# MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS FISHERIES DIVISION

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<u>REGION 4</u> <u>4600 GIANT SPRINGS ROAD</u> <u>GREAT FALLS, MT 59405</u>

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#### ABSTRACT

## Hauser Reservoir

Angling pressure on Hauser Reservoir in 2003 increased slightly from 2001 levels (33,803 angler days) to 37,237 angler days placing it 20<sup>th</sup> in the state pressure rankings. Rainbow catch rates during both summer and winter reached near record highs in 2003. Excellent survival of Arlee strain rainbows (7.3"-7.9") stocked in the fall beginning in 2002 has provided a much-needed boost to the Hauser sport fishery. Kokanee salmon gillnet catch rates improved in 2002 and 2003 however; the majority of fish collected were products of the 2002 and 2003 hatchery Larger, age zero kokanee were stocked in fall 2002 (6.6" in September) and releases. overwintered age 1 (8") were stocked in October 2003. Wild kokanee recruitment has been nonexistent since 1997. Angler catch rates for walleve declined in 2002 and 2003 however, gillnet catch rates remained stable. Walleye relative weights improved in the 10"-15" and 20"-25" categories. An increase was noted in the 15"-20" category in 2002 but declined in 2003. Angler catch rates for yellow perch remained low in 2002 and 2003. Beach seining in 2003 collected a near record number of yellow perch. Record numbers of YOY carp were collected in 2002 beach seining and record numbers of fathead minnows were collected in 2003 beach seining. A 1.7-mile reach from Hauser dam to Beaver Creek was electrofished for in 2003. Rainbow trout estimates were 4,585 per mile averaging 16.6 inches. Brown trout estimates were 129 per mile averaging 16.9 inches.

#### **Holter Reservoir**

Angling pressure on Holter Reservoir continued to decline in 2003 to an estimated 47,652 angler days, placing it 11<sup>th</sup> in the state pressure rankings. The long-term average (1989-2001) has been 68,500 angler days with winter pressure contributing nearly 19,000 angler days. Rainbow trout fishing was very good with catch rates near or above long-term averages. Winter rainbow catch rates in 2003 (0.44 per hour) were more than double the long-term average. Evaluation of rainbow strain and size at stocking continued through 2003. Since 1996, age 1+ Eagle Lakes have demonstrated an approximate 4 fold higher rate of return over the age 0+ Eagle Lake plants (planting date constant). For rainbows stocked in 2000, age 1+ Eagle Lake have demonstrated a 6-11 fold return advantage over the age 0 Eagle Lake and fall release Arlee plants. Winter angler catch rates for perch (2.4 per hour) remained strong through 2003; slightly above the long-term average of 2.2 per hour. Walleye catch rates remained strong for anglers with average size of fish in the summer creel declining slightly in 2003 to 13.8". Fall gillnet trends indicate a declining walleye trend since record highs in 1999. A relatively strong 2001-year class of walleyes was netted in 2002 and 2003. In general, the Holter walleye population has seen a shift to a younger, less diverse age structure.

# **METHODS**

Monitoring methods detailed in this report have been described by Berg and Lere (1983) and MFWP (1985). A map of the two-reservoir system is presented in Figure 1. A map of the Hauser Tailrace and electrofishing section is presented in Figure 2. Vertical and horizontal gillnetting (timing, net size and net locations) continued in 2002-2003 based on procedures established in Lere (1986). A modified Peterson estimate was used to determine population abundance (Ricker 1975)

General hydroacoustic methods used to estimate pelagic fish densities and total fish abundance are described in Skaar and Humphrey (1995). Hydroacoustic sampling was conducted using a HTI<sup>®</sup> 241 split beam echo sounder. A fixed 15-degree down-looking transducer was mounted on the port side of a 22-foot Almar fisheries research boat. Fish data were analyzed by size (decibels); longitudinal and depth distribution were analyzed using Hydroacoustic Technology Inc. EchoScape<sup>®</sup> (version 2.0 beta f) software package. 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 at the dam and were fished concurrent with acoustic sampling to allow for apportioning of acoustic targets by species.

The partial weekend creel survey continued on Hauser and Holter reservoirs from May through October and again during ice-covered months (January through March) as described in Lere (1987). Tailwater electrofishing methods used to estimate salmonid densities in the 2.7km reach below Hauser dam in 2003 were described in Spoon (1985).



Figure 1. Map of Hauser and Holter Reservoirs.



Figure 2. Map of Hauser Reservoir tailrace and electrofishing section.

# Hauser Reservoir

# **Results and Discussion:**

#### Gillnetting

Netting trends for the principal game fish (rainbow trout, kokanee salmon, yellow perch and walleye) of Hauser Reservoir are displayed in Figure 1. Netting data for all species collected in Hauser Reservoir since 1986 is tabulated in Appendix A and B.

## Spring Horizontal Gillnets

Eleven floating and six sinking gillnets were fished during May 2002 and 2003. A total of 118 fish were caught in 2002 and 352 fish in 2003. General catch per net results show rainbow trout declining from 2001 to 2002 but increasing in floating nets in 2003. Results from sinking gillnets indicate a substantial increase in white sucker numbers from 2002 to 2003. Yellow perch catch rates also increased from 0.7 per net in 2002 to 4.0 in 2003.

## Fall Horizontal Gillnets

Eleven floating gillnets were fished in October 2002 and 2003 while seven and six sinking gillnets were fished in 2002 and 2003 respectively. Only six sinking nets were fished in 2003 as one net in the Causeway was stolen and not recovered. A total of 394 fish were caught in 2002 and 444 fish were caught in 2003. Substantially more rainbow and kokanee salmon were caught in 2003 than 2002. Rainbow catch rates were the highest measured since 1990 while kokanee catch rates were the highest measured since 1996. Most of these fish were of hatchery origin and the kokanee salmon were primarily early maturing jack males from the 2002 plant of 48,500 (6.6") released in October. Walleye catch rates have remained stable since 2000. Yellow perch catch rates increased dramatically from 1.9 per net in 2002 to 9.0 per net in 2003.

#### Vertical Gillnets

Monthly vertical netting trends are displayed in Appendix E-J. Vertical nets are fished in the Hauser forebay during ice-free months and are the principal monitoring tool of kokanee salmon abundance and survival. Nets were fished May through October in 2002 and May through November in 2003.

A total of 105 kokanee were caught in 2002 while 77 were caught in 2003. These numbers are an improvement over previous years (2000=19; 2001=11). Kokanee collected however, remain nearly entirely comprised of hatchery fish. Only one of 105 kokanee in 2002 and two of 77 kokanee in 2003 were classified as wild based on absence of tetracycline marks on vertebral cross-sections. In 2002, 88% of kokanee were caught in the months of August and October. All

25 kokanee that were captured in August 2002 (Appendix E) were from the June stocking of 4.0" kokanee fingerlings. In October of 2002, 62 of 67 kokanee were from the late September hatchery stocking of 6.6" kokanee. Kokanee catch rates in 2003 gillnets were more evenly distributed across the months (Appendix H). A total of 19 kokanee were caught in May of 2003, of which 18 were products of the 2002 September stocking of 6.6" fish. This trend continued through August where 100% of the kokanee collected were from the September 2002 release of 6.6" kokanee. Twenty-five of 26 kokanee netted in September and October 2003 had been stocked as yearlings stocked in mid-July. Nets were fished into November of 2003 to monitor kokanee survival. Of the 28 kokanee collected, 25 had been stocked as yearlings in 2003. Only one of 28 was a wild reproduced kokanee.

Based on these catch data, survival of kokanee fry (319,104 stocked in 2002) and fingerlings (36,190 stocked in 2002) is near zero. Survival of 2002 late-release kokanee (48,549 fish @ 6.6") and over-wintered kokanee stocked in 2003 (75,671 fish @ 8"), was significantly better than fry or fingerlings however, these fish did not make a significant contribution to the Hauser sport fishery.

Flushing losses of kokanee are likely significant based on the seasonality and composition of the vertical gillnet catch. These vertical gillnets are fished in the Reservoir, approximately 200 yards upstream of Hauser Dam. Kokanee catch peaked in October 2002 and November 2003 and nearly all of them were recently stocked hatchery fish. Interestingly, rainbow trout captured in 2002 and 2003 followed trends similar to kokanee in that catch rates increased in the late fall months (Appendix F and I). Additionally, the majority of the rainbow trout captured between September and November of 2002 and 2003 were recently stocked rainbow. For example, 43 rainbow were collected in October 2003. The catch was comprised of 30 coded wire tagged Eagle Lake fingerlings stocked in mid-August and 10 were from the early October stocked group of Arlee rainbow. Approximately 104,000 Eagle Lake and Arlee rainbows were stocked in 2003.



Figure 1. Hauser Reservoir gillnetting trends for principal game species (1986 through 2003). Rainbow trout, yellow perch and walleye are based on number of individuals caught per horizontal gillnets. Kokanee salmon trend is based on total catch in vertical gillnets fished in July, August and September each year.

# Hatchery Rainbow Trout Survival Evaluation (Size, Stocking Time and Strain);

### Fall Horizontal Gillnets

A total of 199,179 hatchery rainbow trout were stocked in 2002 and 310,707 in 2003 (Appendix S). Two hatchery groups were evaluated in 2002; 100,562 Arlee rainbow trout (4.7-5.2 inches) stocked in late-June and 98,617 Arlee rainbow trout (7.3-7.9 inches) stocked in early October. The fish stocked in the fall were marked with an adipose fin clip. Rainbow stocking was similar in 2003, except for the addition of 104,900 Eagle Lake Rainbow trout (6.1 inches) from the Ennis National Fish Hatchery. These Eagle Lake rainbow were stocked in mid-August were marked with a coded wire tag.

