MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO.: F-78-R-1 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, 1994 THROUGH JUNE 30, 1995

ABSTRACT

Trout gill net catch-per-unit-effort (CPUE) increased substantially in Beaver Creek Reservoir from 1993. Trout gill net CPUE also increased in Bear Paw Lake in 1994. However, average size and condition has not improved despite the removal of 92,000 suckers (13.3 tons) since 1989. White sucker and crayfish population estimates were down substantially from 1993 levels. The disappearance of older suckers is responsible for the decline and is unexplained. Smallmouth bass predation has been limited due to spatial separation from prey. Growth, survival and condition of rainbow trout at Grasshopper Reservoir remains good following chemical rehabilitation. Sucker numbers in Faber Reservoir are increasing and the 1994 trout stocking was unsuccessful. Condition of trout remains good despite increasing sucker numbers. Management recommendations for all waters are presented.

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 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.

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 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 improved considerably and condition remained good. Trout condition is believed to be associated with white sucker numbers, which have declined to all-time lows, and should remain low, due primarily to northern pike predation.

Arlee rainbow have exhibited consistently higher condition factors than Eagle Lake in this reservoir and the addition of the Arlee strain is suspected as the largest contributing factor to the increase in trout condition. The last time Arlee rainbow were present in the reservoir, the large sucker population presented significant competition. Sucker numbers have since declined to the lowest levels since the reservoir was first filled. Arlee rainbow were reintroduced to determine if they could achieve better growth than Eagle Lake rainbow under less competitive circumstances. It appears that growth performance is much better now than under the competitive circumstances of the past.

Table 1. Summary of gill net catches and relative abundance of fishes in Beaver Creek Reservoir, 1974-94.

	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	---	----	----	---	----	----	----	---	----	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

[1]Number of fish caught per gill net.

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

Adult northern pike numbers peaked in 1987, but are relatively low at present due to several years of poor reproduction and heavy fishing pressure. 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. Northern pike, at present, are rather large, though not particularly numerous. 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 decreased in 1994, but average size increased considerably. Trout were found in walleye stomachs for the first time in 1994. Fall gill netting produced a 19.8-inch (6 year old) and a 22.8-inch (7 year old) walleye. Both had trout in their guts. It is not known, however, if the trout were picked from the gill net or ingested prior to capture. 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 population is increasing in numbers and in size.

Gill net catch-rates for yellow perch increased considerably, 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 in 1990 (Figure 1). 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 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.

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

Bear Paw Lake
Gillnet Results

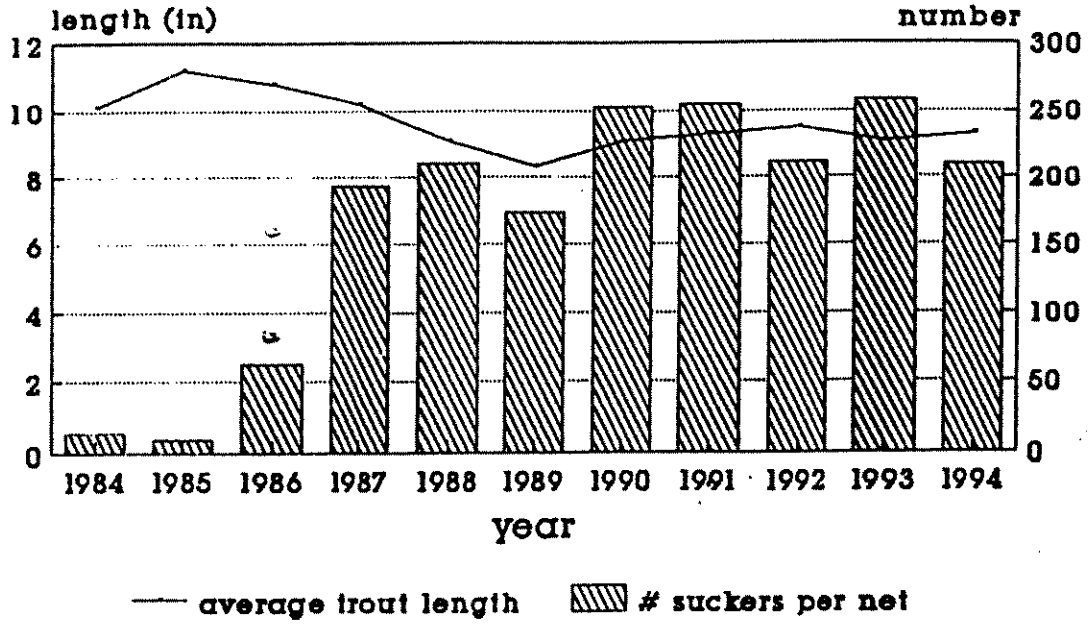

Figure 1. Comparison of white sucker increases, after chemical rehabilitation in 1983, with trout growth in Bear Paw Lake.

