JOB PROGRESS REPORT

As Required by

FEDERAL AID IN FISHERIES RESTORATION ACT

TEXAS

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

REGION 2-A FISHERIES STUDIES

Job No. C-1: Pollution Studies

Project Leader: Charles T. Menn

Clayton Garrison
Executive Director
Texas Parks and Wildlife Department
Austin, Texas

L. J. Peters
Chief of Inland Fisheries

Robert J. Kemp, Jr.
Director, Fish and Wildlife

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Job Progress Report

State of Texas

Project No. F-4-R-18 Name: Region 2-A Fisheries Studies

Job No. C-1 Title: Pollution Studies

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

Objective:

To determine the source and nature of natural or man-made pollutants which affect fish populations in the public waters of Region 2-A.

Procedures:

Reports of fish kills and suspected pollution were investigated. Efforts were made to determine the nature and source of any pollutants by using appropriate water analysis methods. If fish kills had occurred, estimates of damage to the fishery were made, including analysis of species affected. When necessary, findings were reported to appropriate enforcement agencies for further action.

Results and Discussion:

Conners Branch

A small lake, created by deposition of sand by the Brazos River, at the mouth of Conners Branch in Young County, experienced a fish kill during the early part of January 1971. The kill was reported January 28 and investigated on January 29. Discussion with residents near the lake revealed that dead fish were first noticed on January 14. Residents also reported that the lake was frozen over for two days prior to January 14.

Because the kill had occurred for such a long period of time and a majority of the fish were badly decomposed, the relative abundance of species were not compiled. Approximately 95 percent of the fish killed were made up of rough fish.

The water quality analysis indicated a very high chloride content. This accompanied with rapid temperature fluctuation and high turbidity of the water were considered the primary cause of this kill.

Brazos River and Palo Pinto Creek

On February 25, 1971 a fish kill was investigated in the Brazos River south of Mineral Wells below the bridge, on U.S. Highway 281, in Palo Pinto County. The kill occurred in a 2.5 mile section of Palo Pinto Creek, a tributary of the Brazos River, and a nine mile section of the Brazos River. The section of Palo Pinto Creek affected extended from the small dam near Brazos, Texas, to the Brazos River. The section of the Brazos River affected extended from the Texas and Pacific Railway bridge downstream nine miles, with the greatest concentration of dead fish occurring near the mouth of Palo Pinto Creek.

Dead and dying fish were collected from both the Brazos River and Palo Pinto Creek. The fish were found to be heavily parasitized with the protozoan ciliate, Ichthyophthirus multifiliis ("Ich"). An extensive check for other parasites, including bacteria, were made but "Ich" was the dominate species parasitizing the fish. Dr. George Klontz, of Texas A&M University, assisted project personnel in the check for parasites.

The epizootic of "Ich" had its greatest affect on the gizzard shad population. Other fish in the area were found to be infected with "Ich" but not to the extent that the shad were. An estimated 12,000 fish of seven species were killed. Approximately 90 percent of the fish killed were gizzard shad and freshwater drum. The remaining 10 percent were made up of river carpsucker, channel catfish, white bass, bluegill, and largemouth bass.

It is postulated that this infection had its origin in the slower flowing Palo Pinto Creek. From there it spread to the Brazos River and included the other species of fish in the area.

The initial stress which stimulated the epizootic of "Ich" was not determined. Several factors were considered as possible contributors, these are:

1. The low volume of flow of the two streams due to insufficient rain.

2. Rapid temperature fluctuations of the water due to changing climatic conditions prior to the kill.

3. An increase in the contrast of the chemical characteristics of the water of Palo Pinto Creek with the Brazos River.

4. A possible over-crowding of the fish in the deeper waters of Palo Pinto Creek.

Any one, or any combination of the above could have caused a stress on the fish which increased their susceptibility for an epizootic of "Ich".

Salt Creek

A fish kill occurred in a one mile section of Salt Creek and a one mile section of the Brazos River, two miles south of Graham, Texas, in Young County. An estimated 500 fish of the following species were killed:

1. Gizzard shad
2. Carp
3. River carpsucker
4. Flathead catfish
5. White bass
6. Green sunfish
7. White crappie
8. Freshwater drum

The kill occurred at the junction of Salt Creek with the Brazos River. Both streams had reduced flow due to insufficient rains. Situated on the reach of Salt Creek, approximately three miles upstream from the site of the kill, was the effluent of the Graham Sewage Plant. This effluent supplied a higher organic load than the two streams, in their reduced state, could compensate for. A

diurnal was not made on the creek, but it is believed that an oxygen depletion occurred, likely in the predawn period, due to the effects of the organic materials added by this sewage plant.