Analysis of hatchery rainbow trout survival was primarily based on recruitment to fall floating and sinking horizontal gillnets (Appendix S). Survival from 1996 through 1998 was relatively consistent with return indexes ranging from 32.4 to 37.7 (See explanation of return index in Appendix S). Even though high spring runoff and extremely low water retention characterized 1996 and 1997, rainbow survival remained constant, as fish were not stocked until early July on the declining hydrograph. The number of rainbow trout stocked into Hauser Reservoir during 1999-2000 was approximately twice the pre-1998 levels. This increase was in response to the collapse of the kokanee fishery and to return to pre-1990 stocking rates. The increase in stocking rates resulted in a dramatic decline in survival. The return index for the years 1999 through 2001 declined from 9.8 to 1.4. Based on gillnet and angler catch data, the largest single biological change that occurred in Hauser Reservoir for the period 1999-2001 was record walleye recruitment (Figure 1) in 1998. Walleye predation impacts have been most dramatic on fingerling rainbow (and kokanee) plants, which have continued through 2003.

Survival of the 8", rainbow trout stocked in the fall has been 40% greater than the July release 5" rainbows planted in 2002. Early results from the 2003 rainbow-stocking scheme indicate poor survival for the fingerling plant while the fall 8" fish demonstrated excellent survival. The bonus 104,900 Eagle Lake planted in August demonstrated a return index of 3.8 compared to 0.0 for the summer fingerling plant and 21.2 for the October release of 8" rainbow.

# **Return to Creel**

Evaluation of season and size at stocking did not begin until 2002 with the marking of 104,000 fall-stocked Arlee rainbow. These fish did not appear in the creel until spring of 2003. Therefore, 2003 was the first year that the two groups of rainbow trout (summer release fingerlings and fall release sub-catchables) were available and of quality size to anglers. In 2003, 281 rainbow trout were measured during the summer creel. Fall release Arlee (2002 plant)

accounted for 60.4% of the catch while 2002 summer stocked fingerlings accounted for only 18.1% of the catch. The 2001 group of summer released fingerlings accounted for 13.5% while the 2000 group of summer release fingerlings contributed 7.8% of the summer rainbow catch (Table 1).

during	the 2003 summ	er creel for r	ecently stocked	d rainbow tro	out in Haus	er Res	servoir 2000-2003	•
Year	Hatchery*	Strain	# Stocked	SAS (in)	MOS	Re	eturn to summer	
						cre	eel (2000-2003)	

5.3-5.7

4.6-6.0

4.7-5.2

7.3-7.9

4.7-5.0

7.1-7.7

6.1

July

July

July

October

July

October

August

7.8%

13.5%

18.1%

60.4%

N/A

N/A

N/A

189,232

211,843

100,562

98,617

101,806

103,981

104,920

Table 1.	Comparison of	month of stocking	(MOS), size at	stocking (SAS)	and percent	t recorded
during th	e 2003 summer	creel for recently st	ocked rainbow	trout in Hauser	Reservoir 20	000-2003.

\*Hatchery; G=Giant Springs, L=Big Springs, E=Ennis

Arlee

Arlee

Arlee

Arlee

Arlee

Arlee

Eagle Lake

Fish stocked in 2003 were too small to be kept by most anglers.

A comparison of hatchery rainbow recruitment to fall gillnets versus the summer angler creel showed some differences, but both methods showed fall -stocked fish substantially outperformed fingerlings stocked in July. Fall-stocked rainbows were 3.3 times more abundant than July released fingerlings in the 2003 summer creel survey and 1.7 times more abundant in fall gillnets.

# **Creel Surveys**

# Summer Creel (Table 1)

2000

2001

2002

2002

2003

2003

2003

G/L

G

G

G

G

G

E

In 2002, 612 anglers were interviewed on Hauser Reservoir and they reported fishing a total of 1799.9 hours. Similar numbers were surveyed in 2003 (818 interviews; 2693.3 angling hours). Total numbers of creeled fish in 2002 include; 87 rainbow trout, 61 yellow perch, 0 kokanee, 96 walleye and 14 brown trout. Fish creeled in 2003 include; 641 rainbow trout, 507 yellow perch, 5 kokanee salmon, 18 walleye and 7 brown trout. On average, a completed shore fishing trip was 3.4 hours in 2002 and 2.6 hours in 2003. Boat based trips lasted 4.4 hours in 2002 and 4.1 hours in 2003.

Summer catch rates for rainbow trout reached near record highs in 2003 at 0.24 rainbow trout per hour. This represents a five-fold increase over 2002 catch rates. Yellow perch catch rates also

jumped to the highest levels since 1996 at 0.19 perch per hour. Walleye catch rates declined from 0.05 per hour in 2002 to 0.01 in 2003. Catch rates for brown trout and kokanee salmon were less than 0.01 fish per hour for both years.

Catch rates for anglers targeting individual species or groups of similar species were higher than for the general non-specific angler. For example in 2002, anglers targeting yellow perch recorded a catch rate of 0.28 per hour while those fishing for "any fish" caught perch at the rate of 0.00 per hour. The same trend held true for walleye and rainbow trout. Anglers specifically fishing for walleye, who comprised 30.7% of anglers, caught walleye at the rate of 0.14 per hour while general anglers, who comprised 31.4%, caught walleye at the rate of 0.01 per hour. Rainbow fisherman, who comprised 16.7% of all respondents, recorded a catch rate of 0.14 per hour while general anglers catch rates for rainbows fell to 0.04 per hour.

Walleye harvested in 2002 averaged 17.9" (range 14.2"-26.5"; n=79). Walleye harvested in 2003 averaged 17.5"; range 15.1"-19.1"; n=6). Rainbow trout harvested in 2002 averaged 19.7" (range 13.8"-23.8"; n=54) and 15.5" (range 9.2"-24.9"; n=281) in 2003.

Harvest estimates (summer and winter angling seasons) were generated for sport fish in 2003. Good survival of hatchery plants in 2002 and 2003 resulted in a rainbow harvest of 21,100 in 2003, the forth-highest estimate since 1989 (Table 1). Kokanee harvest remained nonexistent in both years. Yellow perch harvest remained well below the long-term average at 6,100 fish in 2003. Walleye harvest continued a three-year decline with an estimated 1,200 fish harvested in 2003.

	I	RAINBOW KOKANEE					YE	LLOW PERC	H	WALLEYE		
Year	Catch rate (fish/hr)	Mean Size (in)	Harvest (X 1000)	Catch rate (fish/hr)	Mean Size (in)	Harvest (X 1000)	Catch rate (fish/hr)	Mean Size (in)	Harvest (X 1000)	Catch rate (fish/hr)	Mean Size (in)	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		0.22	15.7		0.17		38.9	0.00		N/A
1991	0.02	15.3	7.8	0.46	14.7	141.3	0.08	8.1	36.8	0.0001	N/A	0.03
1992	0.05	15.1		0.22	15.8		0.16		55.4	0.0005		0.08
1993	0.05	16.3	16.5	0.22	16.0	89.3	0.05	9.0	49.4	0.0001	N/A	0.03
1994	0.02	16.6		0.15	14.8		0.15		38.2	0.0004		0
1995	0.05	17.5	11.5	0.11	17.0	29.1	0.16	8.9	23.2	0.002	*	0.08
1996	0.05	17.5		0.10	14.1		0.31		37.2	0.002		0.09
1997	0.08	16.9	11.0	0.03	16.8	5.8	0.07	8.4	16.1	0.001	*	0.09
1998	0.08	16.4		0.01	16.3		0.12		28.9	0.04		3.9
1999	0.12	17.4	21.4	0.01	19.1	1.8	0.06	9.2	12.9	0.14	13.6	7.9
2000	0.06	20.5		0.00	N/A		0.01		6.8	0.02		4.9
2001	0.05	16.5	11.8	0.0002	N/A	0.04	0.01	11.2	2.0	0.05	16.2	7.6
2002	0.05	19.7		0.00	N/A		0.03		3.7	0.05		5.6
2003	0.24	15.5	21.1	0.002	N/A	0.86	0.19	8.2	6.1	0.01	17.5	1.2
Mean	0.10	16.3	14.4	0.13	16.0	37.7	0.11	9.3	25.5	0.02	16.0	2.4

Table 2. Summer catch rates, mean size, and harvest estimates of selected species in <u>Hauser Reservoir</u>. Harvest estimates include ice fishing statistics collected during winter season. Harvest estimates are not generated during even numbered years, as no statewide angling pressure estimates are available.

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

# Winter Creel (Table 2)

A total of 103 anglers were interviewed during the winter of 2001-2002 for a total of 220.7 angling hours. Slightly fewer (81) were interviewed in the winter season of 2002-2003 for a total of 242.4 angling hours. Rainbow trout catch rates jumped from 0.10 in 2002 to 0.18 in 2003. This represents the highest winter catch rate since 1989 and double the long-term average of 0.09 rainbow per hour. Yellow perch catch rates declined from 0.05 in 2002 to 0.02 perch per hour in 2003. No kokanee salmon were recorded caught in 2002 or 2003. Brown trout and walleye catch rates were extremely low (<0.01 per hour) in 2003.

				Catch ]	<u>Rates (fish per</u>	<u>r hour)</u>	
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
2000	266	188	0.11	0.00	< 0.01	0.11	0.04
2001	306	192	0.17	0.01	< 0.01	0.02	0.01
2002	103	34	0.10	0.01	0.00	0.05	0.00
2003	81	51	0.18	< 0.01	0.00	0.02	< 0.01
MEAN	320	510	0.09	0.01	0.10	0.30	0.01

Table 3. Total catch, number of interviews and angler catch rates for the principal game species from **winter creel** surveys on Hauser Reservoir.