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 from 1993, 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 (1988-94) 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

[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 91,674 suckers with a total biomass of 13.3 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 2 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.

Table 3. Number and poundage of white suckers removed from Bear Paw Lake from 1989 to 1994.

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
TOTALS	91,674	26,613

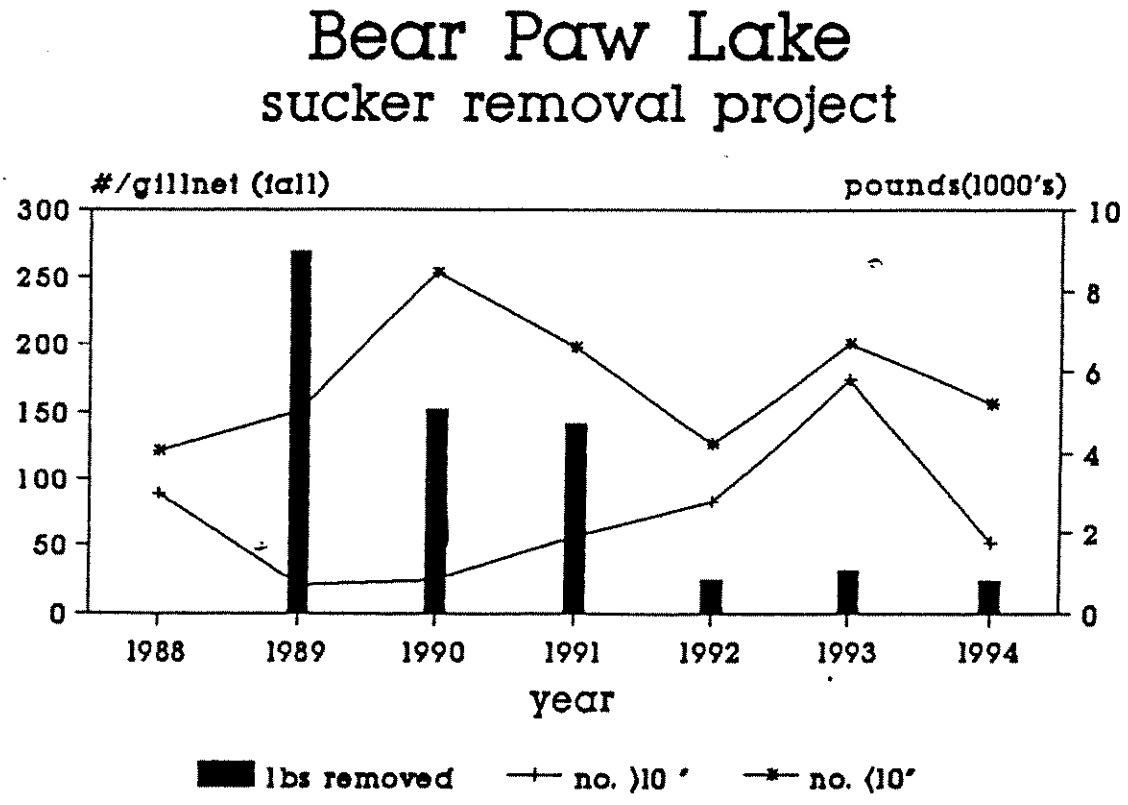

Figure 2. Number of juvenile and adult suckers captured per gill net in each year of the study compared with the pounds of suckers removed each year with decreasing effort.

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.

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.

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 3). Population data will be gathered annually. A mark-recapture estimate was made of both sucker and crayfish populations in 1992, 1993

and 1994. 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 has not been a factor in reducing numbers of older suckers.