North Fork of the Bosque River

A fish kill occurred in the North Fork of the Bosque River, four miles west of Iredell in Bosque County, on April 24 and 25, 1971. An estimated 1500 fish were killed. All species of fish known to be present in the river were affected by this kill. The kill was investigated on April 25, one day after it was reported. Fish were still dying in the area during the investigation. Water analysis revealed a 0.5 mg/l concentration of rotenone. This was the apparent cause of the kill. A Game Management Officer was successful in finding the person responsible for the application of rotenone to the river. The person was found guilty in court and was fined $500.

Lake Arrowhead

On April 27, 1971, a fish kill in Lake Arrowhead, in Clay County, was investigated. The severity of this kill was considered light. An estimated 500 fish of the following species were killed: channel catfish, largemouth bass, bluegill, white crappie and freshwater drum.

A number of water quality constituents were checked and found normal for the area. The exact cause of the kill was not determined, but pesticides were suspected.

Lake Palo Pinto

A small die off of flathead catfish in Lake Palo Pinto was investigated on April 29, 1971. The lake warden reported that a total of five flathead catfish, all weighing approximately forty pounds, had died over a six week period. A frozen specimen was obtained from the lake warden and taken back to the Fort Worth office for further investigation. The fish had no external parasites, hood marks, or any lesions of any kind. Because the tissues were badly decomposed, and the lack of proper equipment, no further investigation of this fish could be made. An effort to catch additional specimens was made but was unsuccessful. No other species of fish were affected.

Trinity River

A fish kill was investigated in the Trinity River, in Fort Worth, on May 18, 1971. The kill originated near the outfall of a local utility company and extended approximately one mile downstream. An estimated 1500 fish of 10 species were killed. Officials of the suspected utility company indicated that a solution used to clean their boilers, had accidently been released into the river prior to the kill. The kill was caused by the toxic affect of this solution. The company took corrective action to prevent any further release of such toxic chemicals.

Paluxy River

On July 10, 1971, a fish kill was investigated in a one mile section of the Paluxy River in Hood County. The kill originated just below the bridge on Rock Church Road. An estimated 1200 fish of 11 species were killed. All indications were

that the river had a fish toxicant added to it. This was not reflected in the water analysis, but the investigation was made approximately three days after it had occurred. The stream showed no evidence of any other pollution.

Stroud Creek

A fish kill occurred in Stroud Creek, one mile north of Granbury in Hood County. The kill was investigated on August 1, 1971. A one mile section of the creek was affected. An estimated 500 fish of six species were killed.

The creek appeared to be receiving some type of organic nutrification. A feed lot was located approximately two miles upstream from the area where the fish kill occurred. Water samples taken during the investigation revealed an oxygen concentration of 0.5 mg/1. This was the apparent cause of the kill. Texas Water Quality Board personnel were notified and corrective action was taken.

An Investigation of the Effects of a Gravel Dredging Operation on the Fisheries in the Brazos River

Anyone desiring to remove sand and gravel of commercial value from any lake, river, or creek, must apply for a permit from the Texas Parks and Wildlife Commission. If the Commission finds that the taking, carrying away, or disturbing of the sand and gravel in the designated territory would not damage or injuriously affect any of the fish inhabiting waters, it may issue a permit.

In December, 1970, a request for a permit to remove sand and gravel from the Brazos River was made by an individual in Hood County. All the requirements for the procurement of a permit were met by this individual and a permit was granted. After a brief check, it was found that little data is available regarding the effects of such a gravel operation on Texas rivers. Because of this lack of information, it was decided to make a survey of the effects this gravel operation will have on the fisheries in the area.

The Brazos River has two sand and gravel plants situated on its reach in Hood and Somervell Counties. The plants will be designated as gravel plant #1 and #2.

Gravel plant #1 is located one mile above the Hood, Somervell County line. The plant obtained its permit in January of this year, but because the plant is not fully eompleted, it has not been in operation during the year.

Gravel plant #2 is located four river miles below the Hood, Somervell County line. The plant has been in full operation since July of this year. The operation consist of the following:

1. The sand and gravel is extracted from the river by two draglines situated on an island in the middle of the river. In the process of dredging, the island has been extended considerably.

2. The draglines load the sand and gravel into pit trucks which haul it from the island across a bridge to the processing plant.

3. The sand and gravel is unloaded at the processing plant where it is washed, sized, and stacked.

4. The water used for the washing is obtained from the river and, after being used, is cycled through a settling pit and returned to the river.

