

FLAMING GORGE RESERVOIR  
AND GREEN RIVER INVESTIGATIONS

Progress Report Submitted on First Segment of Project F-28-R

Colorado River Drainage Reservoirs and Tailwaters

Fisheries Management, Investigation, and Surveys

By

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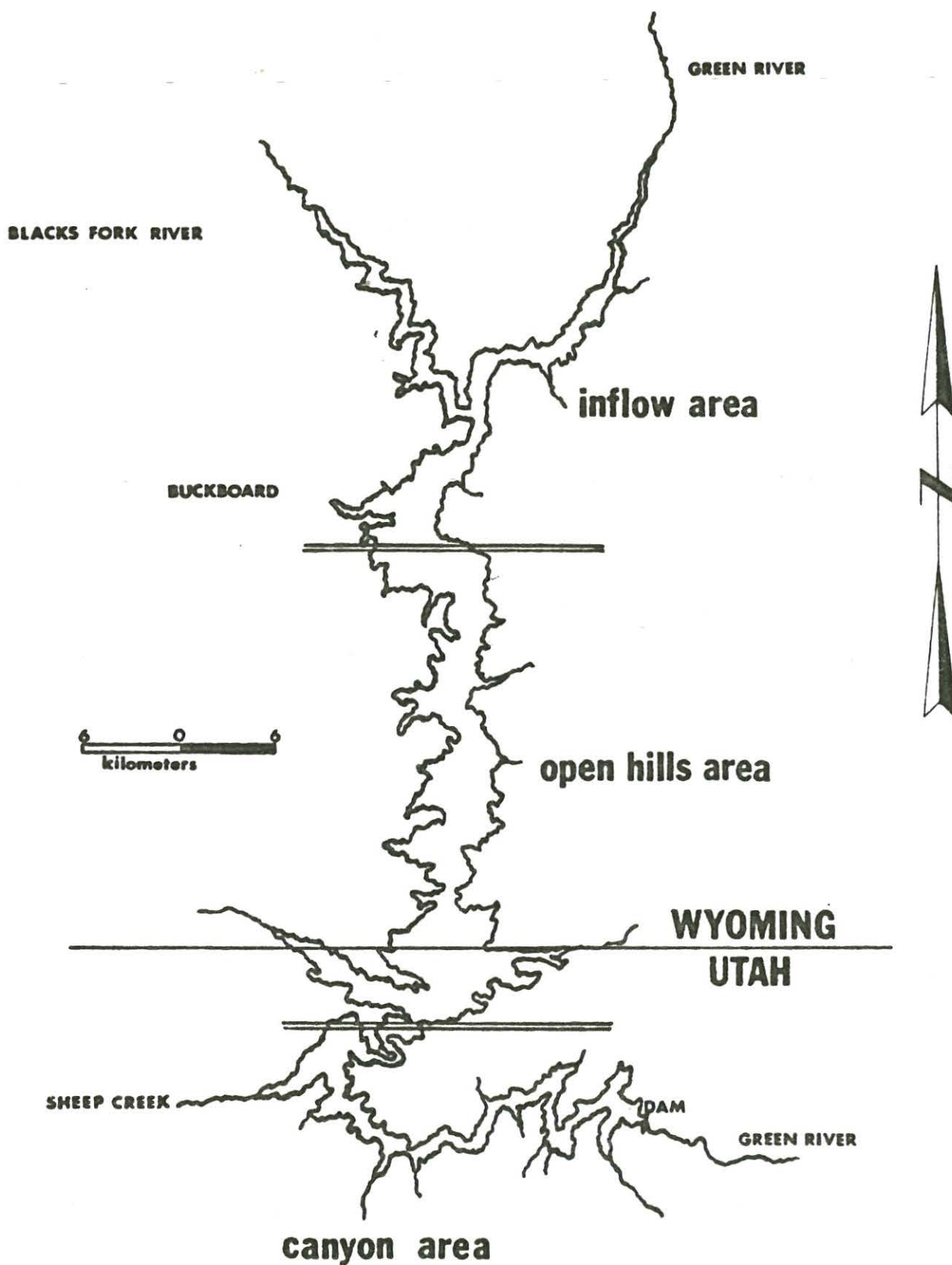
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## INTRODUCTION

This progress report represents a combination of fishery and limnological information and activities during 1971 and the first six months of 1972 on Flaming Gorge Reservoir and the Green River below the reservoir, and necessarily includes some information collected in 1971 under the final segment of the Section 8 Project (Upper Colorado River Storage Project Act).

