THIRTY-TWO YEARS OF FISH MANAGEMENT NOXON RAPIDS AND CABINET GORGE RESERVOIRS

by
Joe E. Huston
Montana Department of Fish, Wildlife and Parks
Helena, Montana

March, 1985

ABSTRACT

This report summarizes efforts on development of a sustainable sports fishery in two run-of-the-river hydroelectric reservoirs on the Clark Fork River in western Montana since 1952. It is not intended as a presentation of scientific data, but rather as a narrative description of events. The two impoundments, Noxon Rapids Reservoir and Cabinet Gorge Reservoir, are owned and operated by Washington Water Power Company, Spokane, Washington.

Maintenance of a viable sports fishery has been difficult and largely unsuccessful. Planted rainbow trout (Salmo gairdneri) produced an excellent sports fishery in 1958 through 1960, but numbers declined dramatically in 1961. Continued planting of rainbow trout did not re-establish a fishery of consequence. Other fish species planted into either or both reservoir that failed to produce a fishery included Yellowstone (Salmo clarki bouvieri) and westslope (Salmo clarki lewisi) cutthroat trout, kokanee (Onchorynchus nerka), silver salmon (Oncorhynchus kisutch), and burbot (Lota lota). The burbot is known most commonly as ling by Montana anglers. Because this report is intended as much for sportsmen as for biologists, the name ling will be used throughout the remainder of the report. Brown trout (Salmo trutta) were planted but also were present before impoundment. A limited fishery may be the result of fish present before impoundment.

Largemouth bass (Micropterus salmoides) were present before impoundment and appeared to increase in abundance in the 1980's. Smallmouth bass (Micropterus dolomieui) were first planted in summer, 1982 and appeared to have survived in good numbers through summer, 1984.

Species composition has changed considerably from the early 1960's to the early 1980's. Species declining in abundance included rainbow trout, mountain whitefish (Prosopium williamsoni), largescale (Catostomus macrocheilus) and longnose (Catostomus catostomus) suckers. Species maintaining about equal numbers included the bull trout (Salvelinus confluentus) and northern squawfish (Ptychocheilus oregonensis). Species increasing in abundance were brown trout, lake whitefish (Coregonus clupeaformis), largemouth bass, peamouth (Mylocheilus caurinus) and yellow perch (Perca flavescens). Other species occasionally caught included pumpkinseed (Lepomis gibbosus), redside shiner (Richardsonius balteatus), and black bullhead (Ictalurus melas).

Gill net catch in 1960 averaged 50.0 fish per net night in Noxon Rapids Reservoir and 27.6 in Cabinet Gorge Reservoir. Catch in 1983 averaged 137.2 fish per net night in Noxon Rapids and 59.5 fish in Cabinet Gorge. Game fish made up 77 percent of the 1960 Noxon Rapids catch and 37 percent of the Cabinet Gorge catch. In 1983, game fish made up 3 percent of the catch from Noxon Rapids and 5 percent in Cabinet Gorge Reservoir.

Two major reservoir operation changes have been made since impoundment of Noxon Rapids Reservoir in 1958. The first in 1961 increased average annual winter drawdown of Noxon Rapids from less than 10 feet to more than 30 feet. The second, in 1979, eliminated drawdowns of more than 6 feet except for unusual power demand occurrences. Cabinet Gorge Reservoir has been used as a re-regulation impoundment for Noxon Rapids Reservoir.

INTRODUCTION

Noxon Rapids and Cabinet Gorge reservoirs are run-of-the-river hydroelectric impoundments on the Clark Fork River in western Montana (Figure 1). Both are owned and operated by Washington Water Power Company, Spokane, Washington. Cabinet Gorge Reservoir was first filled in 1953 and Noxon Rapids Reservoir in 1959. The entirety of Noxon Rapids Dam and Reservoir is in Montana while Cabinet Gorge Dam and the first one-fourth mile of impoundment are located in Idaho.

Prior to construction of Cabinet Gorge Dam, the Clark Fork River drainage in Montana upstream to the Thompson Falls Dam (Figure 1) served as spawning and rearing areas for game fish emigrating out of Lake Pend Oreille, Idaho. Species of game fish migrating into Montana included bull trout, cutthroat trout, mountain and lake whitefish, and kokanee. Tributaries reported to have spawning runs of bull and cutthroat trout included Prospect Creek, Grave Creek, Vermilion River, Trout Creek, Marten Creek, and Swamp Creek all tributaries of Noxon Rapids Reservoir and Rock Creek, Pilgrim Creek, Elk Creek, and Bull River tributaries to Cabinet Gorge Reservoir. It was also reported that most whitefish and kokanee spawned in the mainstream Clark Fork and the lower reaches of some of the above-named tributaries.

The U. S. Fish and Wildlife Service recommended to the Federal Power Commission that design of Cabinet Gorge Dam include a fish ladder for passage of migrating fish. This recommendation was not included in the license, and the dam blocked all spawning migrations. Fish passage facilities were not recommended for Noxon Rapids Dam.

Washington Water Power Company and Montana Department of Fish, Wildlife and Parks have cooperated in fishery management and investigations since 1952. The Company contracted $187,050 to the Department for investigations and management between 1954 and 1958 as mitigation of expected fishery impacts. Since 1958, the Company has provided equipment, technical services, and personnel as needed on a voluntary basis.

The following brief overview of fisheries' activities on Cabinet Gorge and Noxon Rapids Reservoirs was summarized from reports by Gaffney (1956 and 1959), Huston (1965), Huston and Vaughan (1968), Huston (1968 through 1982), and considerable unpublished data.

OBJECTIVES

This report summarizes 32 years of fishery investigation and management effort on Cabinet Gorge and Noxon Rapids Reservoirs. The objective has been the establishment and maintenance of a viable sport fishery. Short-term objectives were the establishment of selected game fish and these are listed as follows:

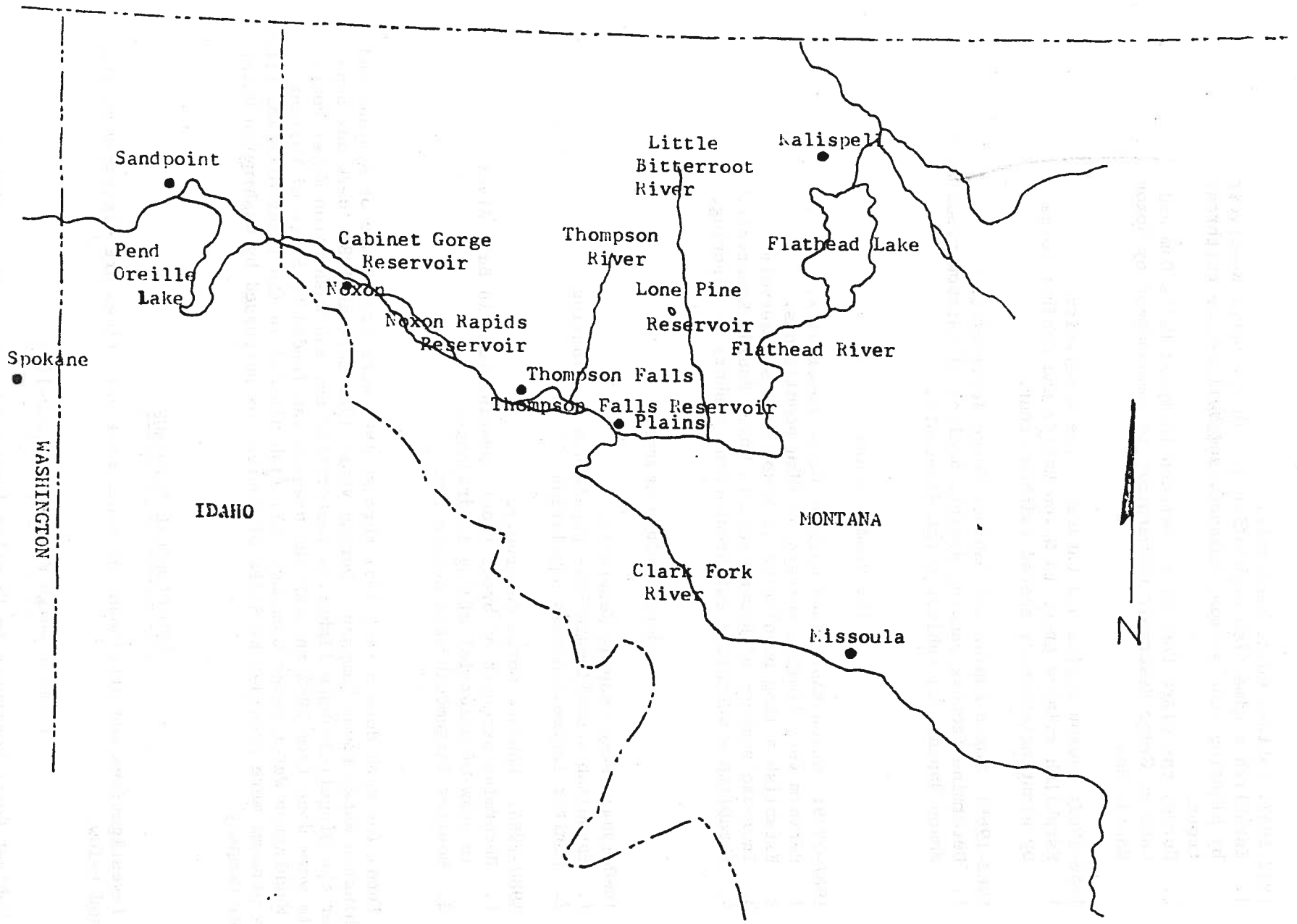

Figure 1. Map of Clark Fork River drainage in Montana and Idaho

The Good Years

A. 1952-1957: Cabinet Gorge Reservoir.
   1. Establish a game fish population in Cabinet Gorge Reservoir by planting coho salmon, kokanee, and Yellowstone cutthroat trout.
   2. Survey the Clark Fork River between Thompson Falls Dam and Cabinet Gorge Reservoir preparatory to impoundment by Noxon Rapids Dam.