Procedures:

Four stations were selected for study. Station I was located three river miles above gravel plant #1 and 19 river miles below De Cordova Bend Dam. Station II was one mile below gravel plant #1. Station III was located five miles below gravel plant #1 and directly below the dredging operation of plant #2. Station IV was located 14 miles below gravel plant #1 and nine miles below gravel plant #2.

Station I was located in a slight riffle area on the east side of Abby Bend. The substrate consisted of approximately 99% sand with a small amount of pebbles along the edge of the south bank. The only vegetation seen in the area was Najas sp. and Cladophora sp.. Aquatic macrophytes were restricted from the area because of the continually shifting sand. The maximum depth of the area varied from 0.5 to 3.5 feet and the average width varied from 85 to 250 feet. The width and depth varied with releases from Lake Granbury.

Originally Station III was located on the north side of an island which divided the river into three channels. Station III was located in a riffle area in the first channel on the north side. The substrate of this riffle area consisted of gravel and rocks. The maximum depth varied from 0.5 to 3.0 feet and the width varied from 10 to 18 feet. The velocity of the water varied from 1 to 5 ft./sec.. During the winter months, there was a large amount of Cladophora sp. covering the substrate.

During August and September, draglines extended the length of the island in both east and west directions. In the process of doing this the river channel was changed. The original three channels were reduced to two and the largest volume of water was flowing through what was Station III. The depth and width of the station was increased and the original substrate was changed.

Station IV was located approximately 500 feet downstream from a bridge on U.S. 67. The substrate consisted of gravel and medium-sized to large rocks. The width varied from 125 to 300 feet and the maximum depth varied from 1.0 to 2.6 feet. The velocity varied from 1 to 5 ft./sec..

Macroinvertebrates were collected monthly with a Suber square foot bottom sampler. Seven samples were taken at each of the four stations. A special effort was made to sample throughout the width of the sample station so as to give a cross section of the river. 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. Two preservatives were used during the year; 80 percent alcohol and a malachite green-formalin solution. A sugar flotation method was used in sorting the organisms from the debris (Lackey and May, 1971). Organisms were identified to thegenera level where possible and enumerated. Pennak (1953) and Hilsenhaff (1970) were the references used to key the organisms to genus. Representative specimens were sent to Dr. Kenneth W. Stewart and Dr. Sidney W. Edwards for assistance with taxonomy.

The width and depth of the stream at each sampling station was recorded and the

type of substrate was noted. The volume of flow and the rainfall received in the area was obtained through the courtesy of the Brazos River Authority. The air and water temperatures were measured with a standard centigrade thermometer.

Water samples were collected at each sampling station and returned to the laboratory for the following analysis: pH, turbidity, specific conductivity, oxygen, carbon dioxide, alkalinity, silica, chlorides, and settleable solids. The regional chemist assisted project personnel in the taking and analyzing the water samples.

The fish population was sampled by the use of a back-pack electroshocker and a twenty foot seine.

Results:

Sampling of the river was initiated in January, 1971, in an effort to collect sufficient data before the gravel dredging operations started. Sampling was conducted on a monthly basis and a total of seven months of data was collected before gravel plant #2 started its operations. All of the data collected below gravel plant #1 could be considered preoperational because of their limited efforts during the year.

Physicochemical Data

Table I shows the results of the water quality analysis taken from the four sample stations during 1971. As indicated in this table, all of the physiocochemical components checked, did not vary significantly between stations for each sample date, except turbidity.

Turbidity increases at Stations II, III, and IV were noted in June, July, and August. These increases were partly due to the deposition of sediments from rainfall run-off and stream bank erosion caused by the high volume of flow, see Table II and III. The operations of the two gravel plants can account for some of the increases at Station II and III.

Higher turbidities were recorded at Station III during November and December. This increase can be attributed directly to the dredging and washing operations of gravel plant #2. The higher turbidity was localized in the area below the operations and extended for only a short distance downstream.

Benthic Organisms

The relative density of benthic macroinvertebrates for each sample station for each sample date is shown in Table IV. As can be seen, there was considerable fluctuation in the density of organisms between sample stations. This can be attributed to the difference in the size of substrate sampled at each sample station. It has been found that large rocks provide better niches for the smaller insects such as diptera, trichoptera and ephemeroptera larvae, (Kennedy, 1967.)

Considerable fluctuation in abundance of the benthic macroinvertebrates from one date to another was noted. These fluctuations can be attributed, in part, to sampling methods, emergence of aquatic insects, normal reproduction of species,

Table I - Results of the water quality analysis taken from the four sample stations on the Brazos River during 1971.