Flaming Gorge National Recreation Area has received national attention for a variety of reasons, not the least being the sport fishing. According to the U. S. Forest Service (unpublished data) Total Visitor Day Use (1VD = 1 person in the area for 12 hours) exceeded 668,000 in 1971. Project estimates indicated that approximately fifteen percent of these days were spent in sport fishing activities.



**FIGURE 1 FLAMING GORGE RESERVOIR**

## STOCKING

A total of 4,105,689 trout were stocked in the reservoir in 1971. To achieve even distribution, trout were loaded from transport trucks to barges and were distributed along over 300 miles of shoreline. The total represents a stocking rate of 132 fish per surface acre (based on the average annual reservoir elevation). A detailed summary of the 1971 stocking by source agency, species, and reservoir area is shown in Table I.

The average size of trout stocked in 1971 was 71 mm (T.L.). The range of sizes stocked from 1963 through 1971 has varied from a low of 51 mm (1963 to a high of 80 mm (1969).

A total of 20,400 rainbows were fin-clipped and stocked in 1971; of this total, 10,200 were marked with an adipose right-pelvic and 10,200 were marked with an adipose left-pelvic. The purpose of this experiment was two-fold: To ascertain more about intra-reservoir movements as the two groups were stocked in different reservoir environments (Figure 1) and to determine the return to the creel of larger sized fall-stocked trout (the group averaged approximately 30 fish/pound or 4.3 inches).

During the first six months of 1972, a total of 4,424,919 rainbow and brown trout were stocked in the reservoir, utilizing planting barges to distribute the fish efficiently. Additional plants will be made during 1973 in the following project segment. A detailed summary of the stocking by source agency, species, and size is given in Table II.

In addition to the stocking of these two trout species, introductions of largemouth bass and threadfin shad were made. It is felt that threadfin

TABLE I: FLAMING GORGE RESERVOIR 1971 STOCKING SUMMARY

	AGENCY	SPECIES	NUMBER SHIPPED	ADJUSTED NUMBER PLANTED	TOTAL POUNDS SHIPPED	ADJUSTED POUNDS PLANTED	AVERAGE NUMBER PER POUND	REMARKS
SPRING PLANTS	BSF&W	RBT	1,702,876	1,680,627	17,204	17,024	99	---
	UTAH	RBT	1,012,752	1,005,969	13,969	13,881	74	---
	WYOMING	RBT	1,183,498	1,130,795	19,418	18,389	61	---
	ALL		3,899,126	3,817,391	50,591	49,294	78	
AREAS								
	CANYON	RBT	1,165,996	1,151,081	11,906	11,729	98	---
	OPEN	RBT	1,687,382	1,671,544	21,267	21,150	80	---
	INFLOW	RBT	1,045,748	994,766	17,418	16,415	60	---
ALL PLANTS	UTAH Canyon	CT	118,800	118,800	110	110	1080	
	Sheep Cr.	RBT	103,937	103,000	3,507	3,504	29.6	10,200 adipose right pelvic
	Sq. Hollow	RBT	102,626	102,000	3,366	3,364	30.5	10,200 adipose left pelvic
TOTALS	AGENCY							
	BSF&W	RBT	1,702,876	1,680,627	17,204	17,024	99	---
	UTAH	RBT	1,219,315	1,210,969	20,842	20,749	59	---
	UTAH	CT	118,800	118,800	110	110	1080	---
	WYOMING	RBT	1,183,498	1,130,795	19,418	18,389	61	---
AREAS								
	CANYON	Includes CT	1,388,733	1,372,881	15,523	15,343	89	---
	CANYON	Excludes CT	1,269,933	1,254,081	15,413	15,233	82	---
	OPEN		1,790,008	1,773,544	24,633	24,514	73	---
	INFLOW		1,045,748	994,766	17,418	16,415	60	---
	ALL (Including CT)		4,224,489	4,141,191	57,574	56,272	73	
	ALL (Excluding CT)		4,105,689	4,022,391	57,464	56,162	71	

shad will compete directly with the Utah chub for food, should the species be able to survive reservoir winter water temperatures. The largemouth bass should utilize Utah chub in their diet as both bass and larger chub are expected to inhabit the same warmer littoral areas not frequented by trout.

In addition to both new species possibly being serious competition for the chub, it is believed they will benefit the fishery by more direct means. Threadfin shad, because of its pelagic schooling habits, should also provide forage for trout. Largemouth bass may provide a summer inshore fishery readily available to large numbers of anglers from the shore.

