MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO.: F-78-R-2 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER AND WARMWATER ECOSYSTEMS

JOB NO.: V-d JOB TITLE: NORTHEAST MONTANA COLDWATER ECOSYSTEM INVESTIGATIONS

PROJECT PERIOD: JULY 1, 1995 THROUGH JUNE 30, 1996

ABSTRACT

Trout gill net catch-per-unit-effort (CPUE) remained high in Beaver Creek Reservoir. Trout gill net CPUE also increased in Bear Paw Lake in 1995. However, average size and condition has not improved despite the removal of 97,000 suckers (14.4 tons) since 1989. White sucker and crayfish population estimates were down substantially from 1994 levels. Smallmouth bass predation has been limited due to spatial separation from prey. Walleye were introduced into Bear Paw Lake for the first time. Growth, survival and condition of rainbow trout at Grasshopper Reservoir remains good following chemical rehabilitation. Sucker numbers in Faber Reservoir are increasing and the 1995 trout stocking was unsuccessful in establishing a large cohort. Condition of trout remains good despite increasing sucker numbers. Management recommendations for all waters are presented.

OBJECTIVES AND DEGREE OF ATTAINMENT

Survey and Inventory

To survey and monitor the characteristics and trends of fish populations, angler harvest and preferences, and to assess habitat conditions in selected waters. Objective accomplished, data presented.

Fish Population Management

To implement fish stocking programs and/or fish eradication actions to maintain fish populations at levels consistent with habitat conditions and other limiting factors. Objective accomplished, data presented.

Technical Guidance

To review projects by government agencies and private parties which have the potential to affect fisheries resources, provide technical advice or decisions to mitigate effects on these resources, and provide landowners and other private parties with technical advice and information to sustain and enhance fisheries resources. Objective accomplished, seven 310 applications were processed; water level recommendations were made to Department of Natural Resource for rehabing dam and spillway at Bear Paw Reservoir; other related activities are presented.

Aquatic Education

To enhance the public's understanding, awareness and support of the state's fishery and aquatic resources and to assist young people to develop angling skills and to appreciate the aquatic environment. Objective accomplished, 12 public meetings associated with aquatic education were held.

PROCEDURES

Streams were sampled with a direct current (DC) backpack electrofishing unit. Lakes were sampled with floating and/or sinking experimental gill nets. The gill nets measured 6 feet deep and 125 feet in length and consisted of 25-foot panels of 3/4-, 1-, 1 1/4-, 1 1/2-, and 2-inch square mesh. All fish were measured for total length (TL) and weighed to the nearest .01 pound. Crayfish were captured in 1/4-inch hardware cloth traps of varying size, with throat entrance holes measuring 1.5-2.0 inches in diameter. The traps were set around the entire reservoir in water less than 10 feet deep. Traps were baited with dead fish and canned cat food. Traps were fished for 48 hours. Crayfish were marked with a partial clip of the extreme edge of the right uropod and scattered within several hundred yards of the trapping location. A recapture sample was secured eight to twelve days later using the same technique. Body length measurements for crayfish were taken from the tip of the rostrum to the posterior margin of the telson. Suckers were trapped, for population estimation, in 1/4-inch mesh frame traps. They were weighed, measured and marked with a paper punch hole in their tail or finclipped.

RESULTS AND DISCUSSION

Beaver Creek Reservoir

This 200 surface-acre reservoir contains a variety of cold, cool, and warmwater species including rainbow trout, northern pike, walleye, yellow perch, white and longnose suckers. The reservoir has been managed primarily as a trout fishery since its filling in 1974.