B. 1958-1962: Noxon Rapids and Cabinet Gorge Reservoirs.
   1. Establish rainbow trout in Noxon Rapids and Cabinet Gorge by planting hatchery-reared rainbow trout.

C. 1963-1966: Noxon Rapids and Cabinet Gorge Reservoirs.
   1. Determine factors causing drastic decline of rainbow trout in Noxon Rapids and Cabinet Gorge Reservoirs.

The Dismal Years

D. 1967-1979: Noxon Rapids and Cabinet Gorge Reservoirs.
   1. Perform very limited surveys of fish populations.
   2. Establish a ling population in Noxon Rapids Reservoir.
   3. Increase numbers of brown trout in Noxon Rapids Reservoir.
   4. Establish a westslope cutthroat trout fishery by planting.

Hope Springs Eternal

F. 1980-1984: Noxon Rapids Reservoir.
   1. Establish a smallmouth bass population by planting.
   2. Monitor largemouth bass population.

G. 1980-1984: Cabinet Gorge Reservoir.
   1. Determine strength of brown trout spawning runs in Bull River in veiw of potential mining in drainage.
   2. Monitor largemouth bass population.

Funds for work done during 1952 through 1967 were from State of Montana and Washington Water Power Company. During years 1968 through 1981, work was done under the Dingell-Johnson fisheries restoration act and Washington Water Power while work done from 1982 through the present was funded by State of Montana and Washington Water Power Company. All fish planted in the reservoirs and tributary streams were provided by State of Montana or purchased by Washington Water Power Company.

CHRONOLOGICAL FINDINGS

Investigations and attainment of management objectives are discussed by time period below.

Cabinet Gorge Reservoir, 1952-1957

Cabinet Gorge Reservoir is 18 miles long and has an average width of about one-third mile (Figure 2). Fluctuations from 1952 through 1958 averaged about

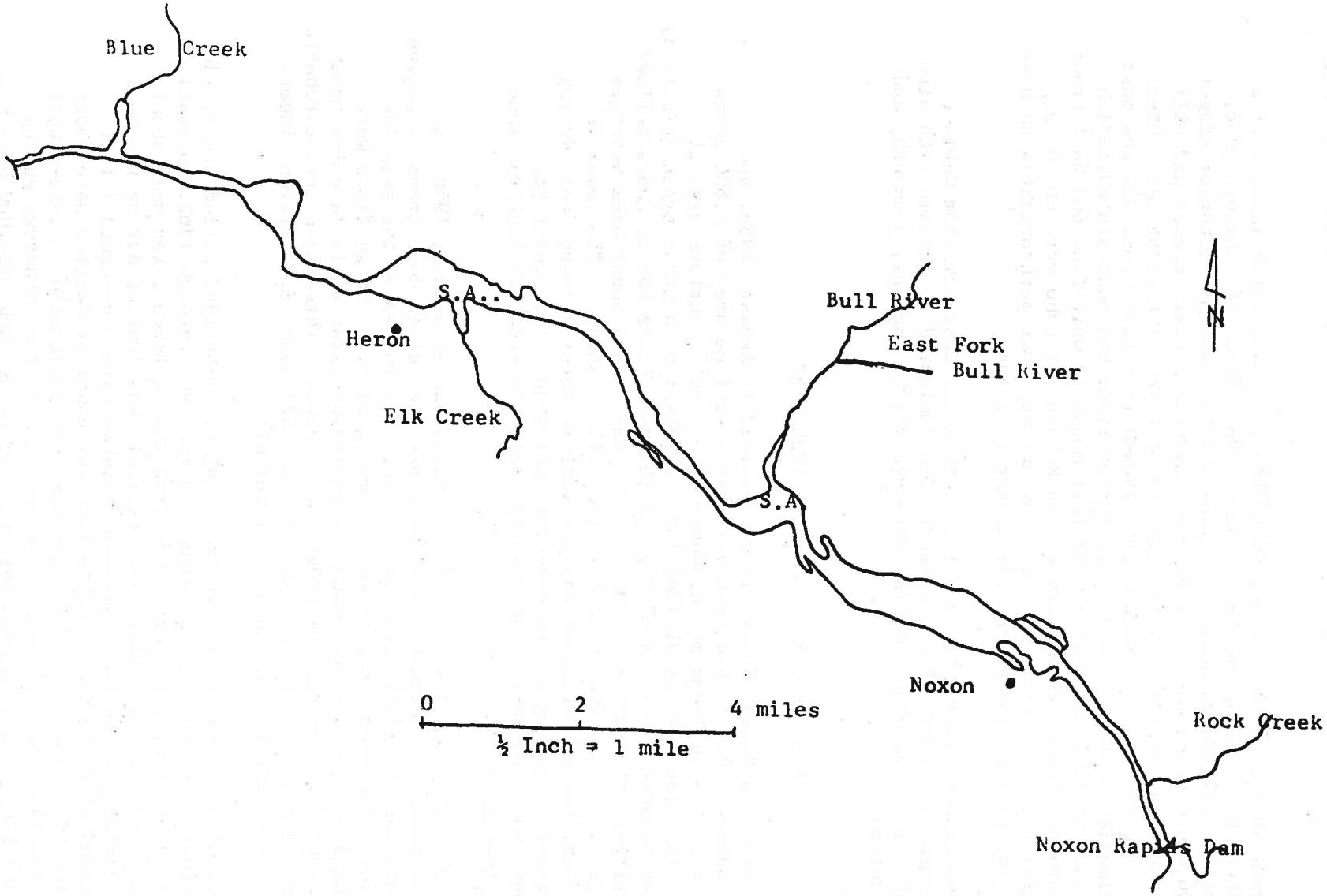

Figure 2. Cabinet Gorge Reservoir and sampling areas (S.A.).

3 feet per day and 14 feet per week. Annual fluctuation was the same as weekly fluctuation. Maximum pool area was 3,400 surface acres while minimum pool was 2,450 acres.

Management objective for Cabinet Gorge Reservoir was establishment of a salmonid fishery by planting hatchery-reared fish. From 1953 through 1956, Montana planted 1,707,000 kokanee fry; 1,184,000 Yellowstone cutthroat fingerlings and 100,000 coho salmon fry into the reservoir. Creel census and gill net sampling was used to evaluate the success of these fish plantings. Creel census data collected in 1954 through 1956 showed that bull trout was the most numerous salmonid caught followed by cutthroat trout and mountain whitefish. Gill net catches in 1955 and 1958 showed that mountain whitefish and bull trout were more abundant than cutthroat trout. No kokanee or coho were caught by anglers or gill nets. In fact, only one kokanee was ever authenticated to have been caught from Cabinet Gorge and this occurred in 1961.

A pre-impoundment survey of the Clark Fork River upstream from Cabinet Gorge to Thompson Falls Dam showed a population dominated by nongame fish with few game fish. The most abundant fish were squawfish, suckers, peamouth, and mountain whitefish.

Noxon Rapids Reservoir, 1958-1962

Filling of Noxon Rapids Reservoir was started in August, 1958, and completed in summer, 1959. This reservoir has a surface area of 8,600 acres at full pool and at actual maximum drawdown of 54 feet a surface area of 5,500 acres. The reservoir is divided into two distinct habitat types (Figure 3). The upper area between Beaver Creek Bay and Thompson Falls Dam is characterized by visible current at almost all times of the year. This upper area averages about 300 yards wide, and the channel is typically U-shaped. The lower 18 miles downstream from Beaver Creek Bay has visible water currents only during spring high water or during severe reservoir drafting. This lower part averages about two-thirds mile wide and has extensive areas of littoral zone less than 50 feet deep.

Immediately prior to closure of Noxon Rapids Dam in August, 1958, the Thompson Falls Reservoir (Figure 1) and the Clark Fork River downstream to Cabinet Gorge Reservoir was chemically treated with rotenone to remove the existing fish population. Treatment results were termed good even though flows were about one-third more than anticipated. Planting was started in late September, 1958 when 295,000 two-inch rainbow trout were stocked. These fish were catchable size in summer, 1959. In 1959 through 1962, an additional 2.2 million fingerling rainbow trout were planted into the reservoir.

Operation of Noxon Rapids Reservoir during the 1958-1962 period was divided into two distinct patterns; 1958 through 1960 and 1961 through 1962. Operation during 1958-1960 was only for power production and drawdown rates were about 1 foot per day, 3-5 feet per week. The reservoir was drafted during the week and refilled during the weekend. Maximum drawdown rarely exceeded 7 feet. During the period of 1961-1962, fluctuations for power production were about the same as for 1958-1960. The exception was incorporation of a late-winter, spring draft for flood control which resulted in a 32 foot drawdown during spring 1961 and 1962. Noxon Rapids Reservoir contains about 230,000 acre feet of usable flood control storage. From 1961 through 1978, Noxon Rapids was drafted during winter-spring with average drawdown being about 35 feet and maximum drawdown being 54 feet.