Date 1971	Station #	Temperature Air °C	Temperature Water °C	Turbidity JTU	pH	Specific Conductance umho/cm	Dissolved Oxygen mg/l	Dissolved Oxygen %sat.	Alkalinity CO_3 mg/l	Alkalinity HCO_3 mg/l	CO_2 mg/l	Si mg/l	Cl mg/l	Setteable Matter mg/l
1/28	I	13	9.0	9	8.2	2266	11.1	96	16	118	0.0	5.0	503	0.05
	II	13	9.5	2	8.1	2156	11.2	96	24	116	0.0	6.0	503	0.05
	III	15	12.0	10	8.1	2222	10.3	95	24	116	0.0	4.5	491	0.05
	IV	18	13.0	11	8.2	2200	10.6	100	24	120	0.0	5.5	479	0.05
3/5	I	13	10.0	5	8.6	2222	10.8	100	8	112	0.0	2.2	667	0.05
	II	15	12.0	15	8.6	2125	10.4	100	12	124	0.0	1.6	473	0.05
	III	15	15.0	11	8.6	2071	10.4	106	10	118	0.0	2.1	533	0.05
	IV	16	13.0	8	8.6	1962	10.3	101	12	124	0.0	0.9	460	0.05
3/29	I	21	18.5	11	-	2240	9.8	102	20	102	-	3.4	509	0.05
	II	20	18.5	12	-	2083	10.3	108	28	92	-	3.9	485	0.05
	III	18	17.2	10	-	2251	8.6	89	20	108	-	2.0	533	0.05
	IV	20	17.2	11	-	2229	9.2	95	20	106	-	3.2	521	0.05
4/26	I	30	28.0	5	-	1035	9.0	117	0	118	-	2.4	509	0.05
	II	31	28.1	10	-	2160	10.2	123	0	110	-	1.5	461	0.05
	III	31	28.5	10	-	1818	8.9	117	0	112	-	1.4	466	0.05
	IV	31	28.5	8	-	1305	8.7	116	0	104	-	0.9	376	0.05
5/17	I	20	23.0	15	-	2523	8.8	100	20	88	-	1.7	557	0.05
	II	22	23.5	10	-	2566	9.2	105	8	102	-	1.5	581	0.05
	III	22	26.0	8	8.6	2610	8.7	105	8	92	0.0	1.6	594	0.05
	IV	20	26.0	10	-	2544	9.1	110	8	92	-	1.7	606	0.05
6/28	I	33	26.0	7	8.3	2280	7.7	95	0	124	0.8	3.2	570	0.05
	II	33	28.0	20	8.3	2480	8.5	107	0	118	0.8	3.0	606	0.05
	III	33	31.0	20	8.3	2400	8.9	120	0	98	0.7	6.2	594	0.05
	IV	33	30.0	20	8.3	2400	8.5	112	0	100	0.8	2.5	606	0.05
7/17	I	25	26.5	5	8.2	1408	8.9	113	0	92	1.2	-	533	-
	II	30	27.0	50	8.1	950	8.9	113	0	98	1.3	-	448	-
	III	32	30.4	100	8.2	950	8.0	110	0	96	1.2	-	388	-
	IV	33	-	100	8.2	880	7.6	-	0	100	0.9	-	303	-
8/30	I	25	28.0	22	8.3	1674	7.8	97	0	106	1.1	1.5	558	0.05
	II	27	29.5	100	8.1	1547	5.9	75	0	92	1.2	1.8	558	0.05
	III	28	31.5	50	8.2	2652	8.0	105	0	88	1.0	1.8	594	0.05
	IV	28	34.5	39	8.3	1550	9.3	120	0	84	1.1	1.0	533	0.05

Table I (Con'd) Results of the water quality analysis taken from the four sample stations on the Brazos River during 1971.