Stocking of Eagle Lake and DeSmet rainbow trout commenced in 1985 to provide a longer-lived trout capable of utilizing Beaver Creek for natural reproduction. The domestic Arlee rainbow stocked previously had failed to provide significant natural reproduction, exhibited poor growth and was short-lived. Studies conducted over several years at Beaver Creek Reservoir indicated the Eagle Lake and DeSmet rainbow had increased longevity over Arlee rainbow. Studies also indicated Eagle Lake rainbow were easier to catch than the DeSmet rainbow (Needham and Gilge, 1987). Though Eagle Lake rainbow continue to utilize portions of Beaver Creek for spawning, recruitment to the lake fishery is minimal. Predation on young-of-the-year (YOY) rainbow is suspected; however, recruitment and/or predation of naturally produced YOY rainbow is as yet undocumented. The stocking of DeSmet rainbow ceased in 1988 and the reservoir was planted exclusively with Eagle Lake rainbow until 1990 when Arlee rainbow were again introduced. Arlee rainbow have been restocked, along with Eagle Lake rainbow, at varying rates and at different times since 1990. Erwin strain

rainbow were marked and planted in 1994 as catchable size trout. Though only 7% of the fall trout gill net catch was comprised of Erwin fish, a cursory creel check during the summer indicated Erwin trout made up 40% of the catch. It appears that growth, survival and catchability of the Erwin strain is similar to that of Arlee rainbow.

Gill-net surveys were conducted in 1974, 1977, and annually since 1980. These surveys were conducted to monitor growth and survival of hatchery trout and to determine relative abundance of other fishes. Results of these netting efforts are summarized in Table 1. The gill net CPUE of trout was high in 1995 and condition remained good. Trout condition is believed to be associated with white sucker numbers. Though sucker CPUE increased slightly in 1995, relative numbers still remain low, due primarily to northern pike predation.

Adult northern pike numbers peaked in 1987, but are lower in numbers at present. The large year classes produced in 1990 and 1991 did not show up in the gill-net catch as expected. The depressed adult pike population is at least partially responsible for the increase in trout numbers in recent years. They are still capable of causing significant predation on catchable trout and suckers. Pike predation is expected to increase in the next few years if the recently produced year-classes are as strong as earlier sampling indicated.

Walleye gill net CPUE increased in 1995 and average size was consistent with that observed in 1994. Trout were found in walleye stomachs for the first time in 1994. Two walleye of 19.8-inches (6 year old) and a 22.8-inches (7 year old) walleye had trout in their guts. It is not known, however, if the trout were picked from the gill net or ingested prior to capture. Four gillnetted walleye were examined in 1995. One, a 23.5 inch fish, had ingested a trout. Eleven northern pike stomachs were examined of which three had ingested trout. Yellow perch were heavily utilized by walleye and pike. Walleye were introduced in 1987 due to local demand and are not considered at this time to be major predators on hatchery trout, despite the fact that the walleye population is increasing in numbers and in size.

Gill net catch-rates for yellow perch remained stable, as did average size. Perch are becoming a much sought-after fish and good catches are made at all times of the year.

A fisherman reported catching a single large crappie in 1994, apparently from yet another illegal introduction.

Bear Paw Lake

Bear Paw Lake is a 45 surface-acre reservoir on Beaver Creek in the Bear Paw Mountains. It is maintained with annual plants of McBride strain cutthroat and Arlee rainbow trout. Summer fishing pressure has exceeded 140 angler-days per surface acre. Fishing pressure becomes excessive when acceptable-size fish are readily available. A creel reduction from 10 to 5 fish was imposed in 1987 to distribute the catch under such conditions. Suckers have historically overpopulated this reservoir. The reservoir was chemically rehabilitated in 1983 to reduce sucker numbers. Post-rehabilitation trout growth in 1984 and 1985 was excellent. However, sucker gill net catches increased from a catch per net of 9 in 1985, to 278 per net by 1990 (Figure A). Despite sucker removal efforts, the population remains high. Competition with large numbers of suckers has reduced growth rates of trout significantly. Fishing pressure has declined

Table 1. Summary of gill net catches and relative abundance of fishes in Beaver Creek Reservoir, 1974-95.