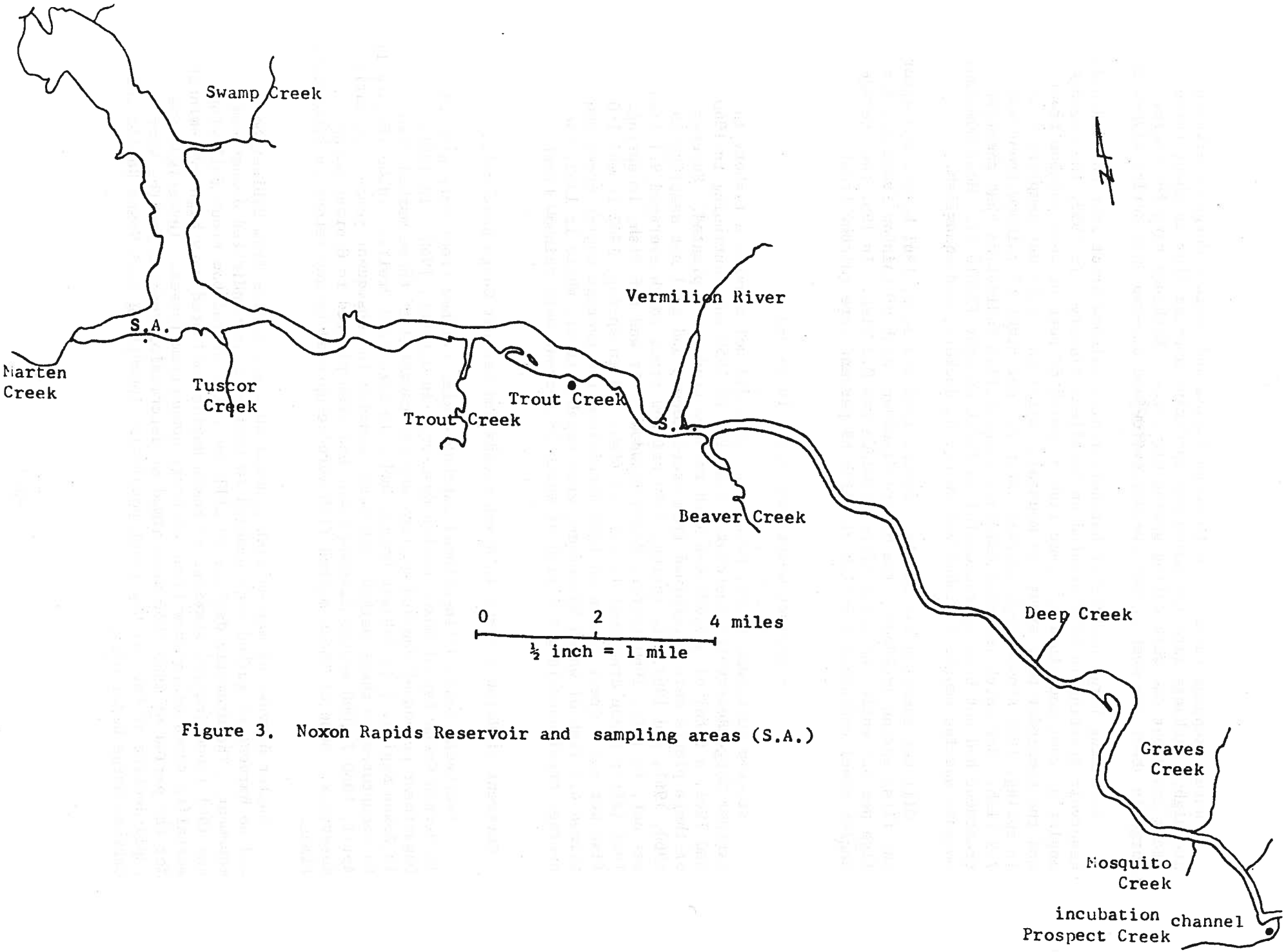

Figure 3. Noxon Rapids Reservoir and sampling areas (S.A.)

Water exchange rates for both Noxon Rapids and Cabinet Gorge reservoirs are high. Exchange rate for Noxon Rapids during average flow is about three weeks and about one week during spring highwater. Exchange rate for Cabinet Gorge is about one week during average inflow and one-two days during highwater.

Releasing large numbers of hatchery-reared rainbow trout into Noxon Rapids Reservoir starting in 1958 created an excellent fishery. In 1959, the average angler's creel contained 5.3 game fish of which 82 percent were rainbow trout and the remainder bull trout and mountain whitefish. Gill net sampling done in spring, 1960 showed that average catch per net night of rainbow trout was 7.9 fish. Net catch included numerous nongame fish indicating that chemical treatment had not been as successful as first thought (Table 1). Most numerous nongame species caught included yellow perch, suckers, and squawfish.

Gill net sampling was one in October, 1960 and June, 1961 before and after the first spring drawdown. The before drawdown catch of rainbow trout was 6.6 fish per net while the catch after drawdown was 0.3 fish. In 1962 the average angler creel contained 0.7 fish of which 68 percent were rainbow trout.

Cabinet Gorge Reservoir, 1958-1962

Stocked cutthroat trout, kokanee or coho did not provide a fishery in Cabinet Gorge Reservoir; therefore, starting in 1959 and continuing in 1960 and 1961, a total of 465,000 4-6 inch rainbow trout were planted. Success of these plants were determined from creel census and gill net sampling in 1960, 1961, and 1962. In spring, 1960 rainbow trout catch averaged 9.1 fish per net, in fall, 1960 (before Noxon drawdown), it was 6.6 fish, in spring, 1961 (after Noxon drawdown) it was 0.0 fish, and in spring, 1962 it was 1.0 fish per net. Creel census in 1960 determined the average angler creel contained 4.3 fish of which 99 percent were rainbow trout, while in 1962, the average creel contained 0.7 fish of which 38 percent were rainbow trout.

Movement of Rainbow Trout in Noxon Rapids and Cabinet Gorge Reservoirs

Fourteen thousand fin-clipped catchable size rainbow trout were planted in Marten Creek Bay of Noxon Rapids Reservoir in October, 1960. In 1961, Department personnel checked anglers who had caught 3 of these marked fish in Noxon Rapids, 5 in Cabinet Gorge, and 1 in Lake Pend Oreille, Idaho (Figure 1). No recaptures of these marked fish were recorded in subsequent years. In early April, 1960 75,000 marked rainbow trout had been planted in Cabinet Gorge Reservoir. None of these marked fish were recaptured by any method in subsequent times.

Angler harvest of marked fish planted in Noxon Rapids from Cabinet Gorge and no harvest of marked fish planted in Cabinet Gorge indicated downstream movement. The dramatic decline in gill net catch of rainbow trout following the 1961 flood control drawdown of Noxon Rapids indicated very high over-winter mortality rates of rainbow trout or heavy downstream losses. Investigations for the period of 1963-1966 were aimed at determining reasons for the very rapid decline of the rainbow trout population inhabiting both Noxon Rapids and Cabinet Gorge Reservoirs.

Table 1. Average catch per net night, Noxon Rapids Reservoir compared to Cabinet Gorge Reservoir in spring, 1960.

Reservoir	No.of Nets	Number of Fish by Species*											
		Rb	DV	LL	MWf	LWf	LmB	CSu	FSu	Sq	CRC	YP	Total
Noxon Rapids	12	7.9	1.4	0.2	12.4	0.0	0.3	5.3	12.6	2.3	0.0	7.8	50.0
Cabinet Gorge	8	9.1	0.8	0.0	0.0	0.3	0.1	6.3	1.4	5.9	3.0	0.9	27.6

*Fish species abbreviations are standard Montana abbreviations and will be used throughout this report. Abbreviations are: Rb--rainbow trout, DV--bull trout, LL--brown trout, MWf--mountain whitefish, LWf--Lake whitefish, LmB--largemouth bass, CSu--largescale sucker, FSu--longnose sucker, Sq--northern squawfish, CRC--peamouth, YP--yellow perch.

Noxon Rapids and Cabinet Gorge Reservoirs, 1963-1966

Jaw-tagged catchable size (7-9 inch) rainbow trout were planted in Noxon Rapids Reservoir in 1963 and 1964. The Department, Company, and area service clubs funded quarterly drawings for cash and merchandise to promote maximum return of tags by anglers. Each tag returned was one chance in the drawings. Tag return drops were established at businesses in towns from Thompson Falls downstream to Sandpoint, Idaho, and Spokane, Washington. Return of tags by anglers with date and place of catch provided good information on catch rates and movement patterns.

In late June, 1963 73,882 tagged rainbow trout from Montana's Arlee Hatchery were released at 9 points along the length of Noxon Rapids Reservoir. In late May, 1964 tagged rainbow trout from two different hatchery sources were released into Noxon Rapids at the same places used in 1963. Number of fish planted from Montana's Arlee Hatchery was 14,975 fish while 10,870 were released from Ed McLeary's Trout Lodge Hatchery located in Soap Lake, Washington. The Trout Lodge fish were reputed to "stay in the same bucket of water they were planted in."

Number of tags returned by anglers and general location of catch is listed in Table 2. The area below Cabinet Gorge includes the Clark Fork River to Lake Pend Oreille, Idaho, Lake Pend Oreille, and the Pend Oreille River downstream. The farthest downstream authenticated tag return was from a fish caught in the Pend Oreille River near the Washington-British Columbia border. Oregon officials determined that a tag return reportedly from The Dalles reservoir on the lower Columbia River was a hoax.

Table 2. Angler harvest and location of tag returns of rainbow trout planted in Noxon Rapids Reservoir in 1963 and 1964 from time of planting through December 31, 1966.

Fish Source	Year Planted	Number Planted	Area of Return: Noxon Rapids	Cabinet Gorge	Below Cabinet	Total
Arlee	1963	73,882	3,950	216	71	4,238 (5.7%)
Arlee	1964	14,975	751	1,340	85	2,176(14.5)
Trout Ldg.	1964	10,870	534	178	7	719 (6.6)

Fish released in June, 1963 were planted when Noxon Rapids Reservoir was near full pool and reservoir discharge 40,000 cfs and declining of which spill discharge was 20,000 cfs. Most of the total harvest was taken from Noxon Rapids the first year (June, 1963-May, 1964) following planting when 3,809 fish were caught. Only 141 tags were returned from fish caught during June, 1964 through December, 1965. Catch from Cabinet Gorge Reservoir and below Cabinet Gorge was 171 fish during June, 1963 through May, 1964 and 117 fish from June, 1964 through December, 1965.

Fish planted in Noxon Rapids Reservoir in 1964 were released in mid-May when the reservoir was 23 feet below full pool and total discharge 30,000 cfs of which 10,000 cfs was spill discharge. Discharge from Noxon Rapids increased

to 120,000 cfs of which 90,000 cfs was spill discharge in mid-June. Spill discharge was 40,000 cfs or more from late May through mid-July, 1964.

