

JOB PROGRESS REPORT

FILE

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FEDERAL AID IN FISHERIES RESTORATION ACT

TEXAS

Federal Aid Project No. F-4-R-18

REGION 2-A FISHERIES STUDIES

Job No. B-42: Investigation of a Portion of the Brazos River

Assistant Project Leader: Allen A. Forshage

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Executive Director
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Austin, Texas

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Director, Fish and Wildlife

December 14, 1972

Abstract

A survey of the Brazos River, extending from the tailrace below Possum Kingdom Reservoir to the head waters of Lake Granbury was conducted. The results of this survey indicate that the tailrace, for the first four miles below the dam, would be suitable for a rainbow trout, (Salmo gairdneri), "put-and-take" fishery. It was also found that, at high flow, the river has the potential for the reproduction of striped bass, (Morone saxatilis).

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Job Progress Report

State of Texas

Project No. F-4-R-18

Name: Region 2-A Fisheries Studies

Job No. B-42

Title: Investigation of a portion of the
Brazos River

Period Covered: January 1, 1971 to December 31, 1971

Objective:

To determine the biological, chemical, and physical characteristics of the Brazos River extending from the tailrace waters below Possum Kingdom Dam to the headwaters of Lake Granbury.

Introduction:

At present, the only rainbow trout, Salmo gairdneri, fishery in Texas is located in the tailrace waters of Canyon Reservoir, Comal County, Texas. This fishery is maintained on a "put-and-take" basis, but it has proven successful for the past five years and has contributed greatly to the economy and recreation of the area (White, 1968). Because of the success of this fishery, a survey of the tailwaters of Possum Kingdom Reservoir, in Palo Pinto County, was initiated to determine the suitability of the river for trout.

Procedures:

In January, sampling stations were set up along the first 20 miles of the Brazos River below Possum Kingdom Reservoir. Nine of the stations were selected in the first 11 miles and one was selected 20 river miles below the dam, see Figure 1.

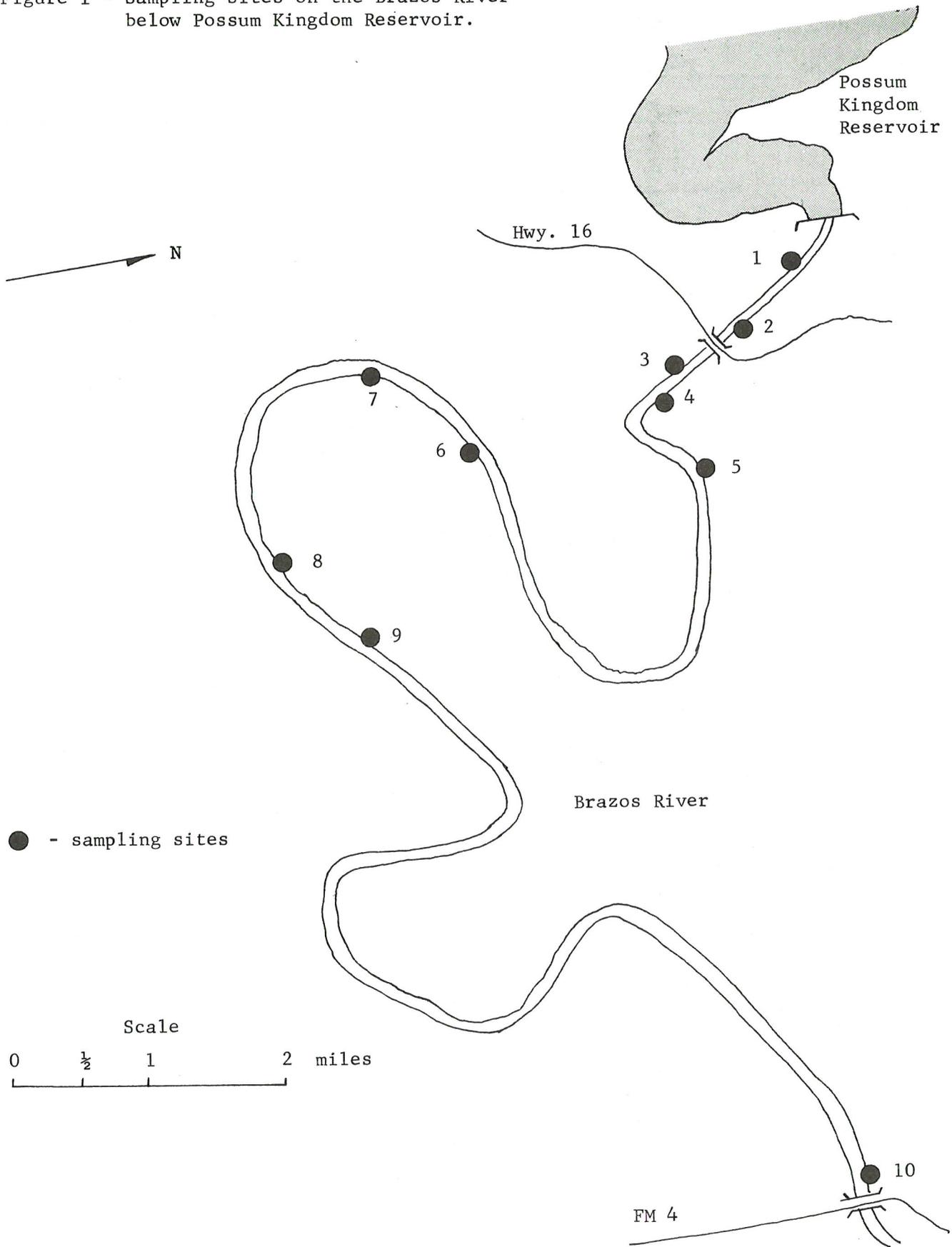
Water samples were collected at each sampling station each month and analyzed for pH, turbidity, oxygen, alkalinity, free carbon dioxide, chlorides and hydrogen sulfide. The width and depth of the stream was recorded and the type of substrate was noted. The air and water temperature was measured with a standard centigrade thermometer. The volume of flow was obtained through the courtesy of the U. S. Geological Survey.