	Rainbow Trout				Northern Pike			Walleye			Yellow Perch			
Year	CPUE[1]	Ave. Lgth. (in.)	Ave. Wt. (lbs.)	C[2]	CPUE	Ave. Lgth. (in.)	Ave. Wt. (lbs.)	CPUE	Ave. Lgth. (in.)	Ave. Wt. (lbs.)	CPUE	Ave. Lgth. (in.)	Ave. Wt. (lbs.)	Sucker Sp. CPUE
1974	24.0	10.7	0.60	48.98	---	----	----	---	----	----	----	---	----	89.7
1977	35.0	10.1	0.39	37.85	---	----	----	---	----	----	----	---	----	115.7
1980	23.3	10.1	0.35	33.97	---	----	----	---	----	----	----	---	----	83.3
1981	7.0	10.4	0.35	31.11	---	----	----	---	----	----	----	---	4----	171.7
1982	8.3	11.2	0.55	37.15	2.3	15.8	0.99	---	----	----	----	---	----	112.3
1983	3.3	11.8	0.62	37.74	3.7	25.1	4.78	---	----	----	----	---	----	99.7
1984	3.0	11.3	0.59	40.89	3.7	26.6	5.49	---	----	----	----	---	----	58.7
1985	3.0	11.9	0.77	45.82	4.3	26.0	5.72	---	----	----	----	---	----	68.3
1986	13.0	11.9	0.66	39.16	4.2	16.7	2.13	---	----	----	----	---	----	42.0
1987	11.3	13.6	0.92	36.57	5.2	22.0	2.81	---	----	----	0.3	6.3	0.12	18.0
1988	9.7	14.7	1.17	36.83	3.0	27.6	7.30	0.7	10.6	0.36	8.2	5.9	0.10	18.0
1989	10.7	13.1	0.80	35.59	1.2	30.3	8.31	0.0	----	----	9.2	7.6	0.21	16.8
1990	18.5	12.0	0.61	35.30	0.7	21.0	2.90	1.8	13.2	0.86	13.0	8.5	0.32	9.8
1991	15.5	12.8	0.77	36.72	2.3	16.6	1.20	5.7	14.0	0.97	12.0	7.4	0.26	11.0
1992	13.7	13.7	0.98	38.11	3.3	25.6	5.32	2.3	17.8	2.15	6.0	6.4	0.13	7.7
1993	3.2	16.4	1.67	37.86	2.0	27.5	6.37	3.3	16.8	1.73	12.3	7.2	0.21	8.5
1994	27.7	11.7	0.66	39.20	2.8	25.5	6.77	1.7	17.4	2.68	23.8	7.7	0.25	7.0
1995	20.2	13.5	0.94	38.59	3.5	21.7	2.89	2.5	18.0	2.62	20.0	7.7	0.28	12.8

[1]Number of fish caught per gill net.

[2]Condition factor = $\frac{W \times 10^5}{L^3}$

dramatically since 1988 due to the small size and poor condition of trout. Respondents to an angler survey indicated a desire to catch larger fish, even at the expense of catching fewer fish. The survey results also indicated a preference for cutthroat trout over rainbow trout.