Largemouth bass fingerling were obtained from Cedar Bluff, NFH, Kansas. Adult largemouth were transplanted from Pelican Lake, Utah. Threadfin shad were stocked as eggs obtained from Lake Powell (Table II).

Table II. Flaming Gorge Reservoir Stocking to June 30, 1972

Agency	Species	Number Planted	Pounds Plants	Average No. Per Pound
BSFW	RBT	2,161,850	26,756	82
Utah	RBT	1,661,679	19,747	88
BSFW	BT	94,715	841	109
Wyoming	BT	506,675	4,489	113
BSFW	LMB*	77,606	75	1,050
Utah	LMB*	282	282	1
Utah	TFS**	600,000	--	--

\* LMB - Largemouth Bass  
 \*\* TFS - Threadfin Shad

## CREEL CENSUS

In 1970 an intensive creel census program was initiated after three years of censusing on a Lincoln Index-Ratio Method. The program in 1970 was designed to correct the past years estimates caused by new visitor access developments and resultant changes in fishing pressure. Because of unforeseeable inaccuracies found in the 1970 estimates, a definite need for an additional year of intensive censusing, with corrective revisions, was indicated.

In 1972, total angling use was estimated by determining traffic use on all reservoir access roads with car counters and scheduled roadblock and boat ramp checks. Area pressure, angler-days and hours, and harvest were estimated from data collected during angler interviews.

Since the end of the first segment of this project occurred at the middle of the summer fishing season in 1972, the results of angler use and success estimates will be presented in the progress report covering the second segment - July 1972 to June 1973.

### TRIBUTARY SURVEY

A survey to identify the extent of available spawning habitat and to judge the utilization of tributary streams for spawning purposes was initiated in 1969. This survey continued through 1971, and it is planned that it will be completed by the fall of 1972. A detailed summary of findings will be submitted as part of the Completion Report under the Upper Colorado River Storage Project (Section 8) Reports.

### UTAH CHUB STUDIES

Studies on the Utah chub continued. Field efforts centered on a recheck of the spawning period of the chub, palatability of chubs to brown trout, seasonal and spatial distribution in the reservoir, and habits of young-of-the-year chubs. Substantial progress was made with the manuscript on the life history of the Utah chub in Flaming Gorge Reservoir. Summaries of all chub data collected and processed will be included in that manuscript.

## FISHERY

Gillnets were set during the year in order to continue assessment of changes in fish populations. The catch per gillnet hour of rainbow trout increased from previous years in the Canyon and Open Areas. However, the catch of rainbow trout in the Inflow Area continued to decline. The data indicate that large numbers of 1970 year-glass rainbow were captured in the nets. The Utah chub continues to be the most dominant species in the gillnet catch; over 85 percent of the net catch consisted of Utah chubs. As in past years, the catch per gillnet hour of rough fish declined down reservoir.

### DEPTH DISTRIBUTION

The data show no significant changes in depth distribution for trout or rough fishes. However, the frequency of occurrence of Utah chubs in the Vertical gillnet catch increased from 1970. These data further suggest that the Utah chub population is continuing to expand. Most of the rainbow trout were captured in the 31 to 40 foot depth range. The distribution of trout as well as other fishes in the water column varied according to temperature - oxygen relationships.

## AGE AND GROWTH

The growth of trout species in the reservoir continues to be excellent. The nature of rainbow trout age, growth and condition from 1963 through 1969 has been reported previously (Varley, Regenthal, and Wiley - 1971). A summary of age and growth information for rainbow, brown and cutthroat trout from 1963 through 1971 is shown in Tables III, IV, and V, respectively.

For rainbow trout of the 1970 year class, first year reservoir growth (mean calculated length at Age I minus the average size at stocking) and total length attained at the end of Age I were very close to the eight year average. Growth from Age II through Age VI was better than the long term average. The Inflow Area maintained the best trout growth although the Open Hills Area trout remained a close second. The Canyon Area rate remained about one-inch slower than the other areas (Table III).

Brown trout, overall, have the best growth rate of any trout species in the reservoir except in their first year. Growth to Age I has been excellent however. It is better than rainbow trout first year growth, and the browns were planted at a much smaller size than rainbow trout. Brown trout growth rates in Flaming Gorge Reservoir compare most favorably with brown growth rates in the best of North American waters (Table IV).

Cutthroat trout in Flaming Gorge Reservoir had better first and second year growth than rainbow trout and were at least comparable, if not superior, to rainbow trout at Ages III through VI (Table V).