Date 1971	Station #	Temperature Air °C	Temperature Water °C	Turbidity JTU	pH	Specific Conductance umho/cm	Dissolved Oxygen mg/l	Dissolved Oxygen %sat.	Alkalinity CO_3 mg/l	Alkalinity HCO_3 mg/l	CO_2 mg/l	Si mg/l	Cl mg/l	Setteable Matter mg/l
9/27	I	30	23.9	-	7.9	2406	5.9	70	0	120	2.4	-	-	-
	II	32	24.1	-	8.0	2500	7.5	90	0	98	1.5	-	-	-
	III	32	24.5	-	7.8	2550	7.2	85	0	98	2.7	-	-	-
	IV	33	26.0	-	7.9	2400	6.4	77	0	96	2.5	-	-	-
11/1	I	25	21.5	-	7.8	2600	7.5	84	0	108	2.8	-	530	-
	II	25	21.5	-	7.6	2440	8.5	95	0	104	5.0	-	530	-
	III	26	22.0	-	7.6	2620	9.6	108	0	104	5.0	-	550	-
	IV	26	22.0	-	7.8	2320	-	-	0	104	5.0	-	580	-
11/29	I	16	13.0	5	8.4	2354	10.1	95	7	106	0.0	4.2	508	0.05
	II	16	13.0	5	8.3	2310	9.8	94	8	106	0.0	3.7	499	0.05
	III	16	13.0	40	8.3	2234	9.4	90	6	112	0.0	3.6	519	0.05
	IV	16	13.0	5	8.5	2310	10.4	97	10	106	0.0	4.0	514	0.05
12/31	I	10	12.0	0	8.2	1950	10.2	95	6	116	0.0	3.0	468	0.05
	II	10	12.0	0	8.4	1900	9.7	90	6	124	0.0	3.0	463	0.05
	III	10	12.0	10	8.2	1900	9.0	85	8	120	0.0	3.2	473	0.05
	IV	10	12.0	0	8.3	1952	9.9	90	6	120	0.0	3.4	478	0.05

Table II - Volume of flow in cubic feet per second as recorded from gate releases from De Cordova Bend Dam by the Brazos River Authority for 1971.

Days	January	February	March	April	May	June	July	August	September	October	November	December
1	337	59	55	99	198	962	1008	0	16,880	3060	4845	575
2	4	59	55	99	198	950	1006	0	15,814	4977	4868	1188
3	405	59	55	99	198	948	1004	0	6,821	6708	3342	1591
4	190	59	55	99	198	1365	1002	0	14,902	4181	3233	595
5	26	59	55	99	198	1539	1000	0	14,918	3128	3273	534
6	26	59	55	99	198	1537	996	50	9,118	5639	3273	534
7	26	59	55	99	198	766	994	52	4,116	3594	3275	869
8	26	59	55	99	198	99	992	52	2,386	5145	1732	2676
9	26	87	55	99	196	99	990	52	1,133	6500	1648	9190
10	26	59	55	99	198	99	986	52	1,271	4360	1033	1340
11	26	59	55	99	198	99	984	52	879	2878	1775	3838
12	26	59	55	99	196	99	990	52	754	1305	1771	1593
13	26	59	55	0	196	99	986	52	226	2507	1769	2101
14	26	59	55	176	155	200	994	0	186	627	553	1351
15	26	59	55	139	155	200	992	0	186	1573	0	1591
16	26	59	55	0	155	200	988	52	186	1640	541	1589
17	26	59	55	0	155	200	986	52	186	2172	1002	781
18	26	59	55	0	87	397	982	0	186	4342	601	133
19	26	57	55	0	87	397	980	52	188	10195	577	522
20	26	55	55	0	87	397	99	50	188	8918	577	534
21	53	55	55	0	87	397	99	50	188	3299	577	532
22	59	55	55	139	434	397	99	50	1067	2852	577	532
23	59	55	55	139	522	403	99	67	377	5096	577	532
24	59	55	55	139	954	395	0	67	702	5361	577	532
25	59	55	55	139	1037	395	0	42	754	3947	579	795
26	59	55	55	198	1033	399	0	50	1380	2235	579	938
27	59	55	65	198	1033	397	0	50	5375	1686	579	936
28	59	55	145	198	1031	397	50	52	6512	3007	577	936
29	59	55	99	198	1031	397	50	52	7014	3277	577	1347
30	59	55	99	198	1035	694	0	1898	17080	3287	577	532
31	59	55	99	198	1039	694	0	4560		3287		532

Table III - Rainfall, in inches, as recorded by the Brazos River Authority at De Cordova Bend Dam for 1971