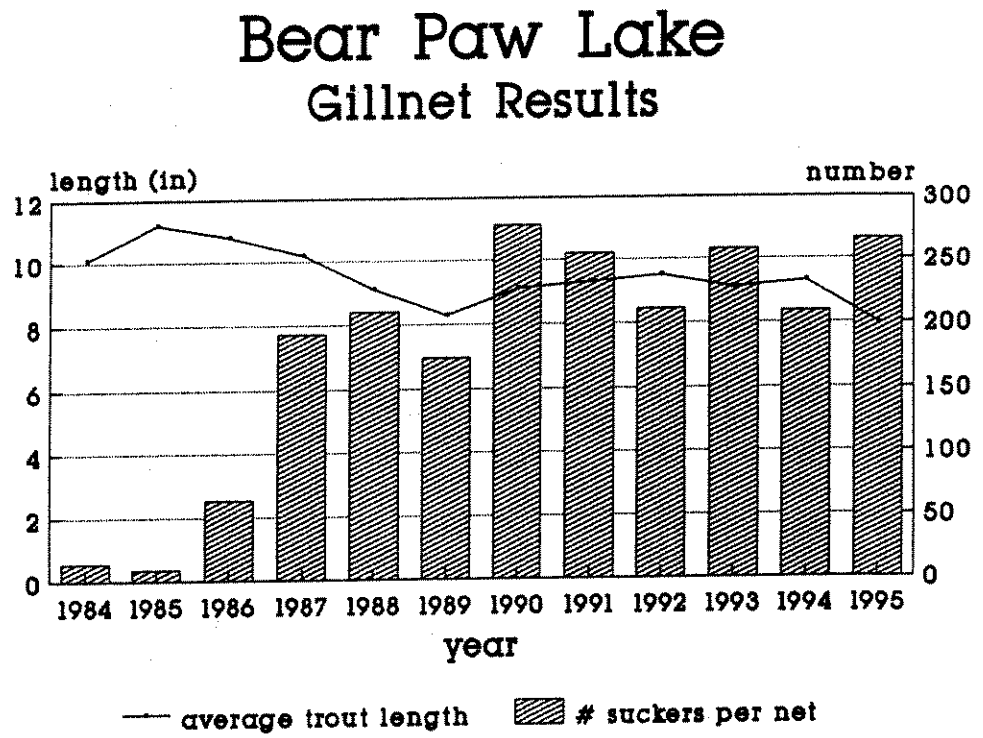

Figure A. Comparison of white sucker increases, after chemical rehabilitation in 1983, with trout growth in Bear Paw Lake.

Drawdown and chemical rehabilitation has been attempted twice. This, however, is not a preferred option for sucker control in this reservoir, primarily due to the loss of recreation, detoxification time, invertebrate loss, bank sloughing, and subsequent trout mortality.

Gill-netting trend data has been collected for a number of years in early September. Utilizing 1988 as a base year, numbers of mature (>10 inches) and juvenile suckers (< 10 inches), as they appeared in the catch, were compared with trout CPUE and condition (Table 2). The trout gill-net catch increased four-fold from 1994, but average size and condition has not improved. Eagle Lake strain rainbow trout had been utilized experimentally since 1986, but were replaced in 1991 with spring planted Arlee rainbow. The Arlee rainbow were responsible for the large increase in condition exhibited in 1992. Fall stocking of Arlee rainbow began in 1992 to facilitate hatchery demands.

Table 2. Relative abundance of suckers and trout as indicated by fall gill netting following sucker removal efforts (1988-95) in Bear Paw Lake.

	Suckers				Cutthroat Trout			Rainbow Trout		
Date	No. <10" Per Net	% Chg[1]	No. >10" Per Net	% Chg	No. Per Net	Avg. Lgth.	C[2]	No. Per Net	Avg. Lgth.	C[2]
Fall 1988	122	----	89	---	8.7	7.9	36.50	9.0	10.3	41.18
Fall 1989	152	+25	21	-76	19.0	8.1	30.11	15.3	8.4	33.74
Fall 1990	253	+107	25	-72	22.3	8.7	34.68	9.0	10.0	32.00
Fall 1991	198	+62	57	-36	15.0	9.1	34.50	4.0	10.2	34.87
Fall 1992	127	+4	84	-6	58.6	9.6	24.87	17.0	9.1	45.12
Fall 1993	200	+64	58	-35	6.0	9.1	33.18	0	----	-----
Fall 1994	157	+33	52	-42	13.7	9.1	31.85	5.7	9.7	38.34
Fall 1995	125	+1	141	+63	60.0	7.8	33.72	14.7	9.1	35.83

[1]1988 used as base year determining percent change in relative abundance.
[2]Condition factor - $\frac{W \times 10^5}{L^3}$