Benthic samples were collected monthly with a Surber square foot bottom sampler. Three samples were taken at each of the ten stations. These samples were pooled and washed through a U. S. No. 30 Standard Sieve. The sieved residue was placed in a jar and a preservative added to cover the entire sample. The sample was returned to the lab where it was sorted, identified to the family level and enumerated.

The fish population was sampled by the use of a 20 foot seine and gill nets.

In addition, a check of the available public access and a check of the current fishing pressure of the area was made.

Figure I - Sampling sites on the Brazos River below Possum Kingdom Reservoir.



A review of the available literature pertaining to trout and striped bass was also made in conjunction with this survey.

Results:

Water Quality Characteristics

The major limiting factor for a trout fishery in Texas waters, is water temperature. Rainbow trout have been reported to tolerate water temperature from below 32°F to over 80°F. The upper lethal limit varies considerably depending upon the oxygen content of the water, size of fish, and degree of acclimation (Needham and Jones, 1959). A maximum of 83°F in well oxygenated waters was indicated lethal to rainbow trout by Needham (1938).

During the summer months, when the water temperature is most critical, a considerable volume of water, being released from the hypolimnion, is required to sustain a low water temperature for any distance downstream. As most rivers in the region, the volume of flow of the Brazos River had been reduced due to drought conditions in the area. The level of Possum Kingdom Reservoir was down approximately 20 feet at one point during August. As a result, a minimal amount of water was released from the dam for the first eight months of the survey. Table 1 shows the volume of flow in cubic feet per second for 1971 recorded by the U. S. Geological Survey gauging station on the Brazos River near Palo Pinto.

The water temperature of the tailrace below Possum Kingdom Reservoir stayed within tolerable levels for rainbow trout during the winter, spring and fall months (see Figure II and III). Due to the low volume of flow, the water temperature in the lower stations varied closely with the atmospheric temperature. As summer progressed, and the atmospheric temperature increased, the water temperature also increased. The extent of this increase on the downstream waters was dependent on the volume of water being released from the reservoir. At low flow, 17 cubic feet per second, during August, the water temperature increased to 82°F six miles below the dam. An over-all annual average temperature plus the range at each station is illustrated in Figure IV.