Days	January	February	March	April	May	June	July	August	September	October	November	December	
					Months								
1	0	0	0	0	0	T	0	0	0	0	0	.53	
2	T	0	0	0	0	0	0	T	0	0	0	.30	
3	T	.02	T	0	0	0	0	.29	0	.33	0	.97	
4	.40	.13	0	0	0	0	0	0	0	1.80	0	0	
5	0	0	0	0	T	0	0	0	0	0	0	1.20	
6	0	0	0	0	T	0	0	0	0	0	0	.11	
7	0	0	0	0	T	0	0	T	0	0	0	.25	
8	0	T	0	0	T	0	0	T	0	.08	0	0	
9	0	0	0	0	.14	0	0	0	0	.28	0	2.25	
10	0	0	0	0	T	0	0	0	0	0	0	1.69	
11	0	0	0	0	.11	0	0	0	0	0	0	0	
12	0	0	0	0	0	0	0	0	0	0	0	0	
13	0	0	0	0	0	0	0	1.02	0	.09	0	0	
14	.25	0	0	0	0	.14	0	1.12	0	.03	0	T	
15	0	0	0	T	0	.07	0	1.46	0	0	0	.22	
16	0	T	0	0	0	0	0	0	0	0	0	0	
17	0	0	0	.74	0	T	0	0	0	0	0	T	
18	0	0	0	.94	0	0	0	0	0	.18	1.56	0	
19	0	.07	0	0	T	0	0	0	0	2.70	0	0	
20	0	0	0	.50	.14	0	0	0	.12	2.98	0	0	
21	0	.75	0	0	.14	0	.03	0	0	0	0	0	
22	0	0	0	0	0	T	.14	0	T	0	0	0	
23	0	0	0	.48	0	.29	0	0	1.32	0	.94	0	
24	0	0	0	0	.52	0	.33	.20	.73	0	0	0	
25	0	.10	T	0	0	0	.55	.27	.17	0	0	0	
26	0	.44	T	0	0	0	0	.15	.54	0	T	0	
27	0	0	0	0	.03	0	.18	.14	0	.56	0	0	
28	0	0	0	0	T	T	.57	0	0	0	0	0	
29	0	0	0	.05	.35	.03	.09	0	0	0	0	0	
30	0		0	0	2.26	T	2.00	0	0	0	0	0	
31	0		0		.03		.39	0		0		0	
Totals	.65	1.51	0	2.71	3.72	.53	4.28	4.65	2.88	9.03	2.50	7.34	39.80

Table IV - Organism list, Organism density per square meter per sampling date per sample station.

Station I
Density / sq. m. / Sampling Date for 1971

Organism	1-28	3-5	3-29	4-26	5-17	6-28	7-17	8-30	9-27	11-1	11-29	12-31
Simulium sp.	46	102	4									23
Tabanus sp.			6									
Hemerodromia sp.												
Pentaneura sp.	140	54	17	8	6		5	6				
Chironomidae			4		2							
Hexatoma sp.												
Dolichopodidae												
Berosus sp.				7	2	1						
Stenelmis sp.					1			7				
H oporus sp.			2									
Allocoris sp.			2									
Paragyractis sp.		6	1			2						
Dineutus sp.												
Cheumatopsyche sp.	5	18	4	5	7	2	1	17				8
Hydrosyche sp.												
Hydroptila sp.		8		1								
Chimarra sp.					1							
Thraulodes sp.	5	12		1	6	2	2	41				1
Stenonema sp.			2					2				
Tricorythodes sp.					56	41	11					
Caenis sp.												
Isonychia sp.								1				
Heptagenia sp.												

Table IV (Cont'd) Organism list, Organism density per square meter per sampling date per sample station.

Station I

Density / sq. m. / Sampling Date for 1971

Organism	1-28	3-5	3-29	4-26	5-17	6-28	7-17	8-30	9-27	11-1	11-29	12-31
Argia sp.	3	2	2			8	23	7				
Erpetogomphus sp.	3			1	4		18	64				
Hetaerina sp.					1							
Macromia sp.								2				
Neperla sp.												
Perlesta sp.												
Chauliodes sp.								2				
Corydalus sp.												
Dineutus sp.												
Enochrus sp.												
Rhagovelia sp.												
Notonecta sp.												
Ancylidae												
Physidae			2	2								
Sphaeriidae												
Tubificidae												
Lumbriculiidae							1	1				
Glossiphoniidae							1					
Unioidae												
Totals	202	202	46	25	86	56	62	150	*	*	*	33

* Not taken due to high water

Table IV (Cont'd.) Organism list, Organism density per square meter per sampling date per sample station.