A sucker control program was initiated in May of 1989. Frame traps were utilized to capture suckers in the spring as they frequented shorelines and the mouth of Beaver Creek prior to spawning. Trapping effort was increased in 1990, but was reduced in 1992. To date, a total of 97,300 suckers with a total biomass of 14.4 tons have been removed from the reservoir (Table 3). Fall gill netting in 1989 indicated the effort had reduced the number of mature suckers significantly. However, by the fall of 1990, juvenile sucker numbers had increased 107% from 1988 levels. Figure B illustrates how juvenile suckers increased after removal of adult suckers, and how quickly the sucker population returned to pre-removal levels even while some control pressure remained. It appears that the biomass of suckers remained relatively stable as vast numbers of smaller suckers replaced the larger suckers that were removed. Based on gill net CPUE, the current sucker population is similar to the preremoval level present in 1988. For the first time, however, the catch of adult suckers exceeded the catch of juveniles in the gill net survey.

Mechanical/physical removal of juvenile suckers is very labor intensive. Juvenile suckers are not as susceptible to capture as they do not congregate in the creek to spawn. The topography of the reservoir with its steep sides and submerged woody vegetation does not facilitate frame trapping or seining.

Table 3. Number and poundage of white suckers removed from Bear Paw Lake from 1989 to 1995.

Year	Number	Pounds
1989	12,545	8,986
1990	44,622	10,206
1991	18,140	4,733
1992	4,133	828
1993	5,239	1,050
1994	6,995	810
1995	5,653	2,100
TOTALS	97,327	28,713

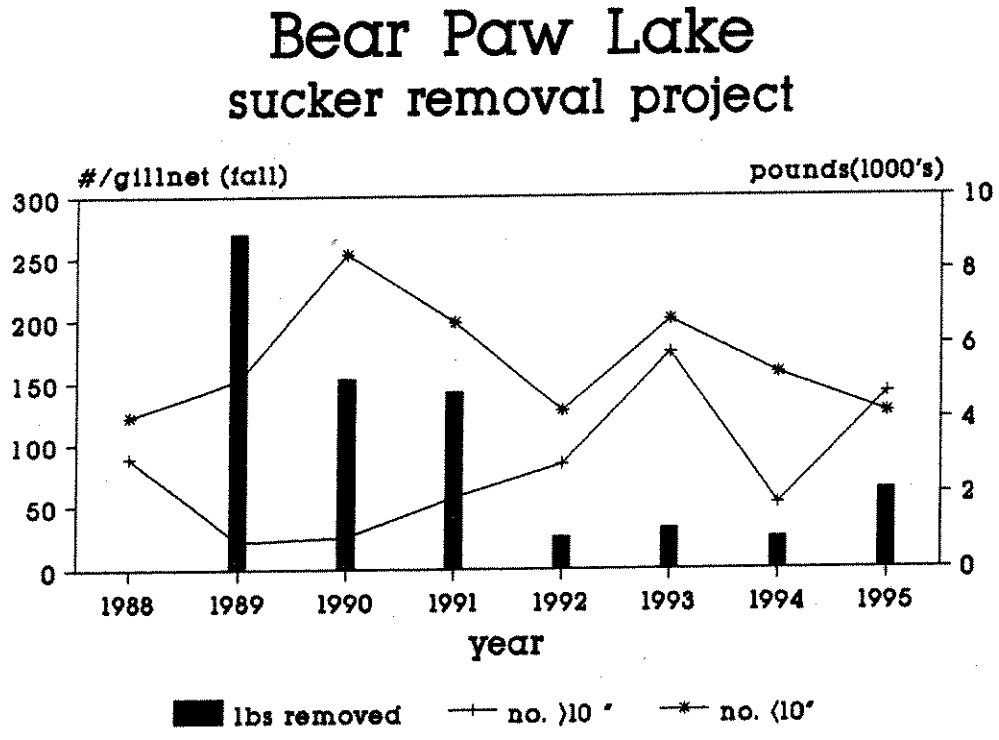

Figure B. Number of juvenile and adult suckers captured per gill net in each year of the study compared with the pounds of suckers removed each year with decreasing effort.