TABLE III: MEAN BACK CALCULATED TOTAL LENGTHS OF FLEETING GORGE  
RESERVOIR RAINBOW TROUT BY YEAR, CLASS AND RESERVOIR AREA

	YEAR CLASS	NO. OF TROUT SAMPLED	AVERAGE SIZE AT STOCKING	FIRST YEAR RESERVOIR GROWTH	MEAN CALC. T.L. END OF EACH YEAR					
					1	2	3	4	5	6
CANYON AREA	1970	331	76	234	241.4					
	1969	366	80	238	246.2	332.7				
	1968	393	66	193	259.3	310.7	391.4			
	1967	161	66	205	270.9	335.1	372.9	477.4		
	1966	228	63	175	237.6	340.0	388.1	453.8	425.0	
	1965	249	61	194	255.1	303.8	378.6	417.7	533.5	*
	1964	349	52	188	240.0	310.7	333.5	*	*	*
	1963	368	51	189	240.2	299.7	350.6	377.8	*	*
	Six YR X Calc. T.L.:	64		202	248.8	319.0	369.2	924.2	479.3	*
OPEN HILLS AREA	Increment of Mean:				248.8	70.2	50.2	55.0	55.1	*
	No. of Trout:				2416	810	135	20	2	*
	1970	579	76	196	271.7					
	1969	423	80	193	272.5	356.0				
	1968	500	66	252	318.3	346.5	396.6			
	1967	148	66	213	279.1	382.9	408.5	476.8		
	1966	229	63	176	238.5	379.1	420.9	461.5	545.4	
	1965	170	61	202	263.1	310.4	394.2	467.0	*	*
	1964	145	52	188	240.4	328.6	368.9	*	487.3	*
INFLOW AREA	1963	126	51	202	253.0	306.9	367.0	404.5	*	*
	Six YR X Calc. T.L.:	64		203	267.1	344.3	392.7	452.5	516.4	*
	Increment of Mean:				267.1	77.2	48.4	59.8	63.9	*
	No. of Trout:				2311	943	260	39	5	*
	1970	92	76	204	279.9					
	1969	251	80	196	276.3	369.1				
	1968	402	66	240	305.6	345.6	407.3			
	1967	117	66	209	274.9	384.8	381.7	479.8		
	1966	143	63	186	248.6	382.0	437.0	403.0	588.7	
	1965	112	61	215	275.9	341.3	436.1	477.7	*	666.0
	1964	97	52	199	250.7	368.9	419.8	*	*	*
	1963	73	51	209	259.7	323.3	446.4	*	*	*
	Six YR X Calc. T.L.:	64		207.1	271.5	359.3	421.4	453.5	588.7	666.0
	Increment of Mean:				271.5	87.8	62.1	32.1	135.2	77.3
	No. of Trout:				1269	534	81	6	1	1

\* None Sampled

TABLE IV: MEAN BACK CALCULATED TOTAL LENGTHS  
OF FLAMING GORGE RESERVOIR BROWN TROUT

YEAR CLASS	NO. OF FISH SAMPLED	NO. OF LIVE FISH STOCKED	AVERAGE SIZE WHEN STOCKED	FIRST YEAR RESERVOIR GROWTH	MEAN CALC. T.L. END OF EACH YEAR						
					1	2	3	4	5	6	
1971	--	0 <sup>2</sup>	--	--	--						
1970	29	163,948	165/1b (61mm)	219.6	280.6						
1969	118	158,840	107/1b (71mm)	226.4	298.2	336.2					
1968	187	144,202	140/1b (67mm)	213.2	281.0	371.3	412.4				
1967	25	151,000	20/1b (126mm)	130.0	256.8	378.0	443.3	506.4			
1966	3	0 <sup>2</sup>	--	225.0	225.0	357.4	402.3	491.4	572.4		
1965	2	0 <sup>2</sup>	--	--	*	331.6	441.8	*	*	602.1	
1964	1	0 <sup>2</sup>	--	--	*	*	445.5	*	*	*	
7 YR. X Calc. T.L. (Weighted):108/1b(71mm)					213.3	284.5	373.3	438.0	493.2	572.4	602.1
Increment of the Mean:						284.5	88.8	64.7	55.2	79.2	29.7
No. of Trout:						362	229	66	8	1	1
1 Mean Calc. Length at Age 1 Minus Ave. Size at Stocking, Except Wild Year Classes											
2 Year Classes From Natural Recruitment											
* None Sampled											