Most of the total harvest of Montana's Arlee rainbow trout was during the first year following planting (June, 1964-May, 1965), but 36 percent of the fish were from Noxon Rapids Reservoir, and the remainder from Cabinet Gorge Reservoir or below Cabinet Gorge Dam. Total harvest during the first year following planting was 2,100 fish. Harvest of Arlee fish from June, 1965 through December, 1966 was only 74 of which 17 were from Noxon Rapids, 35 from Cabinet Gorge, and 22 from below Cabinet Gorge Dam.

Harvest of the Trout Lodge rainbow trout during the first year following planting was 689 fish of which 76 percent were from Noxon Rapids and 24 percent from Cabinet Gorge Reservoir and downstream. Only 30 Trout Lodge fish were caught during the period of June, 1965 through December, 1966 and catch by area was 9 fish from Noxon Rapids, 16 from Cabinet Gorge and 5 from below Cabinet Gorge Dam.

This movement and harvest study showed that hatchery rainbow trout do move out of Noxon Rapids Reservoir, and that movement is correlated with spill discharge. Spill discharge of 40,000 cfs or more appear to precipitate significant downstream movement. Frequency of spill discharge of 40,000 cfs during 10 years, 1974-1983, was 60 percent of the time. The data also indicates that the Trout Lodge rainbow trout did not emigrate out of Noxon Rapids as much as the Arlee rainbow, but that they were not as catchable as the Arlee fish. Catch rates of both the Arlee and Trout Lodge fish were extremely low after the first year in the reservoir.

Noxon Rapids and Cabinet Gorge Reservoirs, 1967-1979

Work done on both reservoirs in 1963-1966 showed that movement out of the reservoir was a major problem in maintenance of a rainbow trout fishery. Reservoir gill netting in Noxon Rapids did indicate that brown and bull trout were not affected as much as rainbow trout. It was decided to try to build up the numbers of brown trout by planting eggs in an incubation channel and releasing fry. This same approach would have been used for bull trout, but the only egg source for bull trout was from Alaskan sea-run Dolly Varden. Brown trout eggs to seed the incubation channel were obtained from California's Hot Creek Hatchery located near Bishop, California.

The incubation channel was located on the Dick Wilkinson property on Prospect Creek (Figure 2) and consisted of 3 small ponds and connecting riffles from a spring water source draining into Prospect Creek. Total surface area was about 9,000 square feet of which about 3,000 feet was riffle area. These ponds had been used by the Northern Pacific Railroad to grow trout in the late 1920's - early 1930's for use in their diner cars.

Personnel from the Department and Company removed 75-100 cubic yards of silt from the riffle areas and replaced it with 85 cubic yards of washed 1/4-1/2 inch graded gravel. Gravel was placed by hand and machine and was 6-12 inches deep. The dam and outlet structure of the lower pond was reconstructed, and an incline screen trap installed in the outlet. This work was done in summer-fall, 1966.

Brown trout eyed eggs were planted in the gravel areas, hatched, the fry trapped and counted, and released to drift into Prospect Creek. Excess

cutthroat eggs from Montana's Libby Hatchery were also planted, hatched, and released in the incubation channel in 1968 and 1969. Table 3 lists the number of eggs and fry released into Prospect Creek from the incubation channel.

Table 3. Brown and cutthroat trout eggs planted and fry released into Prospect Creek from Wilkinson incubation channel.

Species	1967	1968	1969	Total
Brown Trout				
Eggs planted	600,000	302,000	720,000	1,622,000
Fry released	195,000	244,000	1/4 mill*	689,000
Cutthroat Trout				
Eggs planted		240,000	450,000	690,000
Fry released		75,000	unknown	unknown**

*Outlet works developed leak and fry released is an estimate.
**Downstream trap not operated in 1969 for cutthroat fry, mortality of cutthroat eggs in hatchery in 1968 and 1969 averaged about 60 percent.

Observations on the 1962 brown trout spawning run into Prospect Creek was about 100 fish. An upstream trap to capture brown trout was fished near the mouth of Prospect Creek from late October through late November in 1965 through 1971. Fry released from the incubation channel in 1967 should have returned to spawn in fall, 1970 and 1971. Catch of brown trout at this trap is listed in Table 4. Considerable difficulties were had with "local residents" tearing the trap out particularly in the latter years with fall freshets and with debris breaking down the trap leads every year. Trap catch has to be considered a minimum number, but probably representative of relative size of the spawning run between years.

Table 4. Catch of spawning brown trout in Prospect Creek trap.

	Trapping Year						
	1965	1966	1967	1968	1969	1970	1971
Number caught	24	8	2	0	2	1	0

Catch of spawning brown trout in Prospect Creek indicated that use of the incubation channel had not resulted in an increased population in Noxon Rapids Reservoir. Limited gill net sampling in both Noxon Rapids and Cabinet

Gorge Reservoirs indicated that brown trout numbers were less in 1967-1976 than in 1958-1962. Anglers also reported catching few brown trout and no cutthroat trout.

Reasons for the failure of brown trout to survive in the reservoir were probably related to effects of reservoir operation and increasing number of squawfish and peamouth. Rapid water exchange rates are inherent to both Noxon Rapids and Cabinet Gorge and limiting development of plankton as a food source. Drafting of the reservoirs, particularly Noxon Rapids, markedly reduced availability of aquatic insects as a fish food item.

Graves Creek (Figure 3) had a spawning run of brown trout in 1962. For some unknown reason, this creek started going underground in late summer, fall, and winter for the first 1/2 mile above the reservoir in fall, 1965. Flow remained intermittent until the fall of 1983 when above-ground water again reached Noxon Rapids Reservoir.

Management failures during the years of 1952-1970 indicated that development and maintenance of a sport fishery was not likely to happen using standard salmonid species and planting methods. Knowledge that any fish species planted in either reservoir would move into downstream waters tempered species planting choices. This knowledge eliminated attempting development of a sport fishery using available warm water species such as walleye pike since they were not present in the Lake Pend Oreille system downstream.

The Department and Company consulted with Idaho, Oregon, Washington, and British Columbia fishery agencies and received their permission and agreement to plant ling in Noxon Rapids Reservoir. This species, although not considered a game fish in Montana, is prized as a food fish. In spring, 1971, 420 ling ranging from 10-20 inches long were trapped in Clark Canyon Reservoir and transplanted into the upper end of Noxon Rapids Reservoir. No ling have ever been taken from Noxon Rapids or Cabinet Gorge Reservoirs during fish sampling efforts and only 3 were reported caught by anglers, the last one in summer, 1972.

In 1971 through 1974, 250,000 kokanee fry were planted in the Clark Fork River near Plains, Montana, in Thompson Falls Reservoir, in the lower end of Thompson River, and in Prospect Creek. It was hoped that these fish would move downstream into Noxon Rapids or Cabinet Gorge Reservoir. This management experiment failed as no kokanee were ever found in either reservoir.

Northern pike (Esox lucius) had been illegally planted in Lone Pine Reservoir near Hot Springs, Montana, in the late 1950's. This small irrigation reservoir drains into the Little Bitterroot River which is a tributary of the Flathead River joining near Perma, Montana. Pike were authenticated to be in Noxon Rapids Reservoir in spring, 1972 when one was caught in a gill net near Graves Creek. Pike were first seen in Cabinet Gorge in 1974 and were first reported from Lake Pend Oreille in 1975.

Gas saturation levels were determined for water entering and leaving Thompson Falls Dam, Noxon Rapids Dam, and Cabinet Gorge Dam in April through August, 1974. Gas saturation in the Thompson Falls Dam forebay averaged about 100 percent throughout the sampling period. During periods of reservoir spill discharge, each dam added about 10 percent to gas saturation levels. Water entering Thompson Falls Dam at about 100 percent saturation would be about 130 percent saturation in the Clark Fork River near Lake Pend Oreille. No equilibration of supersaturated water occurred in either Noxon Rapids or Cabinet Gorge

Reservoir or in the Clark Fork River downstream of Cabinet Gorge Reservoir. Powerhouse discharges at all three dams raised saturation levels about 2-4 percent.

Effects of saturation levels upon biological communities were not determined. Casual observations on fish indicate few scars symptomatic of gas bubble disease.

Intensive gill net sampling of shoreline and mid-water sections of Noxon Rapids Reservoir was done in May through October, 1976. Purpose of this sampling was to determine if habitat was utilized in pelagic areas of the reservoir. This sampling showed that all fish species were most abundant within 100 yards of the shoreline and along the bottom. Peamouth and squawfish were frequently caught in the pelagic zone, but other species were largely absent.

In Montana, westslope cutthroat trout have done well in large fluctuating impoundments with a multi-fish species complex. These fish are generally opportunisitc feeders eating plankton and aquatic and terrestrial insects. They are pelagic in nature. Reservoir westslope cutthroat spawn in tributary streams and the young fish rear in these streams for 1-3 years before smolting into the parent water. These smolts are large enough in size to compete with other fish. In addition, the westslope is the native trout of western Montana including the drainages impounded by Cabinet Gorge and Noxon Rapids Dams.

Cutthroat planted previously in Cabinet Gorge and Noxon Rapids Reservoirs were Yellowstone (Cabinet Gorge) or a mix of westslope, Yellowstone, and rainbow trout (Noxon Rapids).

Starting in 1977 and continuing through 1979, Noxon Rapids Reservoir and 4 tributaries--Prospect, Graves, Trout, and Swamp Creeks--were planted with large numbers of young-of-the-year (1-2 inches) westslope cutthroat trout. Numbers of fish planted during the 3-year period were: Noxon Rapids Reservoir, 519,000; Prospect Creek, 115,000; Graves Creek, 48,000; Trout Creek, 31,000; and Swamp Creek, 213,000.

Evaluation of these plantings through reservoir gill net sampling has indicated little to no success. Measurable spawning runs have not been documented into any creek. Increased net catches of westslope have not been recorded. In fact, netting shows westslope cutthroat rarely being caught. The only "glimmer of success" has been fishermen reports of good catches of cutthroat trout in the Noxon Rapids tailrace down to the Noxon bridge in the spring.