Dissolved oxygen concentrations ranged from 7.8 to 10.2 ppm. The only fluctuations from this occurred during large releases from the reservoir. The oxygen concentration dropped to 2.6 ppm during September at sample station # 1, with a release of 12,800 cubic feet per second and only increased to 6.2 ppm at station # 10. The low oxygen concentrations were likely due to the large volume of anerobic water coming from the hypolimnion plus the higher organic load of this water.

Total alkalinity ranged from 94.0 ppm to 132 ppm, pH ranged from 7.4 to 8.8 and carbon dioxide concentrations ranged from 0.0 to 10.1 ppm. Volume of flow or season had little effect on any of these parameters.

Hydrogen sulfide was only encountered at stations #1 and #2 in trace amounts. This occurred during August and September with large releases from the dam. The concentrations of hydrogen sulfide never exceeded 0.1 ppm.

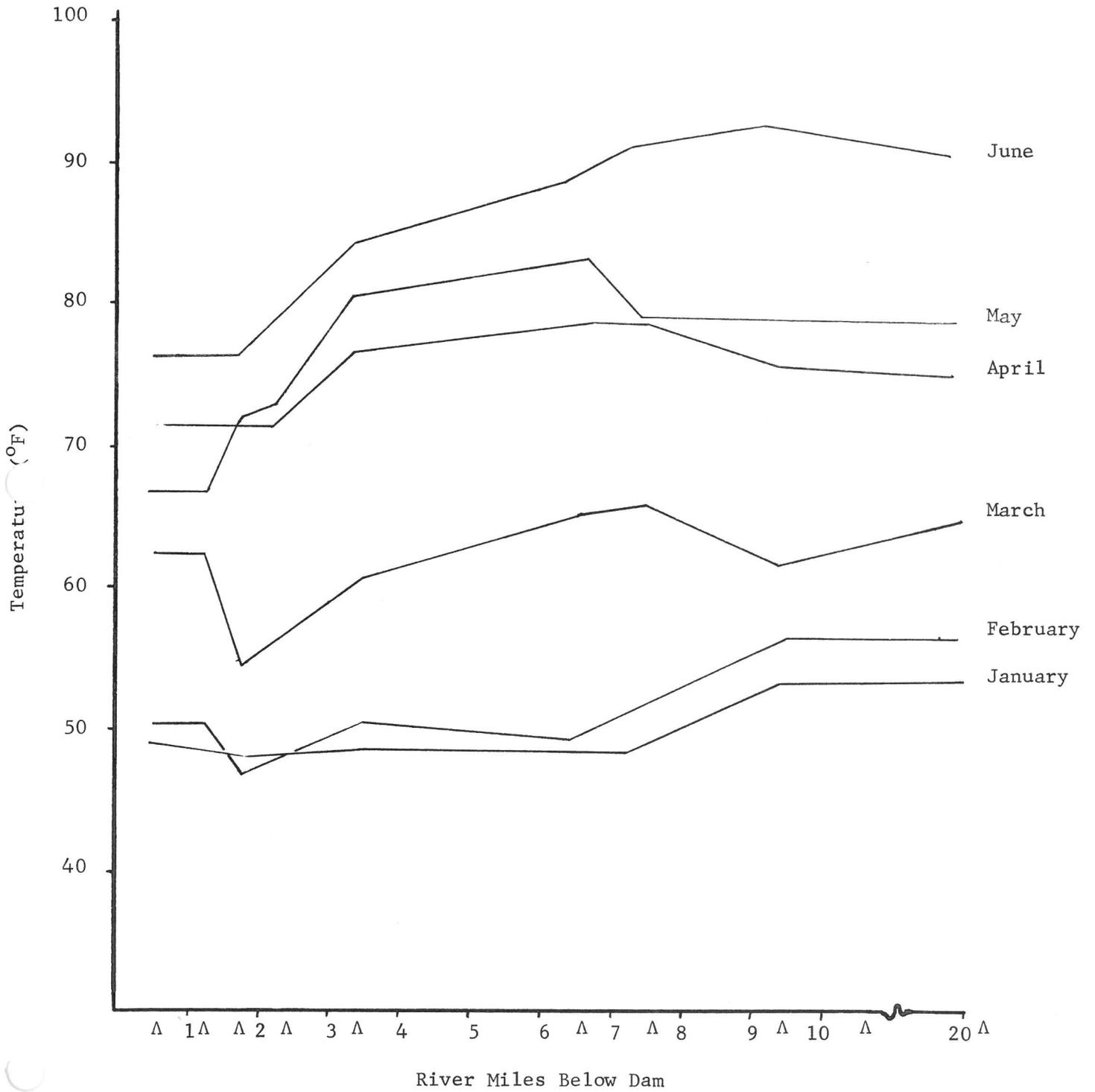
Turbidity increases were encountered only when rain in sufficient quantities to provide runoff was received in the area or by bank erosion caused by high