Crayfish have become abundant in recent years and may have an effect on food availability for trout. A study from Newcastle Reservoir in Utah by Hepworth and Duffield concluded that crayfish changed the reservoir ecosystem by altering the food web, thereby reducing energy transfer to rainbow trout. Momot (1978) described the ability of crayfish to dominate the benthic community and prey on amphipods, isopods, chironomids, cladocerans, ostracods, and odonate naiads. Crayfish have also been reported to eat gastropods (Dean, 1969). Crayfish are utilized, to some degree, as food by trout. However, only trout greater than 12 inches appear able to consume them on a regular basis. A 12-inch trout in Bear Paw Lake is a rarity, so utilization of crayfish by trout is negligible.

A proposal to introduce smallmouth bass for the purpose of inflicting significant predation on juvenile suckers was submitted in 1991. Juvenile bass were expected to feed primarily on YOY suckers, while adult bass were expected to prey heavily on crayfish. Adult smallmouth bass were not expected to consume a significant number of the catchable-size trout stocked annually. Though the primary objective is to improve trout growth, smallmouth bass should make an outstanding addition to the fishery.

A concern that arose during the lengthy environmental review process was that a "no action" alternative, or a delay in implementing an action, might cause frustrated fishermen to attempt their own predator introduction. A similar situation (sucker over-population) occurred downstream in Beaver Creek Reservoir in 1982. Unknown individual(s) introduced northern pike into this existing trout fishery apparently to control sucker numbers. Gill netting in Bear Paw Lake in 1992 proved that this was indeed the case, as a single adult walleye was captured. It is believed that only a few fish were illegally introduced and the probability of successful reproduction in this reservoir is extremely low. A fisherman reported catching a 2.5 pound northern pike from Bear Paw Lake in 1994, but the report could not be confirmed.

Following an environmental review, 25,000 smallmouth bass fingerlings, averaging 1.3 inches, were introduced into Bear Paw Lake in August of 1992. It was hoped that YOY suckers would suffer immediate depredation losses; however, the bass were too small to effectively feed on YOY suckers. A cool August and September undoubtedly reduced growth rates of bass and over-winter survival of this introductory plant was questionable. No bass were captured in 56 trap-days of effort in the spring of 1993. However, electrofishing the shoreline in mid-July captured 23 age I smallmouth bass, ranging in length from 2.2-5.1 inches. All but two of the bass were taken from the dam face riprap. Bass preferred rocky substrate over emergent/submerged vegetation, which was plentiful. A total plant of 40,000 1.7-inch bass was made in July and August of 1993. Another plant of 24,000 fingerlings was made in 1994. No bass were stocked in 1995 due to unavailability.

In order to evaluate changes in the forage base due to bass predation, baseline data on sucker and crayfish populations was gathered prior to the smallmouth bass introduction (Figure C). Population data will be gathered annually. A mark-recapture estimate was made of both sucker and crayfish populations from 1992 through 1995.