Noxon Rapids and Cabinet Gorge Reservoirs, 1980-1984

Operation of Noxon Rapids Reservoir was substantially changed in 1979 returning to conditions similar to that which occurred in the 1958-1960 period. Winter, early spring drafting of the reservoir was eliminated and operation objective was to maintain as near full pool elevation as possible within the constraints of the Northwest Power Pool Agreement of 1960. Maximum drawdown of Noxon Rapids since 1979 has been about 7 feet except for a short period in mid-May, 1984 when a Seattle, Washington, based utility requested electrical energy under terms of the Northwest Power Pool Agreement. Total drawdown during May, 1984 was about 12 feet with drawdown from near full pool and refilling occurring within two weeks.

Essentially, the Northwest Power Pool Agreement requires private utilities to honor requests from other utilities for electrical energy. The delivering utility can provide the requested energy from their own resources or from outside resources.

Cabinet Gorge Reservoir was not materially affected by changed operation of Noxon Rapids. Cabinet Gorge was used as a re-regulation impoundment for fluctuating discharge from Noxon Rapids and to provide a 3,000 cfs minimum flow for the Clark Fork River between Cabinet Gorge Dam and Lake Pend Oreille, Idaho. Daily fluctuations of 1-3 feet have increased in frequency, but maximum drawdown has rarely exceeded 5 feet.

Fisheries management and investigations since 1980 are described below:

Rainbow Trout

About 200,000 yearling rainbow trout were planted in Noxon Rapids Reservoir in late June, 1981 after spilling was completed. Local anglers reported catching noticeable numbers of small rainbow trout from Noxon Rapids in summer-fall, 1981, from Noxon Rapids Dam forebay area in winter-early spring, 1982, and from the Noxon Rapids Dam tailrace in spring-early summer, 1982. Reservoir sampling in both Noxon Rapids and Cabinet Gorge Reservoirs in spring, 1982 and 1983 yielded very few rainbow trout indicating poor survival of these fish in the reservoirs.

Smallmouth Bass

Young-of-the-year smallmouth bass were planted in the upper end of Noxon Rapids in summer, 1982 (100,000 fish) and in summer, 1983 (50,000 fish). The bass planted in 1982 arrived at the planting site in excellent condition being in transit from Miles City Hatchery only about 10 hours. Fish planted in 1983 were in poorer condition having been in transit about 16 hours.

Limited survey to determine if any smallmouth bass had survived was started in August-September, 1983. Methods used included shoreline snorkeling and nighttime electrofishing from the planting site downstream to Graves Creek, a distance of about 4 miles. No smallmouth bass were observed or caught. Other species, including suckers, peamouth, squawfish, lake whitefish, redside shiners, and an occasional largemouth bass, were caught or observed.

An intensive search was done from mid-May through mid-August, 1984 to determine Micropterus spp distribution in Noxon Rapids Reservoir. A brief synopsis of this survey funded by Washington Water Power Company and additional Department data is presented here. The survey report is available from Environmental Affairs, The Washington Water Power Company, Spokane, Washington 99220.

Survey work was done using hook and line sampling, snorkeling, and when crew was available, beach seining. Smallmouth bass were first caught in the vicinity of Graves Creek using hook and line and beach seining. A total of 39 smallmouth bass were caught in 4 days of angling (26 fish) June 17-20, and five hauls of a 200' x 8' x 1/2" beach seine (13 fish) June 28, 1984. Size of fish caught by angling ranged from 7.0 inches to 9.3 inches total length and averaged 8.0 inches. Aging of scales indicated that all these fish were from the 1982 planting and essentially 2-year old fish. Annulus marks were being laid down indicating that in 1984 annulus formation occurred in late-June, early-July.

Size of fish caught by seining ranged from 5.5 inches total length to 8.3 inches and averaged 6.9 inches. It was judged that one fish 5.5 inches long was 1 year old and from the 1983 planting while the remainder were 2 years old and planted in 1982.

Smallmouth bass sampling efforts in July and August were concentrated in the lower part of Noxon Rapids between the dam and Trout Creek. None were caught in July, but 17 were caught in August. Fish caught ranged from 5.2 inches total length to 10.6 inches and averaged 8.2 inches. Aging of scales from 15 fish showed that 6 were 1-year old and 9 were 2-year old fish. One-year old fish ranged from 5.2 to 7.4 inches total length while 2-year old fish ranged from 7.6 to 10.6 inches total length.

Areas in which smallmouth bass were either caught or observed are shown in Figure 4.

The survey showed that smallmouth bass were distributed along the entire length of Noxon Rapids Reservoir even though all fish had been planted in the upper 2 miles of the impoundment. Smallmouth planted in summer, 1982 were found near the planting site and 30 miles downstream from the planting site in summer, 1984 showing rapid downstream movement. No smallmouth bass were observed in Cabinet Gorge Reservoir in summer, 1984 indicating they had not yet passed through or over Noxon Rapids Dam.

Stomach contents of smallmouth bass were analyzed for food items. Fish, redside shiners, and peamouth, or unidentifiable fish remains were the most common food item followed by aquatic insects and crayfish.

Small numbers of largemouth bass have been present in Noxon Rapids and Cabinet Gorge Reservoirs since impoundment. Number of fish declined in Noxon Rapids following increased winter-spring drawdown starting in 1960. Largemouth bass appeared to be more abundant in Cabinet Gorge but restricted to a few backwaters and sloughs. Survey of suspected largemouth bass habitat was conducted in both Noxon Rapids and the upper half of Cabinet Gorge Reservoirs in May-August, 1982 and 1984. Areas in which largemouth bass were caught or observed are shown in Figure 4 (Noxon Rapids Reservoir) and Figure 5 (Cabinet Gorge Reservoir).

Largemouth were scarce in Noxon Rapids Reservoir upstream from Vermilion Bay except in the Finley Flat area. The reservoir channel upstream from Vermilion Bay is mostly U-shaped except for the extensive littoral area of Finley Flat. In both 1982 and 1984, good numbers of largemouth ranging in size from fry to 20 inches were observed. Snorkeling of shoreline areas indicated that spwaning was taking place in the Finley Flat slough. Several other areas of very limited littoral habitat, each less than an acre in size, exist above and below Finley Flat. Largemouth bass were observed in these areas in either or both 1982 and 1984.

Noxon Rapids Reservoir below Vermilion Bay contains extensive areas of littoral habitat and bass were observed in almost all these areas. Schools of fry largemouth bass were frequently observed and small bunches (10-100 fish) of fingerling-size bass were common during the 1984 survey. The largest bass observed was estimated to weigh between 6 and 8 pounds.

Growth rates of largemouth bass inhabiting both reservoirs were slow. Fish reached a catchable size of 10 inches at the start of their fifth year of

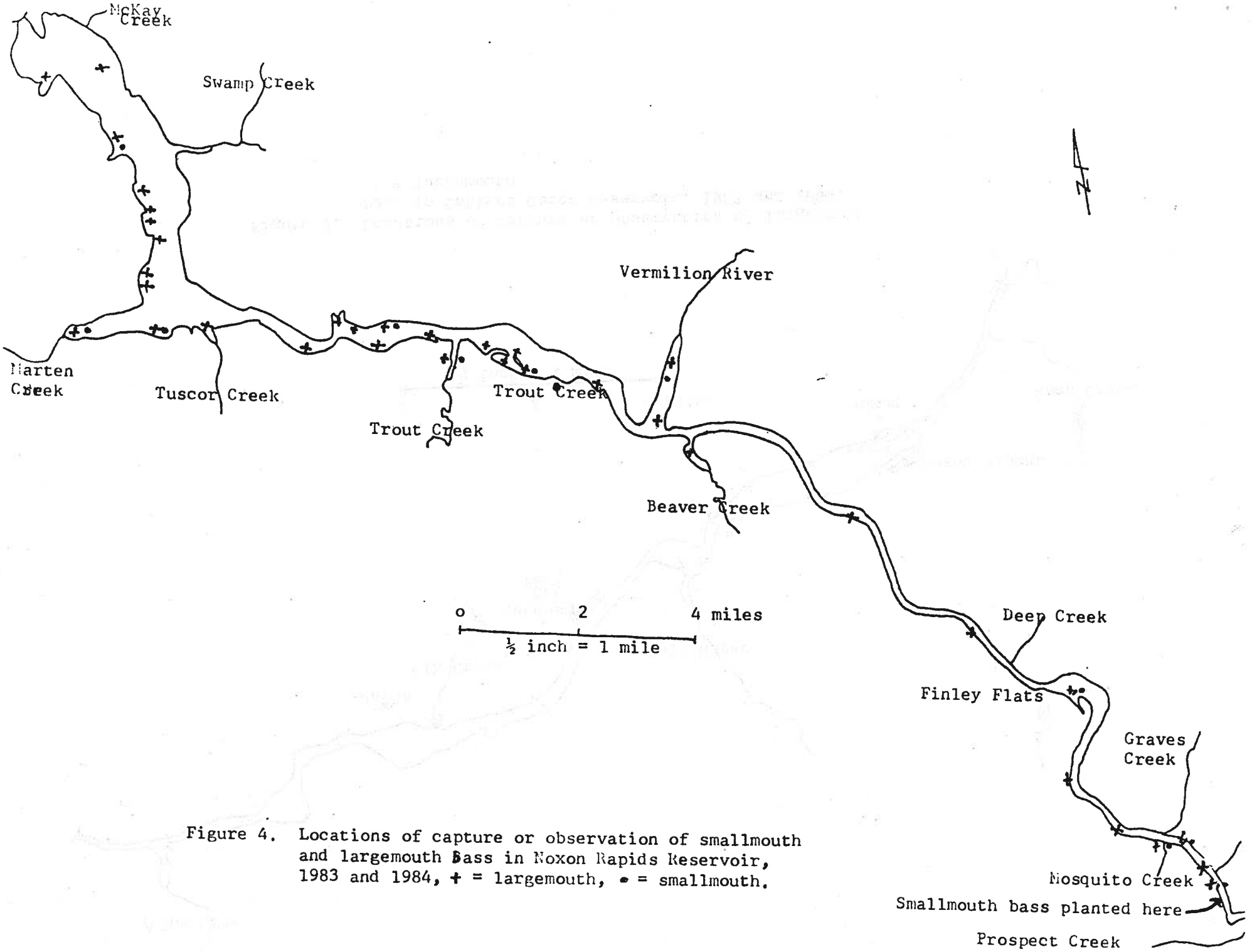

Figure 4. Locations of capture or observation of smallmouth and largemouth bass in Noxon Rapids Reservoir, 1983 and 1984, + = largemouth, • = smallmouth.