#### **Beach Seining**

Hauser Reservoir beach seining was conducted on August 12, 2002 and August 25, 2003. Yellow perch numbers fell below the long-term average in 2002 but rebounded in 2003 to nearly 1,000 per haul; the second highest on record. Conversely, young of year suckers were collected in near record numbers in 2002 but fell by 60% in 2003. Young of the year walleye relative abundance continued to decline following record highs in 1997 and 1998. This is probably due to reduced flushing of walleye from Canyon Ferry Reservoir as a result of lower than average

runoff since 1997. Also, gillnet sampling in Canyon Ferry indicates the density of young of year walleye has declined since 2001. Carp, which were not counted in beach seining until 1994, exploded in 2002. An average of 1,133 carp per haul were netted in 2002; the highest since 1994. The second highest catch of carp was in 2001 at 201 per haul. Likewise, fathead minnow production reached record highs in 2003. An average of 508 per haul were counted in 2003 while 71 per haul were collected in 2002 (Table 4).

			Nu	mber per Haul		
Year	Number of Hauls	Yellow Perch	Suckers	Walleye	Carp*	FHM
1990	2	15.5		0.0	0.0	0.0
1991	20	36.6		0.0	0.0	0.0
1992	20	1153.1	107.6	0.0	0.0	48.2
1993	20	145.0	1105.9	0.0	0.0	21.4
1994	20	52.8	729.6	0.0	7.4	10.7
1995	20	47.0	187.5	0.1	3.1	14.1
1996	19	232.0	573.6	0.0	49.5	87.8
1997	20	58.0	81.5	2.7	0.05	2.8
1998	19	670.4	361.1	3.3	28.6	24.4
1999	20	191.1	63.5	1.3	2.4	3.7
2001	20	495.7	757.9	2.3	201.3	84.6
2002	20	118.7	939.5	1.0	1132.6	70.8
2003	20	980.0	343.5	0.1	13.7	508.0
Mean		313.2	473.9	0.7	160.0	79.7

Table 4. Number of fish per beach seine haul in Hauser Reservoir 1990-2003. (FHM=fathead minnow *Pimephales promelas*)

\* Carp not counted until 1994.

# Hydroacoustic Surveys

Hauser Reservoir hydroacoustic surveys were conducted at night on September 23<sup>rd</sup>, 2002 and October 14<sup>th</sup> and October 15<sup>th</sup>, 2003. Numerous technical problems were encountered during these surveys. Unfortunately, the Hydroacoustic Technology, Inc. Model 241 echo sounder was processing fish target data incorrectly due to an internal electrical problem. The sounder was sent back for repair in 2003 but was returned too late to repeat surveys.

Year	Pop. Est.	S.D.	#/Acre	Kok	Rb	We
1996	400,000	<u>+</u> 100,000	N/A	324,000	19,200	0
1997	200,000	<u>+</u> 100,000	N/A	74,000	7,800	1,800
1998	210,000	<u>+</u> 93,000	183	0	157,000	10,000
1999	110,000	<u>+</u> 81,000	96	4,000	19,400	11,300
2000	400,000	<u>+</u> 280,000	349	89,500	79,000	42,000
2003	258,000	<u>+</u> 67,600	225	63,400	181,800	4,200

Table 5. Hydroacoustics estimates of Hauser Reservoir fish populations from Eldorado Bar to Hauser dam including the lower half of the Causeway arm. Estimates are apportioned by species (Kok=kokanee salmon, Rb=rainbow trout, We=Walleye).

Hydroacoustic fish population estimates for 2003 were only completed for two mid-reservoir transects when equipment was operating properly (Transects I and J). Volumetric estimates for esonified waters were 258,000 fish (225/acre). Acoustic targets were apportioned by the percentage of each species collected in vertical gillnets fished on October 21, 2003. Netting results indicated the fish population was comprised mostly of rainbow trout (71%) and kokanee salmon (25%). The large numbers of rainbow counted during acoustic surveys were probably hatchery rainbow trout released at York Bridge FAS in late September and early October.

#### Hauser Tailrace Electrofishing

A mark-recapture electrofishing estimate was conducted on the 1.7-mile (2.7km) reach of the Missouri River below Hauser Dam (Figure 2) on September 18, 2003 and September 25, 2003. A total of 1,428 rainbow, 89 brown trout, 45 kokanee salmon, 76 walleye and 4 burbot were collected during the two nights of electrofishing. Two boom-mounted electrofishing boats were used for the mark and recapture runs. Water temperatures ranged from 54-56F.

The rainbow trout population estimate for the 1.7-mile reach was 8,132 fish greater than eight inches  $(SD\pm927)$ . The brown trout estimate for this reach was 239 fish greater than eight inches  $(SD\pm61)$ . These estimates standardized to a one-mile reach length are 4,783 rainbow and 140 brown trout per mile.

Average length of rainbow trout was 16.6 inches while brown trout averaged 16.9 inches (Appendix U). Relative weights were excellent, averaging 114.6 for rainbow trout and 104.8 for brown trout. Walleye averaged 18.5 inches long (range=12.5-28.3") and 2.6 pounds (range=0.65-11.4 lbs). Walleye relative weights averaged 96.8 (range=76.7-123.9) Walleyes greater than 16 inches (N=53) were uniquely jaw tagged to monitor angler harvest and fish movement. A sub sample of walleye spines was collected, cross-sectioned and manually read to

determine age of the walleye in the river section. Nearly 50% of walleyes collected were six years old (1997 year class) while walleyes produced in 1996 accounted for 15%. The 1999-year class of walleyes comprised 11% of the age sample.

# **Yellow Perch Habitat Enhancement**

Bundles of Christmas trees weighted with cinder blocks have been submerged in Hauser Reservoir annually since 2001 in an effort to improve yellow perch spawning and recruitment. Bundles have been placed in and around the Hauser Causeway as this water is the earliest to warm in the spring and historical trap netting indicates that perch congregate to spawn in these areas. A total of 349 bundles (1832 trees) were deployed in 2002 with deployment depths ranging from 13-27 feet. A total of 171 bundles (855 trees) were deployed in 2003 with target depths of 11-18 feet. Appendix V and W detail the GPS locations of 2002 and 2003 habitat bundles.

Yellow perch spawning activity on these structures has been observed during spring SCUBA diving. In addition, perch young of the year relative abundance has increased in fall beach seining since 2001. Average perch per seine haul has nearly doubled for the period 2001 through 2003 compared to the period 1991 through 1999. Recruitment of perch to fall gillnets increased in 2003 with the highest catch rate since 1996. It is difficult to ascertain if these increases are a result of the habitat additions, climatic events favorable to spawning success or simply flushing of perch from Canyon Ferry following production of the abundant 2001-year class.

# Holter Reservoir

# **Results and Discussion:**

# Gillnetting

Netting trends for the principal game fish (rainbow trout, kokanee salmon, yellow perch and walleye) of Holter Reservoir are displayed in Figure 2. Detailed netting results for all species collected in spring and fall, floating and sinking gillnets from 1986 through 2003 are tabulated in Appendix C and D.

# Spring Horizontal Gillnets

Rainbow trout collected in spring floating gillnet catch rates improved to 5.0 per net in 2002; which is about double the 2001 catch rate of 2.4 per net. Floating gillnets fished in 2003 caught 4.2 rainbow per net. These catch rates remain below the long-term average of 5.4 rainbow per net.

Walleye collected in spring sinking nets increased to 7.5 per net in 2002, matching the highest number on record. Walleye catch rates declined by more than half in 2003 to 3.2 per net. Yellow perch catch rates in springtime sinking nets increased over previous years and remained strong at 10.7 per net in 2002 and 9.8 per net in 2003. However, these recent catch rates remain substantially below the long-term average catch rate of 29.5 perch per net (Appendix C).

# Fall Horizontal Gillnets

Rainbow trout collected in fall floating gillnets decreased from 5.9 per net in 2002 to 3.2 per net. The current three-year running average of 4.8 rainbow trout per fall floating gillnet fails to meet the management plan target of 8 per net (Figure 2).

Walleye collected in fall sinking gillnets remained strong in 2002 at 4.5 per net and declined to 2.5 per net in 2003. The current running three-year average of 3.9 walleyes per net remains above the management plan target of 3.0 per net. Young fish dominated age structure of Holter walleye in 2002; 20 of 29 were age 3 and younger. Similar results were seen in 2003 with 13 of 18 walleye being age 3 and younger.

Yellow perch collected in fall sinking gillnets in 2002 averaged 7.9 inches (n=27) with the majority of fish being 7.5 inches to 8.5 inches. In 2003 perch averaged 7.5 inches (n=31), with strong representation from age 3 and 4 perch. Perch catch rates have improved in recent years but remain well below the long-term average fall rate of 9.5 per net and significantly lower than levels in the late 1980's (Appendix D).

# Vertical Gillnets

Monthly vertical netting results for 2002 and 2003 are displayed in Appendix K-P. Vertical nets are fished in the Holter Reservoir forebay during ice-free months and are the principal monitoring tool of kokanee salmon abundance. Nets were fished May through October in 2002 and May through November in 2003.