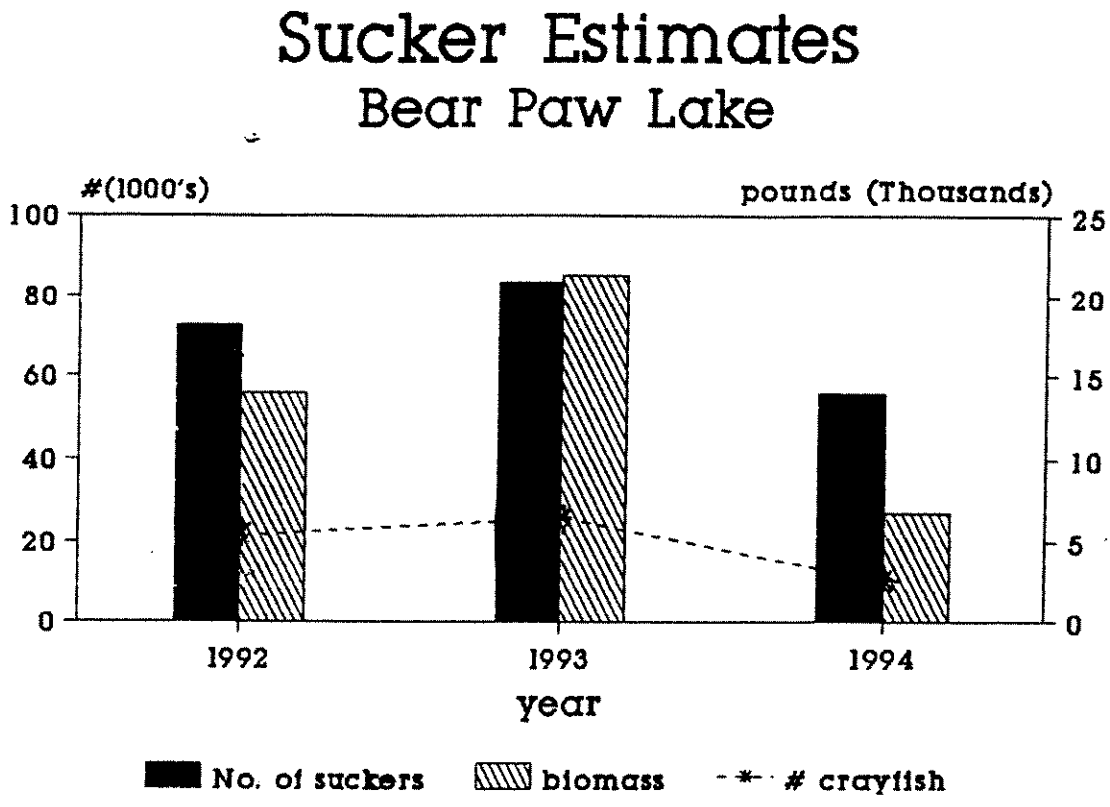

Figure 3. White sucker and crayfish estimates for Bear Paw Lake, 1992-94.

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 in 1994 to 10,356 or 9.6 pounds per acre.

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 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).

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 most recent stocking strategy for this reservoir includes alternate year plants of Arlee and Eagle Lake rainbow trout. This is done to utilize the longevity of Eagle Lake rainbow, along with the growth and catchability characteristics of the Arlee.

Poor trout growth in the past has been associated with high numbers of white suckers in the reservoir. Spring trapping and removal of suckers was conducted from 1988 to 1991. Though the sucker catch rate decreased from 128 lbs./trap-day (TD) in 1988 to 11 lbs./TD in 1990, juvenile sucker numbers continued to increase at an alarming rate. Gill netting in the fall of 1991 revealed a low trout population accompanied by very low water levels. A decision was made to chemically rehabilitate the reservoir with rotenone. The reservoir and the immediate upstream drainage was successfully treated and the reservoir was fallowed over winter. Catchable-size (7 inch) and fingerling (3 inch) Arlee rainbow trout were planted in the spring of 1992.

A floating and a sinking experimental gill net were fished overnight in mid-September of 1992 and 1993. A total of 122 trout were captured in 1992 averaging 10.3 inches and 0.47 pounds. Due to the high trout density, no fish were planted in spring of 1993. Gill netting in the fall of 1993 captured only one trout which was 18.6 inches long and weighed 3.44 pounds. Fingerling Eagle Lake rainbow trout were planted immediately following fall gill netting. Fifty-three trout averaging 12.6 inches and 0.93 pounds were netted in fall of 1994. Condition factors of trout are good in this reservoir. No suckers were netted, indicating successful rehabilitation with no recent recontamination.

Faber Reservoir

This reservoir is one of the most popular fishing access sites in northcentral 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. 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.

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 introduction. Determine food competition overlap between species and evaluate extent of bass predation on suckers. Increase number and size of smallmouth bass planted annually and coordinate stocking with YOY sucker schooling for maximum predation . Investigate rock placement around reservoir to help redistribute bass. Investigate need and potential for use of walleye as an alternate biological control.

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, dietary studies.

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