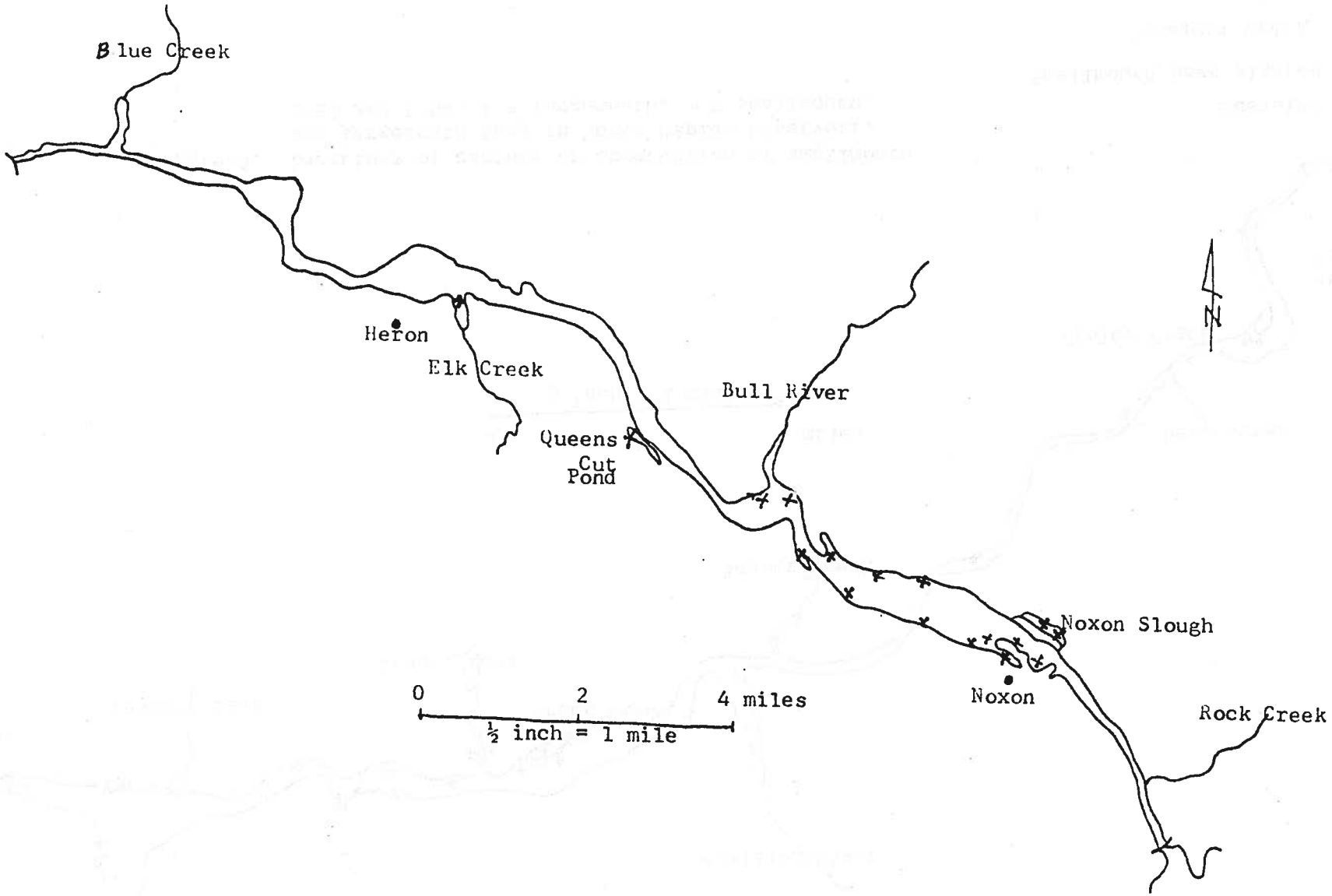

Figure 5. Locations of capture or observation of largemouth bass in Cabinet Gorge Reservoir, 1983 and 1984, + = largemouth.

life. Growth after the fifth year averaged about 1 - 1 1/2 inches per year. Aging of largemouth bass older than 10 years was extremely difficult, but it was estimated that fish 20 inches long or longer were at least 15 years old.

Observations have indicated that largemouth bass spawn in the latter part of June. Both reservoirs are generally still turbid adding to difficulties of locating specific spawning areas and times.

Number of largemouth bass harvested by anglers is small in both reservoirs. Small numbers of people angle for bass but with good success rates. Much of the current fishing is limited to the upper end of Cabinet Gorge Reservoir and the area of Noxon Rapids immediate to Trout Creek. Increased dissemination of largemouth information should increase utilization of this resource.

Northern Pike

Northern pike were first ascertained to be in Noxon Rapids Reservoir in 1972 and in Cabinet Gorge by 1974. Specific surveys have not been done on this species. Angler reports of catching pike appear to have increased in recent years with about a dozen known caught in May through August, 1984. Most of the fish reported caught were large fish exceeding 20 inches length. No small pike (fry to 18 inches) have ever been caught or observed by gill netting, beach seining, or snorkeling indicating that natural reproduction is minimal. Reservoir fluctuation may preclude successful natural reproduction largely limiting fish availability to downstream drift from upstream areas.

Brown Trout

Information on abundance of brown trout in the reservoirs is limited to gill net catch rates (to be presented later). These data do suggest brown trout maintained stable but low numbers from 1960 through the early 1980's and may be increasing in numbers at the present time.

The major spawning area for brown trout living in Cabinet Gorge Reservoir is the Bull River drainage. Concern over potential mining in the drainage prompted locating and counting of redds in major brown trout spawning areas starting in 1980 and continuing through 1984.

Sampling in Bull River Bay and Bull River indicated that brown trout congregate around the river mouth in October and enter Bull River in late October and November. Actual spawning does not start until stream temperatures approach 40° F and is usually finished when stream temperatures reach 35° F; usually late November to mid-December.

The 1980 preliminary survey showed that almost all brown trout spawning occurred in Snake Creek below the East Fork Bull River Road downstream to the East Fork, in the East Fork Bull River from Snake Creek downstream to Bull River, and in Bull River from the mouth of East Fork downstream to about two miles above Cabinet Gorge Reservoir. Flow of Snake Creek during time of brown trout spawning ranges from less than 1 cfs to 2 cfs. Flow of East Fork Bull River ranges from 5 to 15 cfs while flow in Bull River varies from 70 to 125 cfs. The three streams are subject to early winter floods resulting from rain on snow cover. These flood flows may increase discharge several times over that found normally. These areas are shown on Figure 5. Only 9 redds out of 115 counted in 1980 and 1981 were found in the remainder of Bull River drainage upstream from the mouth of the East Fork Bull River.

Number of brown trout redds counted in East Fork Bull River including Snake Creek and in Bull River below the East Fork is shown in Table 5. East Fork counts for the years of 1980-1982 are not comparable to 1983 and 1984 counts. Shelf ice and anchor ice was absent in 1980-1982 but abundant in 1983-1984 obscuring an unknown number of redds in the latter years. Icing conditions have not affected counting conditions in Bull River, and these data should be comparable between years.

Table 5. Number of brown trout redds counted in East Fork Bull River and Bull River below East Fork, 1980-1984.

	Number Redds Counted				
Stream	1980	1981	1982	1983	1984
E. Fork Bull Rv.	24	41	35	20	15
	10	31	49	26	53
TOTAL	34	72	84	46	68
DATE OF COUNT	12/17	12/4	12/15	12/7	12/5

Size of fish in the Bull River spawning run has not been examined since fall, 1979. Reasons include time of year, lack of manpower, difficulty of collection, and type of gear needed. Considerable opposition has been expressed by local residents to use of potential kill gear, namely gill nets. Observations of spawning fish and size of redds excavated would indicate that fish spawning in the 1980's were as large as those measured in 1979. Size of fish measured is shown in Table 6 by sex.

Table 6. Average size and range of adult brown trout, Bull River Bay, October and November, 1979.

	Males	Females
Number	10	12
Average Size	19.6 inches	19.1 inches
Range	16.0-24.5 inches	13.0-24.7 inches

It was impossible to obtain a scale sample for age analysis from any of the male brown trout and only five samples from the female fish could be aged with any degree of accuracy. The ages and growth rates of these female fish are listed in Table 7.

Table 7. Ages and growth rates of five female adult brown trout, 1979.

Length (inches)	Weight (pounds)	Length in Inches at Annullus* I	II	III	IV
13.0	0.82	4.0	10.0	13.0	
18.5	2.48	4.2	10.1	18.5	
19.3	2.56	2.8	11.0	16.3	19.3
20.5	3.70	3.1	9.1	19.0	20.5
21.8	3.73	3.1	9.3	18.2	21.8

*Edge of scale considered an annullus.

The limited age and growth data extrapolated to size ranges in Table 6 would indicate that the spawning population is made up of at least three and probably more age groups of fish. Growth rates of the five fish shown were excellent and probably indicative of a piscivorous diet. It is thought that most newly hatched brown trout drift into the reservoir as young-of-the-year and start eating other fish during their second year of life.