A total of 17 kokanee salmon were collected in vertical gillnets in 2002. Kokanee catch increased in 2003 to 31. Wild salmon comprised a surprising 41% of the catch in 2002 and 52% in 2003. The majority of these fish in 2002 were 2001-year class (age 1) while in 2003; the majority were 2000 (age 3) year class fish. Some of these fish could be products of the unmarked kokanee egg and/or fry plants in Hauser in 2000-2002. Hatchery kokanee were stocked in Holter Reservoir in 2002 (166,000 fish; 3-3.2" long; 1TM) in response to extremely low survival of Hauser Reservoir stocking since 1997. Only five of these fish were collected in 2002 and 2003. In addition, kokanee recruitment is strongly influenced by flushing out of Hauser Reservoir. For example, in 2002, 60% of the hatchery fish collected were originally stocked in Hauser hatchery kokanee salmon into Holter has continued even though spring runoff remained below average in 2002 and 2003. Additionally, in 2003, 53% of the hatchery kokanee collected in Holter were products of the September plant of 48,549 (6.6") in Hauser.



Figure 2. Holter Reservoir gillnetting trends for principal game species (1986 through 2003). Rainbow trout, yellow perch and walleye are based on number of individuals caught per horizontal gillnets. Kokanee salmon trend is based on total catch in vertical gillnets fished in July, August and September each year.

#### Hatchery Rainbow Trout Survival Evaluation (Size, Stocking Time and Strain);

# Fall Horizontal Gillnets

The survival of various strains and sizes of rainbow trout stocked since 1996 in Holter has been monitored with floating and sinking gillnets (Appendix R). A total of ten combinations of age and strain have been collected in fall gillnets. Tracking of cumulative returns indicates most fish remain at large for three years or less in the reservoir. For instance, 81% of all the 1997 plant of age 0's and 99% of all the 1998 plant of yearlings netted were caught by fall of 1999 (Table 7). On average, 79% of all 1+ Eagle Lake rainbow captured in fall gillnets were caught by year two and 94% were caught after the third season in the reservoir. By comparison, 75% of age 0+ Eagle Lake rainbow were caught by year two in the system and 92% were caught by the third year (Table 6). Based on size at stocking, the age 0+ do no fully recruit to gillnets until the second year in the system while the age 1+ will recruit in year one.

With at least four years to return (99%-100% return), the 1996 plant of age 1+ Eagle Lake has shown a return index of 78.2 compared to 21.3 for the 1997 plant of age 0+ Eagle Lake rainbow. The 1998 stocking of age 1+ Eagle Lake have shown a return index of 33.2 compared to 6.0 for the 1999 age 0+ group (Appendix T). Interestingly, between three and four times more age 0+ Eagle Lake rainbow were planted than age 1+ rainbow during these years. The 2000 stocking of age 1+ Eagle Lake plants have shown a return index of 51.8 compared to 4.7 for the age 0 Eagle Lake rainbows. Additionally, in 2000, 65,000 Arlee rainbow were stocked in October at seven inches. The return index on this initial group of Arlee was better than the age 0 Eagle Lake at 9.2.

On a per-fish basis, it cost 1.8 cents to raise a 4.2-inch rainbow versus 12.8 cents to raise an 8.25inch rainbow or a seven-fold difference (personal comm. Jack Boyce, Manager, Big Springs State Fish Hatchery). The survival of the 8.25-inch fish is four times greater than the 4.2-inch fish, but the cost to raise these larger fish is seven times greater. Therefore, the most cost effective approach would be to dramatically increase numbers of 4.2-inch rainbow planted. However, this assumes that survival is linear based on numbers stocked, which is probably not the case and also that sufficient eggs would be available. Results from Seminole Reservoir on the North Platte Reservoir System in Wyoming indicated roughly 500,000-fingerling rainbow were consumed within three weeks post-stocking by the abundant walleye population (McMillan 1984). In numerous examples, fingerling rainbow have been shown to be highly vulnerable to predation, regardless of numbers planted (Yule et al 2001). Season of planting (Summer versus Fall or Winter) could be manipulated to determine if planting fingerlings at periods when predation is lower would enhance survival of the fingerling plants. For example, the 1999 plant of age 0+ Eagle Lake was split between 66% plant in early July and 33% in October. Fall 1999 gillnets failed to collect any of the July plant, however, the following fall, 15 of 55 rainbows (27%) were probably products of one of the October stocking. The October fish did not possess a tetracycline mark and therefore were difficult to distinguish from wild fish.

Conclusive evidence that fall planted, catchable (approximately 9") rainbow trout outperform summer stocked subcatchables (approximately 7") in the presence of walleye was shown in the Wyoming North Platte study (Yule et al. 2001). Over the course of this investigation, returns of fall-stocked rainbow were nearly twice those of spring-stocked rainbow. Walleye predation was stated as the primary factor in the survival differences with larger rainbow trout being less vulnerable to predation. Additionally, walleye predation declines in the fall-winter period resulting in fewer rainbows consumed.

Table 6. Cumulative rates of return of age 1+ and 0+ Eagle Lake strain rainbow trout to fall horizontal gillnets (floating and sinking). Age 1+ were evaluated based on 1996, 1998 and 2000 stocking years; age 0+ were evaluated on 1997, 1999 and 2001 stocking years.

Age 1+ Eagle Lake Rainbow						
Net Year	Cumula	tive Perc	ent Caught	Average		
Year 1 (age 1)	64%	62%	31%	52%		
Year 2 (age 2)	85%	79%	74%	79%		
Year 3 (age 3)	92%	96%	95%	94%		
Λσ		la Laka I	Dainhaw			
Ag	e ut Lag	gie Lake I	Nampow			
Net Year	Cumula	tive Perc	ent Caught	Average		
Net Year Year 1 (age 0)	<i>Cumula</i> 23%	tive Perco	ent Caught 22%	Average 15%		
Net Year Year 1 (age 0) Year 2 (age 1)	<i>Cumula</i> 23% 62%	tive Perco	ent Caught 22% 100%	<i>Average</i> 15% 75%		

Table 7. Longevity and cumulative return of hatchery rainbow to fall horizontal gillnets (sinking and floating) in Holter Reservoir (1996-2003). Cumulative percentages are not listed for groups of rainbow in 2003 that will continue to recruit to gillnets beyond 2003. Strain; A=Arlee, EL=Eagle Lake

					Num	ber Caught in I	Nets (cumulativ	ve % in parent	hesis)		
Year		Age @									
Stocked	Strain	Release	1996	1997	1998	1999	2000	2001	2002	2003	Total
1996	EL	1	53(64%)	18(85%)	5(92%)	6(99%)	1(100%)				83
1997	EL	0		18(23%)	31(62%)	15(81%)	14(99%)	1(100%)			79
1998	EL	1			29(62%)	8(79%)	8(96%)	2(100%)			47
1999	EL	0				0(0%)	15(63%)	8(96%)	1(100%)		24
2000	EL	1					12(31%)	17(74%)	8(95%)	2(100%)	39
2000	EL	0					2(22%)	6(89%)	1(100%)	0(100%)	9
2000	А	0					3(50%)	0(50%)	3(100%)	0(100%)	6
2001	EL	1						10(63%)	4(88%)	2	16
2001	EL	0						4(67%)	1(83%)	1	6
2001	А	0						2(15%)	11(100%)	0	13
2002	EL	1							12(75%)	4	16
2002	EL	0							4(36%)	7	11
2002	А	0							3(60%)	2	5
2003	EL	1								4	4
2003	EL	0								0	0
2003	Α	0								5	5

	RAINBOW TROUT		DUT	KOKA	ANEE SALM	AON	YEI	LLOW PERC	CH	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	0.004	17.9	0.3
1991	0.27	12.6	62.3	0.10	15.2	22.4	0.40	8.6	237.7	0.003	16.4	0.5
1992	0.22	14.1	53.2	0.09	16.6	20.4	0.52	8.9	492.9	0.005	20.4	0.6
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	1.3
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	49.3	0.16	14.1	34.0	0.04	9.5	49.3	0.02	13.2	1.9
1997	0.11	15.5	32.3	0.02	16.9	4.0	0.07	7.8	29.3	0.01	17.7	1.1
1998	0.10	15.5	15.4	0.01	16.8	1.9	0.10	9.7	82.4	0.04	15.5	4.6
1999	0.14	18.0	41.3	0.002	15.6	0.4	0.23	8.3	75.7	0.05	14.1	5.6
2000	0.05	19.6	16.0	0.001	*	0.09	0.08	7.9	139.9	0.13	14.8	24.3
2001	0.06	17.1	14.1	0.001	*	0.3	0.07	8.7	35.2	0.06	15.1	8.3
2002	0.19	17.8	27.1	0.01	*	1.6	0.06	9.0	24.1	0.06	15.0	8.0
2003	0.20	17.3	39.9	0.01	16.2	1.1	0.14	9.4	74.7	0.13	13.8	12.5
Mean	0.19	15.3	35.4	0.04	16.1	9.5	0.26	8.9	175.1	0.03	16.5	5.0

Table 8. Summer catch rates, mean size, and harvest estimates of selected species in <u>Holter Reservoir</u>. Harvest estimates include ice fishing statistics collected during the winter season

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

# **Return to Creel**

A total of 202 (2002) and 315 (2003) rainbow trout were recorded (fish weighed and measured by the creel clerk) during the summer creel. The winter creel recorded 52 (2002) and 40 (2003) rainbow trout. Fall release Arlee rainbow accounted for 18% of rainbow caught in 2002 and 28% in 2003 (approximately 100,000 have been stocked annually since 2000). These numbers increased during the winter creel where Arlee comprised 31% of the rainbow catch in 2002 and 38% in 2003. Analysis of the contribution of Eagle Lake (age 0 vs. age 1) and potentially wild rainbow to the creel has not been determined, since vertebrae from harvested rainbow trout have not been collected during the creel periods. Vertebras are necessary for age and hatchery differentiation because tetracycline marks on vertebra are used to differentiate these three test groups.