Table 1 - Volume of flow in cubic feet per second as recorded by the Geological Survey gauging station on the Brazos River near Palo Pinto for 1971.

Days	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1	28	11	15	22	22	49	25	23	12600	2040	1480	60
2	26	12	16	28	22	31	24	21	9550	1250	1360	60
3	27	11.	18	30	22	237	23	19	9220	818	1140	91
4	27	12	18	26	22	81	22	19	9200	2730	1550	274
5	220	11	17	27	23	37	21	32	5720	2780	1370	331
6	455	9.5	15	28	24	25	19	110	533	1120	681	308
7	86	9.5	18	28	24	20	269	110	120	2750	518	123
8	89	9.9	19	26	22	17	78	44	909	2760	256	167
9	332	20	20	25	22	16	38	28	525	2040	1100	150
10	77	35	22	26	21	16	26	23	104	231	665	348
11	38	19	22	27	21	16	23	20	57	498	114	162
12	27	11	23	24	19	17	21	20	43	245	155	123
13	25	11	23	21	18	20	18	24	38	506	91	106
14	24	8.5	24	27	16	19	17	30	35	207	62	202
15	23	7.6	22	30	15	19	17	31	714	876	55	123
16	22	7.6	23	31	16	19	17	36	259	1090	165	305
17	21	6.7	25	35	14	19	16	33	63	514	292	274
18	21	11	23	36	14	19	14	25	39	286	371	119
19	22	8.5	27	32	13	19	13	22	36	703	245	80
20	20	8.5	27	33	17	26	24	37	37	896	99	73
21	15	15	25	29	18	39	26	24	35	2730	62	70
22	13	16	25	26	19	94	24	22	42	2750	150	190
23	13	12	26	22	19	42	29	19	66	2730	779	928
24	14	8.5	28	24	17	28	32	187	62	640	413	134
25	13	9.4	28	23	17	21	37	90	725	811	215	80
26	12	13	29	22	15	18	31	357	277	987	102	70
27	11	16	30	21	15	521	29	2680	2720	1320	67	63
28	12	16	28	21	19	91	29	2780	5730	1310	58	63
29	12		29	21	40	46	35	2840	12800	1310	55	62
30	12		29	21	165	33	30	6390	3110	1430	57	62
31	11		25	21	102	29	29	14000	1230	1230		60
Mean	55	12.4	24	26	27	55	34	970	2512	1342	458	170
Max.	455	30	30	36	165	521	269	14000	12800	2780	1550	928
Min.	11	6.7	15	21	13	16	13	19	35	207	55	60