Core substrate samples were taken from 16 brown trout redds in 1980 and 1981. Substrate composition of these core samples are listed in Table 8. The two samples from Snake Creek were visually selected to represent the extremes chosen by fish for redd construction. Redds in East Fork Bull River and Bull River were visually selected to represent a wide range of stream velocities in which fish had spawned. Redds sampled were, in fact, redds as eggs were found in all samples analyzed. Two core samples were discarded as they did not contain eggs.

Substrate sampling indicated that brown trout constructed redds and deposited eggs in a wide variety of gravel sizes and composition. Occassionally rubble in excess of three inches was moved during construction. The noticeable difference of material composition between the three areas sampled was the amount of gravel more than two inches in diameter and less than 0.03 inches in Bull River. The Bull River redds had less of the largest material and more of the smaller material than other streams. This phenomenon is likely related to stream gradient; gradient in Snake Creek and East Fork Bull River is about 106 feet per mile while gradient was only 8 feet per mile in Bull River.

Brown trout redds were observed in mid-channel areas with no readily available fish cover and along shorelines with cover readily available. Water depths over redds varied from a few inches to about 5 feet. Water velocities varied from 0.1 feet per second to 2.8 feet per second. None were found in velocities sufficient to cause surface disturbances like in the middle of a riffle with wave action.

Students from the University of Idaho College of Forestry, Wildlife and Range Sciences collected substrate samples from three sites in Bull River October 6, 1984. Two of these sites had been used for spawning by brown trout in previous years while one site had never been used. The never-used site looked as good or better for spawning than the two known-used sites. Redd

survey done in 1984 showed that one of the two previously used sites contained a redd, one site had not been used, and that the never-used site did contain a redd.

Table 8. Size of substrate found in brown trout redds, Bull River drainage December, 1980 and 1981 by percent of total sample dry weight.

	Size of Material in Inches					
Stream	2"	1-2"	0.5-1.0"	0.25-0.5"	0.03-0.25"	<0.03"
Snake Creek	0.0%	15.3	14.8	22.5	38.0	9.4
Snake Creek	29.6	19.4	19.6	12.2	15.9	3.3
Average	14.8	17.3	17.2	17.4	26.9	6.4
E.Fork Bull Rv.	8.0	22.2	25.7	23.3	16.6	4.2
"	12.5	30.8	20.5	18.3	17.3	0.6
"	10.6	29.2	19.2	14.9	20.2	5.9
"	11.5	23.2	20.5	18.0	24.8	2.0
"	0.0	21.3	19.9	20.6	31.2	7.0
"	12.8	47.1	17.5	9.8	11.3	1.5
"	28.5	15.7	9.4	11.6	28.7	5.9
Average	12.0	27.1	19.0	16.6	26.9	3.9
Bull River	8.2	16.8	19.4	13.7	32.7	9.2
"	10.9	16.9	14.4	16.0	33.9	7.9
"	11.7	15.8	19.7	15.8	26.6	10.4
"	17.3	26.2	14.0	8.5	25.5	8.5
"	0.0	28.8	24.4	15.6	22.7	8.5
"	8.2	19.3	16.3	14.7	34.6	6.9
"	1.9	16.4	25.8	17.5	29.7	8.7
Average	8.3	20.0	19.1	14.5	29.5	8.6

Analysis of the core samples by these students showed that the one used-site reused in 1984 contained 37 percent (by volume displacement) of the sample less than 0.4 inches diameter and 2 percent less than 0.03 inches. The sample from the never-used site used in 1984 contained 41 percent material 0.4 inches in diameter or less, and 2 percent less than 0.03 inches. The sample from the used-site not used in 1984 contained 51 percent material 0.4 inches in diameter or less, and 9 percent 0.03 inches or less. The two used in 1984 sites had water velocities measured at 0.6 depth of 1 and 2 feet per second, while the unused site had a velocity of 0.1 foot per second.

POPULATION TRENDS

Noxon Rapids-Cabinet Gorge, 1960-1983

Reservoir fish population trends were determined by gill net sampling two sites in each reservoir during late May and early June. Average catch per gill net night for the years of 1960, 1969, 1982, and 1983 are presented by reservoir in Table 9. Netting done in spring, 1960 occurred about 6 months before the first severe drawdown of Noxon Rapids Reservoir. Data from 1969 were collected near the mid-point of 20 years of severe drawdown while data from 1982 and 1983 were collected after the severity of reservoir drawdown had been reduced in 1979.

Gill net data clearly show that rainbow trout contributed significantly to the catch of both reservoirs only during 1960 when reservoir drawdown was minimal and fish were being planted. Catch from Noxon Rapids Reservoir in 1982 and 1983 included one rainbow trout even though 200,000 yearlings had been planted in 1981. Spill discharge in spring, 1982 in excess of 40,000 cfs occurred 28 days out of 83 days of spilling. Rainbow trout have been absent from the catch in Cabinet Gorge since 1960.

Catch of bull trout appears to have declined in Noxon Rapids but remained somewhat stable in Cabinet Gorge. Bull trout appear to be more abundant in Cabinet Gorge than in Noxon Rapids. Abundance of bull trout is probably related most closely to amounts of spawning and rearing habitat. Bull trout rear from 1-3 years before smolting from the natal stream into the reservoir. Rearing habitat for juvenile bull trout is thought to be more abundant in the tributaries of Cabinet Gorge than in tributaries of Noxon Rapids considering the size of each reservoir.

Brown trout were not abundant in Noxon Rapids in 1960. By 1969, numbers had increased enough that they became the second most abundant salmonid caught. Net catch was similar for years of 1969, 1982, and 1983. Tributaries to Noxon Rapids used by brown trout for spawning include Prospect Creek, Vermilion River, and Marten Creek. No brown trout were caught in Cabinet Gorge Reservoir in 1960. Catch since 1960 appears to have increased and browns were the second most numerous salmonid captured. Tributaries utilized for spawning include Bull River, the lower part of Rock Creek below Highway 200, and a spring area in the tailwater of Noxon Rapids Dam.

Mountain whitefish, the most abundant salmonid in the Clark Fork River prior to impoundment, have not survived well in either Cabinet Gorge or Noxon Rapids except for a few years following reservoir filling. The decline of mountain whitefish in Noxon Rapids and Cabinet Gorge is unusual as this species has done well in other fluctuating impoundments such as Hungry Horse Reservoir.

Lake whitefish, not reported to occur in the Clark Fork River as a resident but as a spawning migrant from Lake Pend Oreille, Idaho, have increased in the gill net catch from both impoundments. The lake whitefish have been the most abundant salmonid throughout the years except during the early year of impoundment when rainbow trout or mountain whitefish were commonly caught. Spawning migrations of lake whitefish into reservoir tributaries have not been documented. Most spawning is thought to occur in the reservoir proper generally in areas such as Bull River Bay, Marten Creek Bay, Vermilion Bay, and in the vicinity of Graves Creek Bay. Spawned-out fish have been caught near Graves Creek Bay in early November.

Table 9. Average catch per bottom gill net night, Noxon Rapids and Cabinet Gorge Reservoirs 1960, 1969, 1982, and 1983.

Reservoir Yr.No.Nets	Average Catch per Net Night											
	Rb	DV	LL	MWF	LWf	LmB	CSu	FSu	Sq	CRC	YP	Total
Noxon Rapids 1960--12nets	7.8	1.3	0.2	12.4	0.0	0.3	5.3	12.6	2.3	0.0	7.8	50.0
Cabinet Gorge 1960--8 nets	8.9	0.8	0.0	0.0	0.3	0.1	6.3	1.4	5.9	3.0	0.9	27.6
Noxon Rapids 1969--17nets	0.2	0.3	0.3	0.0	0.5	0.0	2.9	0.0	0.4	23.8	7.8	46.5
Cabinet Gorge 1969--10nets	0.0	0.3	0.6	0.0	1.4	0.0	2.3	0.0	20.0	8.7	3.1	36.4
Noxon Rapids 1982--11nets	0.1	0.3	0.4	0.6	2.7	0.0	1.5	1.6	2.6	15.5	11.5	36.8
Cabinet Gorge 1982--6 nets	0.0	0.0	0.5	0.0	3.0	0.0	2.5	0.5	3.3	17.8	10.5	38.1
Noxon Rapids 1983--10nets	0.0	0.1	0.6	1.1	2.5	0.0	6.0	0.0	7.8	25.0	94.1	137.2
Cabinet Gorge 1983--7 nets	0.0	0.6	0.4	0.1	1.7	0.0	3.6	0.9	10.0	17.9	24.3	59.5

Largemouth bass are notorious for avoiding entrapment nets such as gill nets, yet several were caught from both reservoirs in the 1960 sampling. None have been caught by gill netting since 1960. Likely the catch of largemouth in 1960 was a vagary of gill net sampling and not an indication of a high population level. Other types of sampling indicate an increasing largemouth bass population in both impoundments since stablization in 1979.

Catch of largescale suckers was highest in 1960 samplings, declined in 1969, and appears to be increasing in 1982-1983 following stabilization of reservoir levels. Abundance of finescale suckers appears to have declined after 1960 with a small increase in catch in 1982-1983. Finescale suckers do not appear to be well adapted to fluctuating reservoir habitat. Abundance of this species has declined with time in Hungry Horse Reservoir and Lake Koocanusa.

Catch rates of squawfish from both reservoirs follows the same trend, low in 1960, increased in 1969, decreasing again in 1982, but increasing in 1983. These wide fluctuations in catch rate appear to be a gill net sampling bias, but periodic sampling in other years tend to support the abundance data present in Table 9.

Peamouth were not caught in Noxon Rapids Reservoir until 1963, but they were caught in Cabinet Gorge Reservoir in 1960 but not in great numbers. This species rapidly increased in abundance in both reservoirs in 1969. Netting done in 1982-1983 indicated that peamouth were one of the most abundant fish in either reservoir.