Differentiation between Arlee and Eagle Lake strains is easily accomplished because 100% of fall-released Arlee rainbow have had the adipose fin clipped since 2000. Eagle Lake contribute heavily to the creel throughout the year but especially in the spring months (Apr-Jun) as spawners congregate along shoreline and are accessible for anglers. Arlee rainbow contribution to the creel increases during July and August as night angling becomes productive. In general, Eagle Lake rainbow contribute two-thirds of the creeled rainbow while Arlee contribute one-third. This was very consistent in 2002 (35% Arlee/65% Eagle Lake) and 2003 (31% Arlee/69% Eagle Lake) (Figure 3). Since 2001 the average annual rainbow stocking program has been comprised of 26% Arlee and 74% Eagle Lake. Thus, Arlee rainbow return to the creel at a slightly higher rate than the initial stocking proportion. Future reports will detail return to creel for age one vs. age zero Eagle Lake rainbows.

# **Creel Surveys**

#### Summer Creel

Total numbers of anglers interviewed in 2002 and 2003 were 476 and 756 respectively. These anglers fished 1717 hours in 2002 and 3341 hours in 2003. They reported catching 323 rainbows, 102 perch, 104 walleye, nine kokanee salmon and brown trout in 2002. In 2003, anglers reported catching 655 rainbow trout, 479 yellow perch, 431 walleye, 36 kokanee and brown trout.



Figure 3. Monthly contribution of Arlee and Eagle Lake strain hatchery rainbow trout to the Holter Reservoir summer creel, 2002 (upper) and 2003 (lower). Number in parenthesis denotes number of rainbow trout measured by month. Monthly samples are comprised of all age classes present in the reservoir.

Rainbow catch rates during summer averaged 0.19 per hour in 2002 and 0.20 per hour in 2003 with fish averaging 17.8" in 2002 and 17.3" in 2003 (Table 7). Average weight of creeled rainbow was 2.3 pounds in 2002 and 2.1 pounds in 2003. Catch rates were similar to the long-term average of 0.19 fish per hour while average size was above the long-term average of 15.3". The estimated rainbow trout harvest, which includes the entire year, was 14,100 in 2001, 27,100 in 2002 and 39,900 in 2003. The long-term average rainbow harvest has been 35,400 since 1989.

Rainbow catch rates vary by month. In 2002, catch rates peaked in April at 0.53 per hour while in 2003 catch rates peaked in October at 0.50 per hour. The highest catch rates occurred in the vicinity of the BLM ramp near Holter Dam during April when Eagle Lake rainbow were cruising the shorelines during the spring spawning season. Recreational use on Holter Reservoir declined in 2003 in large part to the construction-based closures of both the BLM boat ramp and campground near Holter Dam in May and June followed by the closure of Log Gulch campground and boat ramp from mid-July through October. This probably affected rainbow catch rates in the springtime because anglers were not able to access the shoreline areas to take advantage of congregating rainbows.

Anglers specifically targeting rainbow trout in 2002 represented 42.6% of all Holter fishermen while 19.7% were targeting walleye. Species designation statistics were not valid in 2003 due to errors conducted during field surveys.

# Winter Creel (Table 7)

A total of 92 anglers were interviewed during the ice-fishing season (January through March) in 2002 and only 36 ice anglers were interviewed in 2003. These fishermen accounted for 401 angling hours in 2002 and 120 hours in 2003. Winter catch rates improved significantly from 2002 to 2003. Rainbows were caught at a rate of 0.15 per hour in 2002 increasing in 2003 to a 15-year record high of 0.44 per hour. In addition, perch catch rates more than quintupled over 2002 levels jumping from 0.46 per hour to 2.40 perch per hour. However, 2003 results should be viewed with caution due to relatively small sample size.

Average length of rainbow trout in the winter creel was 17.7" in 2002 and 16.7" in 2003. Perch averaged 8.8" in 2002 and 8.6" in 2003. Anglers kept over 90% of rainbows and perch caught in 2002, while this declined in 2003 to 80%. The majority of winter anglers reported they were fishing for rainbow trout (41% in 2002; 36% in 2003). Those specifically targeting perch represented 34% of all anglers in 2002 and 14% in 2003. Anglers targeting "any fish" comprised 14% in 2002 and 11% in 2003.

			Cat	ch Rates (fish per h	our <u>)</u>
Year	<b># of Interviews</b>	<b>Total Catch</b>	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
2000	88	958	0.11	0.00	3.22
2001	243	564	0.06	0.00	0.50
2002	92	251	0.15	< 0.01	0.46
2003	36	345	0.44	0.00	2.40
Mean	246	2080	0.19	< 0.01	2.22

Table 9	Anglers catch rates on Holter Reservoir during the <i>ice-fishing</i> season; 1989 through
2003. (	atch rates for walleve and brown trout were less than 0.01 for all years.

# **Beach Seining**

Beach seining was conducted on Holter Reservoir on August 14<sup>th</sup>, 2002 and August 27-28, 2003. A total of 20 standardized hauls were conducted during both years. Yellow perch numbers in both years were above the long-term average, and the 2002 catch was the third highest on record. Conversely, sucker and walleye counts were below average. Sucker counts in 2002 were the second lowest on record and were less than half of the long-term average in 2003. Walleye catch in 2002 and 2003 declined from the high levels observed in 1998, 1999 and 2001. The high catch of YOY walleye in 1998 and 2001 resulted in above average recruitment to fall gillnets. However, YOY walleye catch in 1999 did not translate to increased recruitment in subsequent years.

			Num	ber per Haul	
Year	Number of Hauls	Yellow Perch	Suckers	Walleye	Carp
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	9.3
1995	16	80.3	120.9	1.0	6.6
1996	19	32.4	385.5	0.6	54.7
1997	20	32.0	327.4	0.6	0.1
1998	20	2906.2	962.3	4.2	2.7
1999	19	3005.7	616.5	4.4	2.7
2001	20	792.3	100.3	4.8	1.0
2002	20	1028.7	61.2	0.4	0.9
2003	20	844.3	110.0	1.0	2.8
Mean		765.5	288.4	1.5	9.0

Table 10. Beach seine results (number of fish per haul) in Holter Reservoir (1990 through 2003).

#### Hydroacoustic Surveys

Holter reservoir hydroacoustic transects were esonified October 14<sup>th</sup>, 2003 from approximately Cottonwood Creek downstream to the Dam. Numerous technical problems were encountered during these surveys. Unfortunately, the Hydroacoustic Technology, Inc. Model 241 echo sounder was processing fish target data incorrectly due to an internal electrical problem. The sounder was sent back for repair in 2003 but was returned too late to repeat surveys.

## **Trap Netting**

Trap nets were fished in 2002 and 2003 to tag spawning walleyes. Age composition of spawning walleye is monitored and tag return information is used to determine angler exploitation. In 2002, a total of 83 male, 24 female and 3 immature walleye were netted in 53 net nights from April 30 to May 10. Average length of spawning age male walleye was 18.6 inches and females were 25.1 inches (Table 11). In 2003, nets were fished from April 29 to May 9. A total of 79 male, 29 female and 15 immature walleye were netted in 54 net nights. Average length of spawning age male walleye was 18.1 inches and females were 24.6 inches (Table 11). The largest walleye ever handled by FWP in Holter Reservoir (32.2 inches; 14.5 pounds) was captured in a trap net in May 2003. This walleye was subsequently caught and kept by an angler during the 2003 summer season.

Total walleye catch in spring trap nets has declined dramatically since 1995, falling from a record high in 1995 of 309 walleyes in 52 net nights to 110 walleyes in 53 net nights in 2002. In addition, size of spawning walleye (both males and females) has decreased and average age of females has increased indicating a decrease in growth. Comparisons of age 5 through 10 female walleye collected in trap nets prior to 2000 show markedly better growth than those collected in 2000 through 2003. Age 3 through 6 male walleye also show dramatic reductions in growth compared to pre-2000 growth rates (Figure 4).







Figure 4. Average length at age for walleyes caught in spring trap nets in Holter Reservoir (1995-2003). Males (ages 3-6) are plotted in the top graph and females (ages 5-10) are plotted in the lower graph. Linear trend lines are plotted for each age group.

Sex composition of walleye in the 20-28 inch range (current slot range) collected in traps in 2002 was 23% (males) and 72% (females), while in 2003 it was 18% (males) and 83% (females) (Table 12). The long-term average trap net catch is comprised of 77% males and 23% females. The proportion of males in this category is largely influenced by strength of recruitment of age 3 males to the spawning population. Females generally recruit to the spawning population at age 5 and therefore are susceptible to two more years of harvest pressure. The proportion of females recruiting to the 20"-28" slot has remained stable since 1995 (84% in 1995 compared to 72% in 2002 and 83% in 2003), indicating harvest pressure on immature females is not impacting recruitment. Average age of female walleye has ranged from 7.6 (1995) to 9.2 (1999 and 2001), with an overall age of 8.1 years old. (Table 12). Average age of female walleye in 2002 (8.1 years) and 2003 (7.7 years) were similar to the long-term average.

Number of captured walleye greater than 28 inches has declined from the high in 1996 (13) to 4 in 1999, 2000 and 2002. This proportion is generally low and has averaged 5% of the catch since 1995. Conversely, the proportion of walleyes less than 16 inches (primarily males at the lower threshold for jaw tagging) has increased since 1996 when these fish comprised less than 1% of the catch. This proportion peaked in 2001 when 36% of the walleye caught were smaller than 16 inches. The proportion of walleyes under 16 inches was 19% in 2002 and 30% in 2003. The long-term average proportion of walleyes smaller than 16 inches is 16%.