FIGURE II

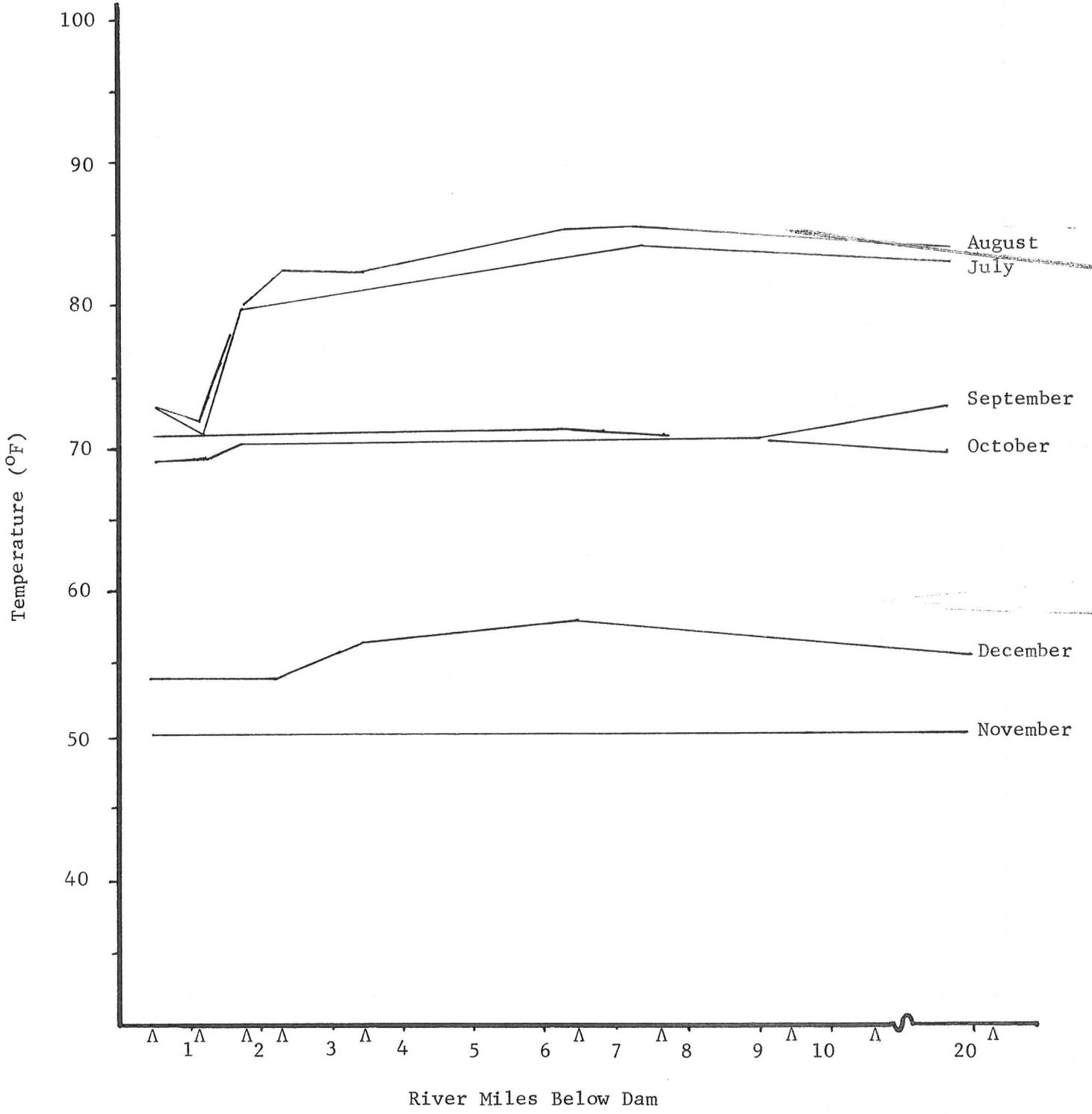
Water Temperature From January Through June, 1971