Station II

Density / sq. m. / Sampling Date for 1971

Organism	1-28	3-5	3-29	4-26	5-17	6-28	7-17	8-30	9-27	11-1	11-29	12-31
Simulium sp.	6	2	2	2						19	6	280
Tabanus sp.			2		1					1		
Hererodromia sp.			2		1							
Pentaneura sp.	209	359	21	36	10			41		14	1	
Chironomidae			133	39	12							6
Hexatoma sp.				1								
Dolichopodidae			1									
Berosus sp.		2	1		7	2	2					
Stenelmis sp.	1	8	10	5	24	2		8		11		8
H. oporus sp.	1	2			1							
Allocoris sp.												
Paragyractis sp.			1		1							
Dineutus sp.												
Cheumatopsyche sp.		2			18	1	2	4		1	12	41
Hydrosyche sp.		1	7		1							1
Hydroptila sp.												
Chimarra sp.			1		5		2			2		
Thraulodes sp.	1	36	27	31	49	2	1	13		10		17
Stenonema sp.			17	1	1	1	1	5		5	1	1
Tricorythodes sp.		2	39		39	82	29	1				5
Caenis sp.			2					104		1		
Isonychia sp.		11										
Heptagenia sp.												

Table IV (Cont'd.) Organism list, Organism density per square meter per sampling date per sample station.

Station II

Density / sq. m. / Sampling Date for 1971

Organism	1-28	3-5	3-29	4-26	5-17	6-28	7-17	8-30	9-27	11-1	11-29	12-31
Argia sp.		4		1	2		10	2		1		
Erpetogomphus sp.		1	1				1	4				
Hetaerina sp.												
Macromia sp.												
Neperla sp.			1									
Perlesta sp.								1				
Chauliodes sp.												
Corydalus sp.												
Dineutus sp.												
Enochrus sp.												
Rhagovelia sp.												
Notonecta sp.												
Ancylidae												
Physidae				1								
Sphaeriidae												
Tubificidae						2						
Lumbriculiidae								5		6		
Glossiphoniidae												
Unioidae												
Totals	218	430	268	117	172	92	48	118	*	71	20	359

* Not taken because of high water

Table IV (Cont'd.) Organism list, Organism density per square meter per sampling date per sample station.

Station III

Density / sq. m. / Sampling Date for 1971

Organism	1-28	3-5	3-29	4-26	5-17	6-28	7-17	8-30	9-27	11-1	11-29	12-31
Simulium sp.	21	32	929	1	8	26					1	1
Tabanus sp.	8		4	5	5	10		1				
Hemerodromia sp.			10									
Pentaneura sp.	5	68	224	8	18			5				
Chironomidae			19	2	2							
Hexatoma sp.												
Dolichopodidae			25			1						
Berosus sp.			1			2						
Stenelmis sp.	19	94	179	349	105	114	43	49				1
Hydroporus sp.						1						
Allocoris sp.					1							
Paragyractis sp.			24		1	2						
Dineutus sp.												
Cheumatopsyche sp.		396	875	53	553	109	8	15			1	
Hydrosyche sp.	1076		66	1	25							
Hydroptila sp.			13									
Chimarra sp.			24		148	37	4					
Thraulodes sp.	19	10	373	1	19	141	12	24			1	1
Stenonema sp.			80	1		11	5	2				
Tricorythodes sp.			47		5	29	4	1				
Caenis sp.								7				
Isonychia sp.		10	18			7						
Heptagenia sp.						8						

Table IV (Cont'd.) Organism list, Organism density per square meter per sampling date per sample station.

Station III

Density / sq. m. / Sampling Date for 1971

Organism	1-28	3-5	3-29	4-26	5-17	6-28	7-17	8-30	9-27	11-1	11-29	12-31
Argia sp.		6	43	6	10	31	20	48				
Erpetogomphus sp.	3	4	23		6		7	14				
Hetaerina sp.												
Macromia sp.												
Neperla sp.	8	5	84	12	42							
Perlesta sp.			2									
Chauliodes sp.			2				1	4				
Corydalus sp.	3											
Dineutus sp.							1					
Enochrus sp.												
Rhagovelia sp.												
Notonecta sp.												
Ancylidae												
Physidae				2		1		1				
Sphaeriidae								2				
Tubificidae												
Lumbriculiidae								1				
Glossiphoniidae												
Unioidae												
Totals	1162	625	3065	441	948	530	105	174	*	*	3	3

* Not taken because of high water

Table IV (Cont'd.) Organism list, Organism density per square meter per sampling date per sample station.