				WAI	LLEYE		PE	ERCH	<u>RAINBOW</u>
			Total	Catch	Mean L	ength (in)			
Year	Dates	Nets	М	F	М	F	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	27.0	1,007	0	159
2000	5/2-5/5	28	66	17	18.9	26.0	291	0	50
2001	5/8-5/11	25	82	24	18.5	25.8	50	0	143
2002	4/30-5/10	53	83	24	18.6	25.1	457	0	194
2003	4/29-5/9	54	79	29	18.1	24.6	157	0	195
AVE	-	45	100	30	20.2	25.8	1191	N/A	172

Table 11. Numbers and species of fish captured in trap nets in Holter Reservoir - 1995-2003. M=Male; F=Female

			,							
	#<	20"	# 20	" <b>-</b> 28"	#>	28"	% ir	n slot	Ave.	Age
Year	M	F	M	F	M	F	M	F	M	F
1995	64	0	184	48	2	9	74	84	5.6	7.6
1996	22	0	153	45	1	12	87	79	6.0	6.8
1997	14	0	52	23	0	5	79	82	7.0	7.9
1998*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1999	19	0	39	9	0	4	67	69	6.9	9.2
2000	40	0	28	13	0	4	41	76	5.4	8.5
2001	54	3	28	11	0	9	34	48	6.0	9.2
2002	65	3	19	18	0	4	23	72	5.2	8.1
2003	62	2	14	24	3	3	18	83	5.3	7.7
AVE	42.5	1	64.6	23.9	0.8	6.3	52.9	74.1	5.9	8.1

Table 12. Walleye caught in spring trap nets; sorted by size categories, sex, percentage in slot (20"-28") and average age on Holter Reservoir (1999 through 2003). The current walleye fishing regulation is all walleye between 20 to 28 inches must be released. M=Male; F=Female

\*1998 trap nets were fished primarily for yellow perch.

# 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 2003 a total of 213 of 1596 tags (13.3%) implanted into Holter reservoir walleye have been returned. First-year tag return percentages have ranged from 0% in 1993 and 1994 to 9.1% in 2000. First year tag return rate was 6.1% in 2002 and 5.6% in 2003 with the long-term average of 4.1%. Cumulative rates of return for walleye that have had at least 10 years to be recovered (1988 through 1993) have ranged from 12% to 36%.

First year returns of tagged walleyes in Bynum, Frances and Tiber Reservoirs generally fall within the same range as Holter Reservoir. During the period 1995 through 2000, Bynum ranged from 0.8% to 7.5%, Frances ranged from 1.4% to 6.4% and Tiber ranged from 6.9% to 12.6%. Cumulative return rates (1995 through 2000) in these three Northcentral reservoirs ranged from 4% to 17% in Bynum, 15% to 19% in Frances and 11% to 20% in Tiber (Hill et al. 2000). Holter cumulative return rates during the years 1995 through 1997 (five to seven years of return) ranged from 4% to 14% which is comparable to Bynum but lower than Frances and Tiber.

Angling pressure for walleye on Holter Reservoir is comparable to Lake Frances and more than double that of Bynum. On average anglers fished 1.6 days per acre or 7,696 angling days per year for walleye on Holter. Walleye anglers comprised a small percentage of total annual fishing pressure from 1995 through 1999 (average 9%). This proportion jumped to 35% in 2001 and 32% in 2003 following the increase in walleye relative abundance in 1999 (Figure 2).

Table 13. Average annual angling pressure for walleye and average pressure per acre (days per acre) on Holter Reservoir and three Central Montana reservoirs for the period 1995 through 2003 (odd years only). 100% of angling pressure on Bynum, Frances and Tiber are assumed to be for walleye. Holter pressure was based on percentage of anglers specifically targeting walleye plus  $\frac{1}{2}$  of angler targeting walleye and perch.

		Sta	atewide Ang	ling Pressur	e (Entire Ye	ear)	Ave. Angling Pressure	Ave. Pressure per
Reservoir	Surface Acres	1995	1997	1999	2001	2003	for WE	(days/acre)
Holter	4,800	3,773	3,886	6,263	15,190	12,261	7,696	1.6
Bynum	4,120	2,735	3,293	2,210	132	280	2,128	0.5
Lake Frances	5,536	10,251	11,850	14,680	8,738	12,074	10,522	1.9
Tiber	22,180	27,625	21,392	23,098	16,482	14,583	20,893	0.9

# **APPENDICES**

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
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(50.0)	0.8(57.1)	2.6(65.2)	0.7(66.9)	2.4(65.0)
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)	0	0.6(14.1)	0	0.3(7.5)
кок	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	0	0.1(2.3)	0.1(8.3)	0.2(5.0)
MWF	0.1(0.2)	0	0.2(1.2)	0	0	0.1(0.4)	0	0	0	0	0	0	0	0	0	0	0	0
WE	0	0	0	0	0	0	0.3(1.1)	0	0.1(0.4)	0	0	0.1(0.7)	0	0	0	0.1(2.3)	0	0.1(2.5)
YP	0	0	0	0	0	0	0	0.1(0.8)	0.1(0.4)	0	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)	0.1(7.1)	0.4(9.2)	0.1(8.3)	0.5(12.5)
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)	0.5(35.7)	0.3(6.9)	0.2(16.5)	0.3(7.5)
CARP	0.2(0.5)	0	0	0	0	0	0.1(0.4)	0	0	0	0	0	0	0	0	0	0	0
U.CHUB	0.2(0.5)	0.3(0.8)	0	0	0	0.6(2.2)	0	0.1(0.8)	0.1(0.4)	0	0	0	0	0	0	0	0	0
TOT #	448	383	164	151	185	271	267	122	244	105	158	146	65	18	14	43	12	40
# NETS	9	10	10	9	11	11	11	9	11	9	9	9	10	10	10	11	11	11
Number	per net (p	percent c	ompositi	on) by sp	ecies for	spring s	sinking g	gillnet cat	tches in l	Hauser I	Reservoi	r.						
SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
RB		0.2(0.2)	0	0	0	0	0	0	0.2(0.4)	0	0	0.3(0.4)	0	0.3(1.0)	0	0.2(0.6)	0	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)	0.2(0.5)	0.2(0.6)	0	0.5(1.0)
кок		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)	1.2(2.9)	0	0	0	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	0.8(2.9)	0.5(2.8)	1.0(1.9)
WE		0	0	0.2(0.2)	0	0	0.5(0.7)	0	0.3(0.8)	0	0	0.3(0.4)	17.7(43.4)	0.8(2.5)	1.3(3.8)	6.5(23.1)	1.0(5.7)	0.5(1.0)
үр		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)	1.8(5.2)	0.8(2.9)	0.7(3.8)	4.0(7.7)
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	9.5(28.8)	10.8(31.2)	9.5(33.7)	8.2(46.2)	7.5(14.4)
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)	19.3(55.7)	9.3(33.1)	5.8(33.0)	38.0(73.1)
CARP		0	0	0	0	0	0	0	0	0.8(1.0)	0.5(0.7)	0	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	0.5(0.8)	0	0.2(0.2)	0	0	0	0	0	0	0	0
BURBOT		0	0.2(0.2)	0.2(0.2)	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)	1.2(2.9)	1.7(5.1)	0.7(2.0)	0.8(2.9)	1.5(8.5)	0.5(1.0)
SM.BUFF		0	0	0.2(0.2)	0	0.2(0.3)	0.2(0.2)	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	208	169	106	312
# NETS	0	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Appendix A. Number of fish per net and percent composition of catch in Hauser Spring Floating (upper) and Spring Sinking (lower) Gillnets (1986-2003). 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	2000	2001	2002	2003
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)	2.8(67.4)	1.3(38.9)	1.9(22.1)	6.0(9.3)
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)	0.9(21.7)	0.5(13.9)	0.9(10.5)	0.3(2.5)
кок	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)	0.1(2.2)	0.6(19.4)	3.7(43.2)	8.5(78.8)
MWF	1.1(4.3)	0	0.4(0.9)	0.1(0.3)	0.3(0.7)	0.2(0.5)	0.2(0.6)	0	0.1(0.5)	0.1(0.5)	0	0	0	0	0	0	0.6(6.3)	0.2(1.7)
WE	0	0	0	0	0	0.2(0.5)	0	0	0	0	0.4(1.8)	0.1(1.8)	1.0(12.8)	0.1(2.0)	0.2(4.3)	0.4(11.1)	0.7(8.4)	0.6(5.1)
YP	0.2(0.7)	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	0.1(0.3)	0	2.5(13.9)	0	0.2(0.9)	0.1(1.8)	0.1(1.2)	0.2(4.0)	0.2(4.3)	0.4(11.1)	0.6(7.4)	0.3(2.5)
WSU	0.3(1.1)	2.4(16.0)	0.2(0.5)	0.1(0.3)	0.1(0.2)	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)	0	0.1(2.8)	0.2(2.1)	0
CARP	0	0	0	0	0	0	0	0	0	0	0.1(0.4)	0	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	0.18(2.3)	0	0	0.1(2.8)	0	0
TOTAL #	281	163	438	339	401	420	346	198	194	183	228	56	86	49	46	36	95	118
# NETS	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Number	per net (p	percent c	ompositi	on) by sp	ecies for	fall sink	<b>cing</b> gillr	et catche	es in <b>Ha</b> ı	iser Res	ervoir.							
SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
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	0.1(0.3)	0	0
LL	1.4(1.0)	0.5(0.4)	0.5(0.5)	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	0.1(0.3)	0	0.4(1.0)	0.3(0.7)	0
кок	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	0	0.6(1.3)	0.2(0.3)
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	0.7(1.7)	0.3(0.7)	0.6(1.3)	0.3(0.6)
WE	0	0	0	0	0	0.6(0.6)	0.1(0.1)	0.1(0.2)	0.3(0.2)	0	0.6(0.7)	1.0(1.8)	4.7(6.5)	3.9(7.5)	2.3(5.4)	2.0(4.7)	2.0(4.7)	2.3(4.3)
үр	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)	1.4(3.4)	2.0(4.7)	1.9(4.3)	9.0(16.6)
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)	14.1(33.4)	16.0(37.6)	15.4(36.1)	12.3(22.7)
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)	22.9(54.1)	21.4(50.3)	19.0(44.5)	29.3(54.0)
CARP	0	0	0	0.2(0.2)	0	0	1.1(1.0)	0	38.1(29.1)	0.1(0.2)	0	0	0	0.1(0.3)	0.1(0.3)	0.1(0.3)	0.4(1.0)	0
U.CHUB	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	0.1(0.3)	0	0	0	0
BURBOT	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)	0.1(0.2)	0.4(0.8)	0.7(1.7)	0.1(0.3)	2.6(6.0)	0.8(1.5)
SM.BUFF	0	0.3(0.2)	0.5(0.5)	0	0	1.1(1.1)	0	0.7(1.0)	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	296	298	299	326
# NETS	5	6	6	6	6	7	7	7	7	7	7	7	7	7	7	7	7	6