Δ - Sample Station

FIGURE III

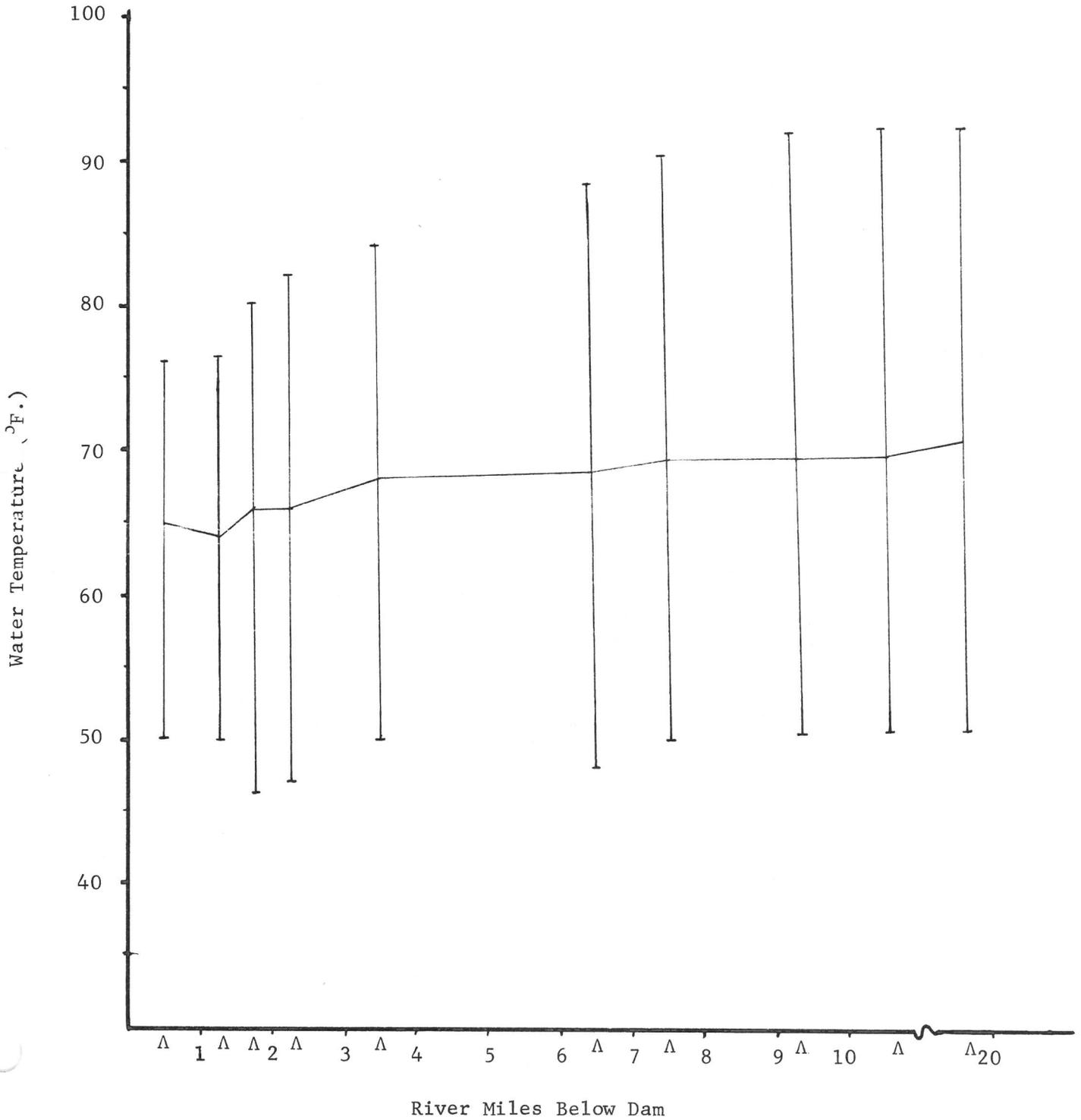
Water Temperature From July Through December, 1971



Δ - Sample Station

FIGURE IV

Average Water Temperature and Range for 1971



Δ - Sample Station

volume flow.

Chloride content ranged from 510 to 1037 ppm. The higher concentrations were noted during June and July and were likely due to the drought conditions of the area.

The water quality studies indicate that the tailrace area will provide suitable trout habitat for the first four miles below Possum Kingdom Reservoir. It is believed that the survey was conducted in an atypical year, due to drought conditions, and that during a normal year, with an increase in the volume of flow, suitable trout habitat would extend further downstream.

Benthic Organisms

The compositions of the bottom fauna is shown in Table II and IIa. Three orders of aquatic invertebrates, Trichoptera, Diptera, and Ephemeroptera, comprised 78 per cent of the total bottom fauna. These three orders of insects are most significant in the food demands of rainbow trout, (Kennedy, 1967). From all indications, the food supply in the form of invertebrates, in Possum Kingdom tailrace area is more than adequate for a trout fishery.

