.5	0.10	0.11	15.5	15.7	5	8	12
1999	400.7	0.14	0.29	18.0	38.5	1	4	25
Mean	**322.1**	**0.21**	**0.19**	**14.6**	**39.6**	**6**	**8**	**35**

%wild in 1986-87 were not estimated because hatchery fish were not marked before 1986.

Appendix L. Holter walleye tagging summary. Dangler tags used between 1988 and 1995; 1996 most walleye were tagged with both jaw and dangler tags; 1997-1999 all walleye tagged with jaw tags.

		NUMBER OF TAG RETURNS BY ANGLERS (HOLTER RESERVOIR)													
Year	#Tagged	1988	1989	1990	1991	1992	1993	1994	1995	1996	1996	1998	1999	TOTAL	%
1988	100	6	2	1	6	4	5	1	1	0	0	1	0	**27**	**27**
1989	30		2	2	0	0	0	0	1	0	0	0	0	**5**	**17**
1990	121			3	10	16	7	3	2	1	0	1	0	**43**	**36**
1991	63				1	4	4	1	0	0	0	0	0	**10**	**16**
1992	42					2	1	1	0	0	0	1	0	**5**	**12**
1993	18						0	5	0	0	0	0	0	**5**	**28**
1994	19							0	0	1	0	0	1	**2**	**11**
1995	284								5	10	4	5	7	**31**	**11**
1996	212									7	5	11	5	**28**	**13**
1997	230										4	4	2	**10**	**4**
1998	54											2	3	**5**	**9**
1999	69												5	**5**	**7**
TOTALS ⟶		**6**	**4**	**6**	**17**	**26**	**17**	**11**	**9**	**19**	**13**	**25**	**24**	**176**	

150 of the 230 walleye tagged in 1997 were from fish relocated from Canyon Ferry

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Date: November, 2000
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