Appendix B. Number of fish per net and percent composition of catch in Hauser Fall Floating (upper) and Fall Sinking (lower) Gillnets (1986-2003). 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	2000	2001	2002	2003
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)	1.9(81.4)	2.4(40.7)	5.0(71.4)	4.2(61.3)
LL	0	0.4(1.6)	0.3(1.2)	0	0.1(1.3)	0	0	0	0	0	0	0	0	0	0	0.1(1.8)	0	0
кок	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	0	0
MWF	0.7(2.5)	0.4(1.6)	0.3(1.2)	0.1(0.9)	0	0.3(1.2)	0.4(3.3)	0	0.1(1.0)	0	0	0	0.1(1.7)	0	0	0	0.1(1.6)	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	0.4(13.0)	0	0.9(14.8)	0.4(6.3)	0.3(4.8)
YP	0	4.8(20.1)	4.0(18.7)	1.3(8.9)	0	0	5.1(38.3)	5.3(29.8)	1.7(14.6)	0	0	0	0	0.7(21.7)	0	0	0	0.4(6.5)
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	1.4(8.1)	0.9(7.8)	0.1(2.8)	0.3(5.0)	1.7(12.0)	0.3(5.2)	0	0	0.9(14.8)	0.3(4.7)	0.4(6.5)
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)	0.6(8.6)	1.4(43.4)	0.4(17.1)	1.7(27.8)	1.0(14.3)	1.3(19.4)
CARP	0.3(1.2)	0.4(1.6)	0.3(1.2)	0	0	0.1(0.4)	0.1(0.8)	0	0.2(1.9)	0	0	0	0	0	0	0	0.1(1.6)	0.1(1.6)
TOTAL #	161	189	171	112	78	258	120	161	103	36	60	125	58	23	21	54	63	62
# NETS	6	8	8	8	8	9	9	9	9	9	9	9	9	7	9	9	9	9
Number	per net (	percent of	composit	ion) by s	pecies fo	r spring	sinking	gillnet ca	tches in	Holter I	Reservoi	r.						
SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
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	0.3(0.5)	0	0.3(0.5)	0	0.6(1.0)
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	0.5(0.6)	0.3(0.5)	0	0	0	0.2(0.3)	0	0	0
КОК		0	0.3(0.3)	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	0.2(0.3)	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)	0	0.5(0.8)	0.5(0.7)	0.2(0.3)
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)	6.2(10.2)	4.3(7.1)	7.5(11.2)	3.2(4.9)
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)	3.3(5.4)	4.0(6.6)	10.7(15.9)	9.8(15.0)
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)	4.5(7.4)	6.8(11.3)	5.0(7.4)	3.2(4.9)
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)	45.0(74.0)	39.7(65.4)	43.2(64.3)	48.4(74.0)
CARP		0.2(0.1)	0	0.3(0.4)	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	0.5(0.8)	0.5(0.8)	0.2(0.3)	0
U.CHUB		0	0.2(0.2)	0	0.4(0.3)	0	0	0.2(0.1)	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	0.2(0.2)	0.2(0.3)	0	0	0
TOTAL #	0	838	658	545	597	894	921	743	549	514	414	529	437	434	365	364	403	327
# NETS	0	5	6	6	5	6	6	6	6	6	6	6	6	6	6	6	6	5

Appendix C. Number of fish per net and percent composition of catch in Holter Spring Floating (upper) and Spring Sinking (lower) Gillnets (1986-2003). 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	2000	2001	2002	2003
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)	5.7(73.9)	5.9(76.8)	5.2(54.0)	3.2(69.0)
LL	0.1(0.8)	0.5(2.2)	0.3(1.9)	0.1(0.9)	0	0.3(1.9)	0.2(1.3)	0	0.1(0.7)	0	0.1(0.5)	0.3(3.7)	0.1(0.8)	0	0.2(2.9)	0.1(1.4)	0.3(3.4)	0.2(4.8)
кок	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	0.2(2.9)	0.2(2.9)	2.2(23.0)	0.7(14.3)
MWF	0.6(3.3)	0	0.4(2.8)	0.1(0.9)	0.2(1.6)	0.4(2.8)	0	0	0.2(1.4)	0	0	0.2(2.5)	0	0.11(2.4)	0.2(2.9)	0.1(1.4)	0.2(2.3)	0
WE	1.7(9.7)	0.1(0.5)	0	0.3(2.6)	0	0	0.1(0.7)	0.2(2.9)	0	0.4(2.0)	1.3(5.6)	1.6(17.3)	0.2(1.5)	0.22(4.8)	0.6(7.2)	0.8(10.1)	1.2(12.6)	0.3(7.1)
YP	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	1.78(12.1)	0.11(2.4)	0	0.2(2.9)	0	0
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)	0.8(10.1)	0.2(2.9)	0.4(4.6)	0.2(4.8)
CARP	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11(2.4)	0	0.1(1.4)	0	0
U.CHUB	0	0	0	0.1(0.9)	0	0	0	0	0	0	0	0.1(1.2)	0	0	0	0	0	0
TOTAL #	123	188	106	115	124	108	150	69	146	205	215	81	132	42	69	69	87	42
# NETS	7	8	8	9	9	8	9	9	9	9	9	9	9	9	9	9	9	9
Number per net (percent composition) by species for <b>fall sinking</b> gillnet catches in <b>Holter Reservoir</b> .																		
SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
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)	0.7(1.3)	1.0(1.8)	0
LL		0.2(0.2)	0.3(0.3)	0	0	0	0	0.2(0.2)	0.2(0.2)	0	0	0.2(0.2)	0	0	0	0	0	0
КОК		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	0.2(0.3)	0	0	0
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	0.2(0.3)	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)	4.7(8.9)	4.5(8.3)	2.5(5.0)
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)	3.7(7.0)	3.0(5.5)	5.2(10.4)
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)	10.7(20.3)	8.0(14.8)	6.5(13.0)
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)	32.8(62.3)	37.5(69.2)	35.7(71.6)
CARP		0	0	0.2(0.2)	0	0.2(0.2)	0	0.3(0.4)	0.3(0.5)	0	0.7(0.8)	0.5(0.7)	0	0	0	0	0	0
BURBOT		0	0	0	0	0	0	0	0	0	0.2(0.2)	0	0	0	0	0	0.2(0.3)	0
TOTAL #		551	601	611	500	486	566	502	401	410	513	451	355	295	299	316	325	299
# NETS		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Appendix D. Number of fish per net and percent composition of catch in Holter Fall Floating (upper) and Fall Sinking (lower) Gillnets (1986-2003). Number per net (percent composition) by species for **fall floating** gillnet catches 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	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	12.4	2	4	
1997	98.7	0.08	0.08	16.9	11.0	3	2	15
1998	98.1	0.08	0.05	16.4	10.6	1	3	11
1999	174.3	0.12	0.17	17.4	21.4	1	2	9
2000	189.2	0.06	0.11	20.5	15.0	1	3	23
2001	211.8	0.05	0.17	16.5	11.8	3	1	5
2002	199.2	0.05	0.10	19.7	11.8	1	2	21
2003	310.7	0.24	0.18	15.5		2	6	4
Mean	167.0	0.10	0.09	16.3	14.7	3	5	11

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

% 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.