Fish Population

Table III shows the list of fish collected and their relative abundance. This list was compiled from the composite findings of collections with 20 foot seines, gill nets and spot creel checks.

Aquatic Vegetation

The upper reaches of the study area had a large amount of green algae (Cladophora sp.) covering up to 90 per cent of the substrate. It has been reported that rainbow trout ingest great amounts of this algae. In addition to its food value, it provides a habitat for large numbers of invertebrates (Pfitzer, 1960). Bushy pondweed (Najas sp.) was also abundant in the study area. Other aquatic plants found in the reach are parrot feather (Myriophyllum sp.), star grass (Heteranthera sp.), pondweed (Potamogeton sp.), cattail (Typha sp.), muskgrass (Chara sp.), bulrush (Scirpus sp.), cut-grass (Cladium sp.), spike rush (Eleocharis sp.), three-square rush (Scirpus sp.), and willow (Salix sp.)

Public Access

At present there is limited public access to the major portion of the study area in that the land along the river is under private ownership, but this will not eliminate fishing the area because the river is considered public; therefore, wade and float fishing will be allowed.

A further investigation of the Brazos River was made during this segment to determine if the Brazos River has the potential for a reproducing population of striped bass (*Morone saxatilis*). The Brazos River flows 110 miles from Possum Kingdom Reservoir to the headwaters of Lake Granbury. The average width of this section is 150 feet with an average depth of 3 feet. The width and depth vary considerably with the releases from Possum Kingdom Dam. The average volume of flow, as recorded by the U. S. Geological Survey for March and April is 1,960 cubic feet per second.

Table II

Possum Kingdom Tailwater Bottom Samples
 Total Number of Organisms Per Month

Fauna	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Diptera												
Chironomidae	212	328	112	142	13	8	21	1	1	144	97	1078
Simuliidae	297	2037	3116	145	14	8	6	10	10	481	356	6462
Tabanidae		3		3	3	8	18			4	1	40
Trichoptera												
Hydropsychidae	92	153	479	920	665	1049	731	21	21	306	174	4630
Hydroptilidae		87	29	42	5	41	10		2	76	77	369
Philopotamidae			7	6	10					2		25
Ephemeroptera												
Heptageniidae	2	9	6	5	9	8	11	2	2	1	2	54
Siphonuridae				1	17	4				1		23
Leptophlebiidae	30	106	73	27	35	25	61	22	22	190	67	636
Tricorythidae			217	102	253	72	97		2	2		781
Caenidae										1		1
Odonata												
Gomphidae	1	7	6	2	8	6	26			1		57
Coenagrionidae	3	18	37	23	70	78	99				1	329
Amphipoda												
Talitridae	13	24	30	1	9	2	8					87
Coleoptera												
Hydrophilidae	10	24	19	5	3	3	4					68
Elmidae	4	14	21	12	21	59	42			6	48	295
Turbellaria												
Planariidae	14	110	2	50	54	17	15					262
Plecoptera												
Perlidae				2	3							5

Table IIA

Fauna	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Hemiptera												
Notonectidae		4	2		1							6
Veliidae												1
Neuroptera												
Corydalidae		1	1			3	3					8
Hirudinea												
Glossiphoniidae	5	10	4		1	1	1					22
Pelecypoda												
Sphaeriidae		92	3	6	198	127	78				4	530
Gastropoda												
Physidae		2	55	8	12	5	22			6	2	112
Planorbidae		1	1				27			4		33
Ancyliidae		12	1				6					19
Oligochaeta												
Lumbriculiidae		16		5	5	8	10		1			45
Ostracoda												
Cypridae		20	40	84	35	2						181
Fish eggs			14									
Fish						1	14					28
Isopoda				1		1	2					4
Sphaeromidae										3		4
Bryozoa				1								
										Present		
Total	683	3092	4261	1632	1444	1527	1312	*	61	1226	829	16173

* No samples taken due to high water

Table III

List of Fish collected in the Brazos River at the ten sample stations and their relative abundance. Rated as VA - Very Abundant, A - Abundant, C - Common, R - Rare, O - Occasional.