Yellow perch were represented in the net catch of both reservoirs throughout all years sampled. Catch in 1983 increased markedly over that of other years; this increased catch was considered not indicative of the true 1983 population level. Netting in 1983 was done during the peak of perch spawning resulting in inflated catch rates. Still, it is probably true that yellow perch have benefited most from reservoir stabilization. Their numbers have increased and will continue to increase.

Several other fish species not mentioned in the gill net data have been caught sporadically. Black bullheads were uncommon in the 1960 netting, and none have since been caught. Swarms of bullhead fry were commonly seen in Noxon Rapids prior to 1961. None were observed between 1961 and 1983, but several swarms were observed in 1984.

Pumpkinseed were caught prior to 1961 in both reservoirs, but were rarely seen or caught in 1961-1980 but have been seen and caught occasionally since 1982. Redside shiners were a measurable part of gill net catch in Noxon Rapids during 1958-1960, but were rarely caught or seen from 1961-1982. Redside shiners have increased in abundance throughout the length of Noxon Rapids, but most noticeable in the area above Vermilion River Bay. This area has never been adequately gill net sampled due to water currents.

Age and Growth, Noxon Rapids Reservoir

Collection of scales for age and growth determinations was a low priority effort primarily due to difficulties in obtaining sufficient numbers of salmonid samples. Age and growth data presented in Table 10 are limited to Noxon Rapids Reservoir during the 1958-1961 and 1966-1976 periods. Data

Table 10. Age and growth of fish collected from Noxon Rapids Reservoir in 1960 and 1961 (Period A) and between 1966 and 1976 (Period B).

Species	Period	Length in Inches at Annulus							
		I	II	III	IV	V	VI	VII	VIII
Rb	A	2.6(30)*	5.7(30)	9.8(28)	13.5(15)	16.4(8)	22.4(1)		
Rb	B	3.0(4)	5.9(3)	10.0(2)	11.6(1)				
LL	A	2.7(21)	5.8(21)	10.1(21)	12.8(16)	15.3(2)			
LL	B	3.1(52)	6.2(52)	10.7(49)	14.2(45)	17.2(42)	19.6(40)	22.8(17)	23.8(2)
DV	A	2.6(25)	5.1(25)	8.4(23)	11.1(15)	13.6(8)	16.0(3)	19.2(1)	
DV	B	3.2(26)	6.3(26)	9.5(24)	13.2(16)	16.9(9)	20.9(8)	24.5(3)	28.2(3)
LWf	A	7.0(54)	10.9(53)	14.0(53)					
LWf	B	5.7(50)	10.0(46)	13.0(37)	15.2(25)	16.8(16)	18.1(6)		
YP	A	3.0(43)	5.6(29)	6.9(18)	8.5(5)	10.1(3)			
YP	B	2.9(42)	5.1(42)	6.2(34)	7.2(13)	8.0(6)	9.0(2)		

*Sample size.

listed for these two periods were collected from fish that had lived their entire life cycle during periods of minimum reservoir drawdown and before impoundment or heavy reservoir drawdown. No data from fish collected in 1980 to the present are shown since growth would have represented both the more stabilized conditions after 1980 and the unstable conditions before 1980.

Growth of rainbow trout taken during period A was slow compared to other Montana reservoirs. So few rainbow trout were collected after 1966 no comparisons between the two periods can be made. Comparisons of growth of bull and brown trout indicate increased rates during period B probably related to increased numbers of forage fish in the reservoir. Chemical treatment of the Noxon Rapids impoundment prior to reservoir filling did decrease numbers of forage fish for several years. Growth of lake whitefish appeared to be greater prior to 1962 than after expressed most noticeably during the first year of life.

Food habits of fish living in Noxon Rapids have been investigated only in a very cursory manner during sampling operations. A major component of the diet of lake whitefish and rainbow trout during period A was snails and clams. These animals disappeared within two years following the first drawdown in spring, 1961 but started becoming abundant in littoral areas in 1983. Stomachs of brown and bull trout examined in the late 1960's and 1970's contained mostly fish including yellow perch, suckers, and peamouth. Stomachs of lake whitefish collected after 1961 contained unidentifiable detritus and, during the summer, considerable amount of Elodea. Rainbow trout caught in Bull River Bay (Cabinet Gorge Reservoir) in summer, 1982 contained measurable amounts of bird faeces.

RESERVOIR LIMNOLOGY

Temperature and oxygen profiles were taken at three stations in Noxon Rapids and at two in Cabinet Gorge in 1960, 1971, and 1983. Temperature data are described for the summer period, June through September, for each reservoir. Noxon Rapids Reservoir does not form a thermocline due to rapid exchange rates. Surface temperatures average about 72° F during the hottest days, but uncommonly reach 75° F. Water temperatures cool with depth to 60-65° F at 100 feet deep and to the low 50° F at 175-200 feet. Oxygen was measured at the surface to range between 9.0 and 7.5 ppm while concentrations were never below 5.5 ppm at the 175 foot depth. Temperature and oxygen were within the tolerance range of most salmonids, but large volumes were above the desirable temperature range for many salmonids. Water temperatures in littoral areas outside the main reservoir current flow sometimes reach 80° F probably eliminating these areas for salmonid use during short period of time in the summer.

Temperature of Cabinet Gorge Reservoir is almost always isothermal being controlled by Noxon Rapids Dam discharge and a rapid exchange rate. Maximum temperature rarely exceeds 72° F except in backwater shallow areas outside the main current pattern. Temperature in the Noxon slough area of Cabinet Groge has been measured at 81° F during the time largemouth bass fry were abundant. Eighty degree water is approaching lethal range for bass fry.

Bays such as Vermilion River in Noxon Rapids and Bull River in Cabinet Gorge have slightly different temperature patterns than either reservoir.

Vermilion River and Bull River discharge during the summer is sufficient to cool the bays below the temperature of the main reservoir. Both bays will have temperature profiles about 6° cooler than the reservoir. This cooler water attracts and holds salmonids during the summer providing increased angler opportunity.

CONCLUSIONS

Development of an maintenance of an acceptable trout fishery in Noxon Rapids and Cabinet Gorge Reservoirs has been a succession of attempts and failures. The standard operation of these run-of-the-river impoundments has been detrimental to fish habitat and that is the primary reason for most of the management failures. Genetic characteristics of fish planted have tended to exacerbate the problem. Reluctance of anglers to adapt their fishing methods away from the "most desirable and easily caught" species toward those that were present in the reservoirs, but hard to catch has also reduced management effectiveness.

Prognosis for the future of sport fishing in both reservoirs is still dim but growing brighter. Reasons for this optimism include a change of management direction by the Department, a willingness of Washington Water Power Company to provide a more stable reservoir environment and a willingness of area sportsmen to accept something other than a rainbow trout fishery.

Washington Water Power Company has recognized that fishery potential of both reservoirs is extremely difficult to achieve when water levels fluctuate significantly. The Company has committed to maintain as full as possible pool within the constraints of their legal obligations and contractual agreements. The Company is also aware that any marked increase in pool fluctuations may negate improvements already apparent and planned fishery management efforts.

For its part, Montana Department of Fish, Wildlife and Parks has started and will continue management efforts to develop an acceptable sport fishery. This new program included planting smallmouth bass in 1982 and 1983. Additional plants of smallmouth bass are scheduled for 1985 and future years if needed. The Department, with Company assistance, will again attempt establishment of ling in spring, 1985. The first attempt in 1971 met with failure, but reservoir conditions are enough different at the present time to warrant another effort.

Efforts will be made to plant the reservoirs and tributary streams with brown trout and bull trout. These two species have survived in the reservoirs under very adverse conditions. Suitable wild egg sources must be located preferably from conditions similar to that found in Noxon Rapids and Cabinet Gorge. Fish from domesticated brood stocks will be planted only if no source of wild fish can be found.

Two strains of rainbow trout different than those used in previous years will be planted in Noxon Rapids in summer, 1985. These fish, obtained from the U. S. Fish and Wildlife Service, will be reared in a Montana hatchery and planted after reservoir spilling is completed for the year. One rainbow strain, Kamloops, is found in lake Pend Oreille, Idaho, is pisciverous, can attain a large size, but is hard to catch. The other strain developed naturally in a fluctuating irrigation reservoir in Nebraska and has adapted to living in a

warm-water reservoir containing numerous otherfish species. These fish will be triploids (sterilized by heat treating the eggs) to avoid further potential contamination of Kamloops rainbow trout in Lake Pend Oreille. The "McCounaghy" strain of rainbow trout is considered a pisciverous fish capable of growing to a large size, but hard to catch. Further plantings of rainbow trout depends upon the success of the 1985 plantings and how they react to reservoir operation especially in reference to downstream movement.

Special Note

As of March 22, 1985, Noxon Rapids Reservoir has been drafted for power production and downstream water to elevation 230 feet msl, 22 feet below full pool elevation of 2,331 feet msl. Drafting was requested by Power Scheduling Division of Bonneville Power Administration under terms of the 1960 coordination agreement. It is not known when drafting will be terminated, but it is likely that total reservoir drawdown will be 26 feet.

Effects of this drawdown upon the biological community of Noxon Rapids is expected to be very detrimental.

REFERENCES

Gaffney, John J. 1956. A survey of the fishery resources in a section of the Clark Fork River in Western Montana. Progress report, Project 29-E-1, MT F & G, Helena, MT 12pp mimeo.

Gaffney, John J. 1959. Partial rehabilitation of a section of the Clark Fork River, Progress report, Project 29-E-1, MT F & G, Helena, MT, 19pp mimeo.

Huston, Joe E. 1965. Investigation of two Clark Fork River hydroelectric impoundments. Proc. MT Acad. Sci., 25:20-40, 1965.

Huston, Joe E. and Tim Vaughan. 1968 Temporal movement of rainbow trout in reservoirs. Proc. West. Assoc. State Game and Fish Comm., Reno, Nevada, 1968.

Huston, Joe E. 1968-1983. Noxon Rapids and Cabinet Gorge Reservoirs study, Fed. Aid Project F-34-R-1 through 16, Job 1, MT DFWP, mimeo reports.