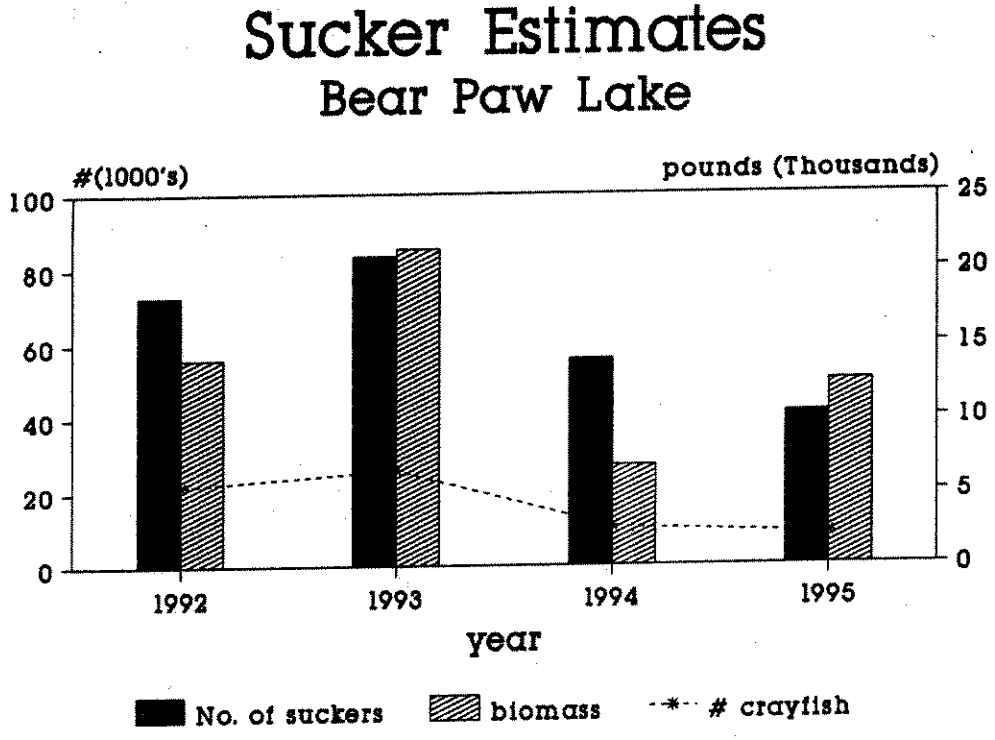

Figure C. White sucker and crayfish estimates for Bear Paw Lake, 1992-95.

The estimate of age II and older suckers was 72,737 in 1992. Total biomass was 13,992 pounds or 311 pounds per surface acre. The estimate of age II and older suckers in 1993 was 83,328 with a biomass of 21,324 pounds. Sucker biomass increased 163 pounds per acre from 1992 to 1993. However, in 1994, the population decreased to 56,012 fish with a total biomass of only 6,745 pounds. The decrease was primarily due to the loss of adult suckers. This is unexplained at this time as predation by bass could not have been a factor in reducing numbers of older suckers. Sucker estimates made in 1995 indicated the population is at the lowest level since 1992. However, average size is increasing and total biomass was double that of the previous year. Crayfish numbers continue to decline possibly in response to bass predation. The 1993 year-class of suckers was the first to be impacted by bass predation. Estimates made in 1995 show a significant reduction in this year-class over the previous years' production. Though predation might have been the chief factor it is too soon to speculate.

Adult crayfish, ranging in size from 2.6-3.8 inches were estimated at 21,577 with a total biomass of 1,292 pounds, or 29 lbs./acre in 1992. Numbers of crayfish increased in 1993 to 25,906, but average size decreased (range 2.5-3.6 in.). A decrease in average size was reflected in a biomass reduction to 21 pounds per acre. Numbers of crayfish also declined to less than 10 lbs/acre in both 1994 and 1995.

Smallmouth bass were the first predator fish utilized in this lake in an attempt to reduce sucker numbers. The results to date are summarized here. White sucker YOY congregate in dense schools in the upper, warmer, weedier portion of the reservoir in July. At this time suckers are very susceptible to predation. It was determined (Gilge 1994) that smallmouth bass must be 1.5 inches TL by mid-July to take full advantage of this food source as YOY suckers move off-shore to deeper water by the first week of August. The 1.3 inch bass introduced in August of 1992 were too small and planted too late to affect any predation on the 1992 sucker year class. Their small size also inhibited over-winter survival, as few bass recruited in 1993. Bass stocked in 1993 and 1994 were of sufficient size by mid-July to effectively feed on YOY suckers. Bass utilized suckers heavily for two weeks in July of 1993. However, while YOY suckers moved to deeper water in early August, bass stayed in the shallows and switched to a diet of crayfish and insects (Gilge 1994). YOY bass in 1994 did not utilized YOY suckers to any extent even though they were abundant and available. Yearling and two-year-old bass fed exclusively on crayfish and YOY bass. As the summer progressed, newly planted bass migrated from the weedy, upper reservoir where they were planted, to the rip-rap on the face of the dam. All bass older than Age 0 were found in the rocks of the dam face. As YOY bass infiltrated the rocky habitat, they were often cannibalized by older bass. Suckers did not frequent the dam face but utilized the warmer, weedier upper reservoir causing predator and prey to be spatially separated. This behavior was observed in each of the three years since introduction. More detailed food habit analysis is presented in a previous report by Gilge (1994).