<u>Common Name</u>	<u>Scientific Name</u>	<u>Abundance</u>
1. Spotted gar	<u>Lepisosteus oculatus</u>	C
2. Longnose gar	<u>Lepisosteus osseus</u>	A
3. Gizzard shad	<u>Dorosoma cepedianum</u>	A
4. Threadfin shad	<u>Dorosoma petenense</u>	O
5. Carp	<u>Cyprinus carpio</u>	VA
6. Golden shiner	<u>Notemigonus crysoleucas</u>	C
7. Redfin shiner	<u>Notropis umbratilis</u>	R
8. Blacktail shiner	<u>Notropis venustus</u>	VA
9. Red shiner	<u>Notropis lutrensis</u>	VA
10. Silverband shiner	<u>Notropis brazosensis</u>	R
11. Sharpnose shiner	<u>Notropis oxyrhynchus</u>	R
12. Bullhead minnow	<u>Pimephales vigilax</u>	C
13. Stoneroller	<u>Campostoma anomalum</u>	A
14. River carpsucker	<u>Carpionodes carpio</u>	C
15. Smallmouth buffalo	<u>Ictiobus bubalus</u>	C
16. Black bullhead	<u>Ictalurus melas</u>	R
17. Yellow bullhead	<u>Ictalurus natalis</u>	R
18. Channel catfish	<u>Ictalurus punctatus</u>	A
19. Flathead catfish	<u>Pylodictis olivaris</u>	R
20. Blackstripe topminnow	<u>Fundulus notatus</u>	A
21. Blackspotted topminnow	<u>Fundulus olivaceus</u>	O
22. Mosquitofish	<u>Gambusia affinis</u>	C
23. Brook silverside	<u>Labidesthes sicculus</u>	O
24. Mississippi silverside	<u>Menidia audens</u>	A
25. White bass	<u>Morone chrysops</u>	C
26. Redbreast sunfish	<u>Lepomis auritus</u>	A
27. Green sunfish	<u>Lepomis cyanellus</u>	C
28. Warmouth	<u>Lepomis gulosus</u>	C
29. Orangespotted sunfish	<u>Lepomis humilis</u>	C
30. Bluegill	<u>Lepomis macrochirus</u>	A
31. Longear sunfish	<u>Lepomis megalotis</u>	A
32. Redear sunfish	<u>Lepomis microlophus</u>	C
33. Spotted bass	<u>Micropterus punctulatus</u>	C
34. Largemouth bass	<u>Micropterus salmoides</u>	C
35. White crappie	<u>Pomoxis annularis</u>	R
36. Orangethroat darter	<u>Etheostoma spectabile</u>	A
37. Logperch	<u>Percina caprodes</u>	R
38. Dusky darter	<u>Percina sciera</u>	R
39. Freshwater drum	<u>Aplodinotus grunniens</u>	C

The length of the river above Lake Granbury would be suitable for the spawning migration of striped bass. The suitability of the river is dependent on the volume of water being released from Possum Kingdom Reservoir. At high flow, the river would likely supply all of the necessary components for successful reproduction.

Conclusion:

The survey indicated that all the requirements for a rainbow trout fishery do exist in the first four miles of the tailrace below Possum Kingdom Reservoir. It is believed that the survey was conducted in an atypical year, due to drought conditions, and that during a normal year, with an increase in the volume of flow, the fishery could extend further downstream.

The survey also indicated that at high flow, the Brazos River should supply all the necessary components for successful reproduction of striped bass.

Recommendations:

In order to determine the desirability of maintaining a "put-and-take" fishery of catchable rainbow trout, it is recommended that a creel census be conducted during 1972, to determine the recreational and economic output units of the existing fishery.

It is also recommended that arrangements be made to obtain rainbow trout for stocking in the tailrace in 1973.

Because the Brazos River below Possum Kingdom Reservoir has the potential for natural reproduction of striped bass, it is recommended that they be stocked in Lake Granbury.

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Approved by: *Lonnie Peters*

Date: December 14, 1972

Robert L. Bounds
Regional Director for Inland Fisheries

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