TABLE V: MEAN BACK CALCULATED TOTAL LENGTHS OF FLAMING GORGE RESERVOIR CUTTHROAT TROUT

YEAR CLASS	NO. OF FISH SAMPLED	NO. OF LIVE FISH STOCKED	AVERAGE SIZE WHEN STOCKED	FIRST YEAR RESERVOIR GROWTH	MEAN CALC. T.L. END OF EACH YEAR						
					1	2	3	4	5	6	
1971	--	118,800	1080/1b (33mm)	--	--						
1970	10	02	--	274.3	274.3						
1969	13	02	--	272.7	296.7	341.5					
1968	19	02	--	271.8	293.7	343.1	418.1				
1967	33	529,778	665/1b (40mm)	228.2	285.3	356.0	352.0	502.6			
1966	8	02	--	--	*	373.0	397.7	504.7	566.1		
1965	2	02	--	--	*	*	464.2	*	*	570.0	
6 YR X Calc. TL.L. (Weighted):740/1b (39mm)				248.3	287.3	351.3	396.5	502.9	566.1	570.0	
Increment of the Mean:					287.3	64.0	45.2	106.4	63.2	3.9	
No. of Trout:					52	30	15	6	5	1	
1 Mean Calc. Length at Age 1 Minus Ave. Size at Stocking, Except Wild Year Classes											
2 Year Classes From Natural Recruitment											
* None sampled											

## CHEMICAL AND PHYSICAL

Reservoir water quality data were collected at three locations: Bear Canyon, Lucerne-Antelope Flat, and in the Buckboard area. Measurements taken included water temperatures and dissolved oxygen. Sampling was also conducted at monthly intervals on the Green and Black's Fork River above the confluence with the reservoir. The sampling and analysis methods were similar to those reported in earlier reports.

Water temperatures at the Bear Canyon station ranged from 32 degrees F. under the ice to 75 degrees F. on the surface in late July and early August. Monimolimnion temperatures always remained near 38-42 degrees F. During stratification in the summer, the epilimnion was 75 degrees F. on top and 70 degrees F. on bottom with an average thickness of approximately 30 feet. The thermocline ranged from 69 degrees F. to 57 degrees F. with an average thickness of 22 feet. The hypolimnion began at a temperature of 56 degrees F. and declined to 39 degrees F. at penstock level. Below the penstock, the monimolimnion temperatures remained nearly homothermic varying only between 38 degrees F. and 42 degrees F.

Water temperatures at the Lucerne-Antelope and Buckboard Stations ranged from 32 degrees F. under the ice in January to approximately 73 degrees F. during the summer. Summertime temperatures fell to 42 degrees F. and 52 degrees F. on the bottom at Lucerne-Antelope and Buckboard, respectively.

Ice formation during the winter of 1970-71 was heaviest in the Inflow Area (28-30 in.), followed by the Open Hills (26 in. ave.). Ice formation in the lower Canyon Area was erratic with some open water available at all times. The average thickness of the iced sections was only two to three inches.

In 1972 the reservoir level reached its spring low of 5,979 feet msl and by July had reached an elevation of 6,022 ft., which was three feet above the previous high water line in 1967. With a yearly average elevation of 6,003 ft. and 30,660 surface acres it was one of the best water years since impoundment.

Dissolved oxygen concentrations found at all stations during 1971 were similar to those reported from past years with the possible exception of the summer months. At Bear Canyon, during the height of stratification, a negative heterograde dissolved oxygen curve was encountered. Values dropped from 6.6 ppm on the surface to 2.1 ppm at 50 feet but then returned to 6.5 ppm at 75 feet. Dissolved oxygen curves at other stations and seasons are described as normal clinograde.

## FLAMING GORGE RESERVOIR TAILWATERS

Investigative activities continued on the Flaming Gorge-Green River Tailwaters during 1971 and 1972. Project efforts centered on estimate of angler pressure and effort, the evaluation of survival, movement, and success of various recently introduced strains and species of fishes; and the effects of temperature and flows on river biota.

As with creel census information on the reservoir, the first segment completion data bisected the summer fishing season; therefore, results of the early 1971 season will be presented with the progress report for the next reporting period.

A total of 434,375 fish of various species, strains and sizes were planted in the tailwaters during 1971. The variety stocked was a result of attempts to find a sport fish suited to the extremely cold temperature of the water released from the Dam.

In the early months of 1972, a total of 20,000 rainbow trout averaging 3.7 fish per pound were stocked. Slightly more than one-half of these were planted utilizing rafts to float them between Flaming Gorge Tailrace and Little Hole. The remaining number were planted directly at Indian Crossing, Bridgeport, and Swallow Canyon in Brown's Park downstream from Little Hole.