Due to the apparent spatial separation of bass and suckers and the short period of active feeding by bass, it was felt that a suitable level of predation may not be exerted upon the sucker population. The use of walleye was investigated and an Environmental Assessment prepared in 1995 (Gilge,1995). Walleye fingerlings (5,000-1.5 -inch) were introduced in May of 1995 and an additional 500 4-inch fish were planted in early fall. Several seining attempts were made in summer and fall but no walleye were captured.

Dam repairs were on-going throughout the summer of 1995 and the reservoir was drawn down 6 feet for several months. The effect upon YOY suckers is unknown but predation may have been high due to lack of shoreline cover.
Continued monitoring of these populations and food habit analysis of all fish species should assist in evaluating the affect of this experimental introduction and better define dietary overlap. It is uncertain whether continued removal of adult suckers would be of value at this time.

Grasshopper Reservoir

The reservoir was not netted in 1995 due to very low water levels created by irrigation demands. The potential for winterkill is very high.

Faber Reservoir

This reservoir is one of the most popular fishing access sites in north central Montana. It has been a consistent producer of quality rainbow trout for three decades.

Adult largemouth bass were found in the reservoir in 1990, the result of an illegal introduction. Shoreline seining and electrofishing were conducted in August of 1993 to determine if bass had successfully reproduced. No YOY bass were found; however, numerous YOY white suckers and several adult suckers were captured. This is the first observation of suckers in the reservoir. Two gill nets set the following week captured 25 rainbow trout and 81 adult suckers. Similar gill net sets in 1987 produced 51 trout and no suckers. The suckers ranged in length from 10.6-13.3 inches. In 1994, the same net sets produced only eight rainbow trout, but 128 suckers. No fish from the 1994 fingerling plant were captured, which indicates a probable loss of the entire year-class. In 1995 only four trout were netted along with 169 suckers. Though numerous, the presence of suckers appears to have had little affect on trout growth rates or condition to date. Overall condition of trout remains excellent, probably due to reduced intra specific competition. No clues to the recent high mortality of fish plants have been found.

RECOMMENDATIONS

Beaver Creek Reservoir: Continue stocking of Eagle Lake and Arlee rainbow catchable-size trout. Evaluate the Erwin domestic strain as a possible replacement for Arlee due to projected future shortfalls of Arlee rainbow in the hatchery system. Increase stocking rate as northern pike population increases.

Bear Paw Lake: Continue McBride strain cutthroat stocking at reduced rates. Continue Arlee catchable stocking at current rates. Annual population estimates of suckers and crayfish should be made to monitor effects of smallmouth bass and walleye introductions. Determine food competition overlap between species and evaluate extent of bass and walleye predation on suckers. Continue stocking of walleye and smallmouth bass until predation objectives are met. Investigate rock placement around reservoir to help redistribute bass.

Grasshopper Reservoir: Continue with annual plants of Arlee fingerlings and alternate year plants of Eagle Lake rainbow. Monitor with annual gill net survey.

Faber Reservoir: Continue to monitor sucker population and growth and condition of trout. Begin investigating potential sucker control measures.

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Waters referred to:

15-4570-03 Beaver Creek Reservoir
15-4560-05 Bear Paw Lake
15-5380-07 Grasshopper Reservoir
15-0320-01 Beaver Creek
15-5140-01 Faber Reservoir

Key Words or Fish Species:

Arlee, Eagle Lake rainbow trout, sucker removal, crayfish, population estimates, smallmouth bass, walleye, dietary studies.

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