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	49.3	2	9	20
1997	371.4	0.11	0.24	15.5	32.3	7	6	29
1998	141.5	0.10	0.11	15.5	15.4	5	8	12
1999	400.7	0.14	0.29	18.0	41.3	1	4	25
2000	331.9	0.05	0.11	19.6	16.0	2	6	7
2001	461.4	0.06	0.06	17.1	14.1	2	6	11
2002	364.2	0.19	0.15	17.8		5	5	8
2003	346.9	0.20	0.19	17.3		4	3	9
Mean	334.1	0.19	0.19	15.3	37.5	5	7	29

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

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

Appendix S. Recruitment of hatchery rainbow trout to fall horizontal gillnets (sinking and floating) in Hauser Reservoir (1996-2003) A=Arlee; EL=Eagle Lake

							HAUSE	R RESERVO	DIR				
						Numb	er in Fall Ho	rizontal Gilln	ets (percent o	of total)			
Year	Stocking (X1000)	Strain	Age @ Release	Release Date	1996	1997	1998	1999	2000	2001	2002	2003	<b>Return Index*</b>
1996	94.2	А	0	Summer	21/42 (50%)	8/28 (29%)	5/38 (13%)	1/23 (4%)					37.1
1997	98.7	А	0	Summer		13/28 (46%)	9/38 (24%)	8/23 (35%)	2/31 (6%)				32.4
1998	98.2	А	0	Summer			21/38 (55%)	9/23 (39%)	2/31 (6%)	4/15(27%)	1/21(5%)		37.7
1999	174.3	A; EL	0	Summer				3/23 (13%)	4/31 (13%)	6/15(40%)	4/21(19%)		9.8
2000	189.2	А	0	Summer					16/31 (52%)	4/15(27%)	2/21(10%)		11.6
2001	211.8	А	0	Summer						1/15(7%)	0/21(0%)	2/66(3%)	1.4
2002	100.5	А	0	Summer							7/21(33%)	10/66(15%)	16.9
2002	98.6	А	0	Fall							4/21(19%)	24/66(36%)	28.4
2003	101.8	А	0	Summer								0/66(0%)	0.0
2003	104.0	А	0	Fall								22/66(33%)	21.2
2003	104.9	EL	0	Summer								4/66(6%)	3.8

\*Return Index. Calculated as the total number of fish recaptured in nets, divided by the number of fish stocked, then multiplied by 100,000.

							HOLTER	RESERVOI	R				
						Number in	n Fall Horizo	ontal Gillnets	s (percent of	total)			
Year	Stocking (X1000)	Strain	Age @ Release	Release Date	1996	1997	1998	1999	2000	2001	2002	2003	Return Index*
1996	106.2	EL	1	Summer	53/92 (58%)	18/62 (29%)	5/76 (7%)	6/37 (16%)	1/55 (2%)				78.2
1997	371.4	EL	0	Summer		18/62 (29%)	31/76 (41%)	15/37 (41%)	14/55 (25%)	1/59(2%)			21.3
1998	141.5	EL	1	Summer			29/76 (38%)	8/37 (22%)	8/55 (15%)	2/59(3%)			33.2
1999	400.7	EL	0	Sum/Fall				0/37 (0%)	15/55 (27%)	8/59(14%)	1/51(2%)		6.0
2000	75.3	EL	1	Summer					12/55 (22%)	17/59(29%)	8/51(16%)	2/29(7%)	51.8
2000	191.6	EL	0	Summer					2/55 (4%)	6/59(10%)	1/51(2%)	0/29(0%)	4.7
2000	65.0	А	0	Fall					3/55 (5%)	0/59(0%)	3/51(6%)	0/29(0%)	9.2
2001	77.5	EL	1	Summer						10/59(17%)	4/51(8%)	2/29(7%)	20.6
2001	263.9	EL	0	Summer						4/59(7%)	1/51(2%)	1/29(3%)	2.3
2001	120.0	А	0	Fall						2/59(3%)	11/51(22%)	0/29(0%)	10.8
2002	88.1	EL	1	Summer							12/51(24%)	4/29(14%)	18.2
2002	170.7	EL	0	Summer							4/51(8%)	7/29(24%)	6.4
2002	105.4	А	0	Fall							3/51(6%)	2/29(7%)	4.7
2003	43.1	EL	1	Summer								4/29(14%)	9.3
2003	197.7	EL	0	Summer								0/29(0%)	0.0
2003	106.1	А	0	Fall								5/29(17%)	4.7

Appendix T. Recruitment of hatchery rainbow trout to fall horizontal gillnets (sinking and floating) in Holter Reservoir (1996-2003) A=Arlee; EL=Eagle Lake

\*Return Index. Calculated as the total number of fish recaptured in nets, divided by the number of fish stocked, then multiplied by 100,000.

Appendix J. Length Frequency of rainbow (upper) and brown (lower) trout collected during electrofishing sampling in Hauser tailrace section (September, 2003).



Length (in)

		BUNDLES		GPS LOCATION		
DATE	GROUP #	PER GROUP	AREA	LATITUDE	LONGITUDE	DEPTH(ft)
4/16/2002	1	15	CAUSEWAY	N46 <sup>0</sup> 43'36.4"	W111 <sup>0</sup> 52'57.8"	14-15
4/16/2002	2	17	CAUSEWAY	N46 <sup>0</sup> 43'36.9"	W111 <sup>0</sup> 52'57.0"	14-15
4/16/2002	3	19	CAUSEWAY	N46 <sup>0</sup> 43'36.9"	W111 <sup>0</sup> 52'57.0"	15-17
4/16/2002	4	20	CAUSEWAY	N46 <sup>0</sup> 43'37.3"	W111 <sup>0</sup> 52'57.6"	15-17
4/16/2002	5	20	CAUSEWAY	N46 <sup>0</sup> 43'37.3"	W111 <sup>0</sup> 52'57.6"	15-17
4/16/2002	6	18	CAUSEWAY	N46 <sup>0</sup> 43'38.4"	W111 <sup>0</sup> 52'58.4"	15-17
4/16/2002	7	18	CAUSEWAY	N46 <sup>0</sup> 43'38.8"	W111 <sup>0</sup> 52'59.3"	15-18
4/17/2002	8	19	CAUSEWAY	N46 <sup>0</sup> 43'38.2"	W111 <sup>0</sup> 52'59.0"	16-19
4/17/2002	9	17	CAUSEWAY	N46 <sup>0</sup> 43'40.9"	W111 <sup>0</sup> 52'57.9"	15-18
4/17/2002	10	17	CAUSEWAY	N46 <sup>0</sup> 43'41.3"	W111 <sup>0</sup> 52'57.4"	16-18
4/17/2002	11	18	CAUSEWAY	N46 <sup>0</sup> 43'42.5"	W111 <sup>0</sup> 53'07.6"	15-18
4/17/2002	12	19	CAUSEWAY	N46 <sup>0</sup> 43'43.5"	W111 <sup>0</sup> 53'09.8"	15-20
4/17/2002	13	18	CAUSEWAY	N46 <sup>0</sup> 43'36.2"	W111 <sup>0</sup> 53'09.8"	15-25
4/17/2002	14	18	CAUSEWAY	N46 <sup>0</sup> 43'33.0"	W111 <sup>0</sup> 53'09.5"	15-20
4/18/2002	15	15	CAUSEWAY	N46 <sup>0</sup> 43'29.1"	W111 <sup>0</sup> 52'54.4"	17-20
4/18/2002	16	17	CAUSEWAY	N46 <sup>0</sup> 43'24.5"	W111 <sup>0</sup> 53'02.2"	14-23
4/18/2002	17	16	CAUSEWAY	N46 <sup>0</sup> 43'24.5"	W111 <sup>0</sup> 53'02.2"	17-27
4/18/2002	18	16	CAUSEWAY	N46 <sup>0</sup> 43'27.9"	W111 <sup>0</sup> 53'04.3"	15-25
4/18/2002	19	20	CAUSEWAY	N46 <sup>0</sup> 44'19.1"	W111 <sup>0</sup> 53'17.1"	13-30
4/18/2002	20	12	CAUSEWAY	N46 <sup>0</sup> 44'12.5"	W111 <sup>0</sup> 53'09.7"	13-20

Appendix V. Habitat bundle locations deployed in 2002 in Hauser Reservoir.

TOTAL= 349

349 BUNDLES X	
5.25	
TREES/BUNDLE=	
1832 TREES	

. 11		1 .				
		BUNDLES		GPS LOCATION		
DATE	GROUP #	PER GROUP	AREA	LATITUDE	LONGITUDE	DEPTH(ft)
4/23/2003	1	15	El Dorado N	N46 <sup>0</sup> 44'11.7"	W111 <sup>0</sup> 52'26.2"	15
4/23/2003	2	14	El Dorado N	N46 <sup>0</sup> 44'12.5"	W111 <sup>0</sup> 52'27.2"	15
4/23/2003	3	15	El Dorado N	N46 <sup>0</sup> 44'13.1"	W111 <sup>0</sup> 52'27.9"	13-14
4/23/2003	4	14	El Dorado N	N46 <sup>0</sup> 44'07.9"	W111 <sup>0</sup> 52'23.9"	14-15
4/23/2003	5	14	El Dorado N	N46 <sup>0</sup> 44'13.3"	W111 <sup>0</sup> 52'28.4"	16-18
4/24/2003	6	14	El Dorado M	N46 <sup>0</sup> 44'55.9"	W111 <sup>0</sup> 52'11.9"	15-16
4/24/2003	7	15	El Dorado M	N46 <sup>0</sup> 43'55.0"	W111 <sup>0</sup> 52'10.8"	15
4/24/2003	8	14	El Dorado M	N46 <sup>0</sup> 43'53.1"	W111 <sup>0</sup> 52'08.7"	15
4/24/2003	9	14	El Dorado M	N46 <sup>0</sup> 43'57.5"	W111 <sup>0</sup> 52'13.1"	13
4/24/2003	10	14	El Dorado M	N46 <sup>0</sup> 43'51.7"	W111 <sup>0</sup> 52'06.9"	16
4/24/2003	11	12	El Dorado M	N46 <sup>0</sup> 43'57.9"	W111 <sup>0</sup> 52'16.0"	13-15
4/24/2003	12	14	El Dorado M	N46 <sup>0</sup> 44'04.6"	W111 <sup>0</sup> 52'21.8"	13
4/24/2003	13	2	Goofy's Bay	N46 <sup>0</sup> 44'35.2"	W111 <sup>0</sup> 53'11.1"	11

Appendix W. Habitat bundle locations deployed in 2003 in Hauser Reservoir

TOTAL= 171

171 BUNDLES X 5 TREES/BUNDLE= 855 TREES

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