Station IV

Density / sq. m. / Sampling Date for 1971

Organism	1-28	3-5	3-29	4-26	5-17	6-28	7-17	8-30	9-27	11-1	11-29	12-31
Simulium sp.	102	35	8	1						268	226	1825
Tabanus sp.	8	12	1	12	4	1	11	2		2		5
Hemerodromia sp.	3	6	1									
Pentaneura sp.	35	35	32	43	13	1		5		6		11
Chironomidae		4		5	1							12
Hexatoma sp.												
Dolichopodidae		2	1	1								
Berosus sp.		1				7	1	1				
S[illegible]elmis sp.	86	119	78	84	67	25	6	37		25	17	17
Hydroporus sp.			1		1							
Allocoris sp.			2									
Paragyractis sp.		5	4	2								
Dineutus sp.						1						
Cheumatopsyche sp.	207	264	67	43	96	24	152	49		176	237	384
Hydrosyche sp.			13	1								
Hydroptila sp.		4			7							
Chimarra sp.		38	44	1	86	47	30					
Thraulodes sp.		15	250		12	112	20	61		33		
Stenonema sp.		44	134		2	4	13	4				
Tricorythodes sp.			21		4		27	2				
Caenis sp.		37						5		1		
I[illegible]nychia sp.			10		2	4				2	2	
Heptagenia sp.					5							

Table IV (Cont'd.) Organism list, Organism density per square meter per sampling date per sample station.

Station IV

Density / sq. m. / Sampling Date for 1971

Organism	1-28	3-5	3-29	4-26	5-17	6-28	7-17	8-30	9-27	11-1	11-29	12-31
Argia sp.		20	7	1		36		12				
Erpetrogomphus sp.	16	5	25	6	10		11	37				1
Hetaerina sp.												
Macromia sp.												
Neperla sp.	5	20	30	19	12					1	2	
Perlesta sp.				2								
Chauliodes sp.		2	1			1	15	13				
Corydalus sp.	3											
Dineutus sp.												
Enochrus sp.	3											
Rhagovelia sp.					2							
Notonecta sp.										1		
Ancylidae												
Physidae						1		1				
Sphaeriidae						4		1		1		
Tubificidae												
Lumbriculiidae								17				
Glossiphoniidae												
Unioidae								2				
Totals	471	668	730	226	323	269	287	249	*	516	484	225

* Not taken because of high water

foraging by predator species, scouring by large volumes of water, and repopulation by stream drift, (Edwards and Prophet, 1969). In addition, the water depth and velocity at the sample stations varied considerably with the releases from De Cordova Bend Dam.

The only deviation in the benthic macroinvertebrate population caused by the operations of the gravel plants was noted at Station III during November and December. At this time, the average number of organisms per square meter decreased from an average of 881 to 3 per square meter. This reduction was due to physical damage caused by the dredging operations of gravel plant #2. In addition, the suitability of the habitat for benthic organisms had decreased. This decrease in benthic organisms and alteration of habitat was localized in the area of the dredging operations, approximately two miles of river was affected.

Fish Population

Due to inadequate sampling methods, very little work with the fish population was done during the year. The back-pack shocker was not functional because of the high conductivity of the water and the river was too shallow for gill nets.

Table V shows the list of fish collected and their relative abundance. This list was compiled from the composite findings of collections with the 20 foot seine and spot creel check.

Conclusion:

This study was initiated in advance of the operation of the gravel plants so as to collect sufficient data before their operations started. The major part of the data collected during this segment were preoperational.

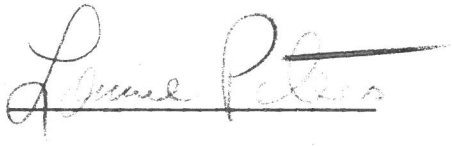
The only physicochemical component which was altered by the gravel operations was turbidity. Higher turbidities were recorded below gravel plant #2. This increase was localized in the area and extended for only a short distance downstream.

The only deviation in the benthic macroinvertebrate population caused by the operations of the gravel plants was a decrease in numbers due to physical damage caused by the dredging operations of gravel plant #2. The dredging operations also decreased the suitability of the habitat for benthic organisms. This decrease in benthic organisms and alteration of habitat was localized in the area of the dredging operations, approximately two miles of river was affected.

Recommendations:

It is recommended that this job be continued under Job B-37, until sufficient data are collected, concerning the effects of a gravel wash and dredging operation on the fisheries of the Brazos River. It is also recommended that Job C-1, Pollution Studies, be continued in an effort to monitor and correct future pollution in the public waters of Region 2-A.

Prepared by: Allen A. Forshage
Assistant Project Leader

Approved by: 

Date: December 14, 1972

R. L. Bounds
Regional Director for Inland Fisheries

Table V - List of species of fish collected in the Brazos River at Stations I, II, III, and IV, and their relative abundance. Rated as VA - Very Abundant, A - Abundant, C - Common, R - Rare, O - Occasional.

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