PERFORMANCE REPORT

As Required By

FEDERAL AID IN FISHERIES RESTORATION ACT

TEXAS

Federal Aid Project F-4-R-20

Region 2-A Fisheries Studies

Objective 9: Effects of Gravel Dredging and Washing Operation on the Fisheries of a Portion of the Brazos River

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ABSTRACT

A study of the physicochemical and biological conditions of the Brazos River in Hood and Somerville Counties, Texas was made in 1973 to determine the effects of a gravel dredging operation on river fauna. Physical damages resulting from dredging caused a change in the river course, depth, and substrate. Turbidity and settleable solids were increased. Dredging was responsible for major changes in benthic macroinvertebrate populations and fish populations in the immediate area of activity, as well as in areas further downstream.

PERFORMANCE REPORT

State: Texas Project Number: F-4-R-20

Project Title: Region 2-A Fisheries Studies

Project Section: Research and Surveys

Study Title: Effects of Gravel Dredging and Washing Operations on the Fishery of a Portion of the Brazos River

Contract Period: From January 1, 1973 To December 31, 1973

Program Narrative Objective Number: 9

Objective: To determine the effects of a gravel dredging and washing operation on the fishery of a portion of the Brazos River.

I. Segment Objective:

To monitor the chemical, physical and biological conditions in the Brazos River which are altered by gravel dredging and washing operations.

II. Summary of Progress:

Methods:

Monthly sampling of the water quality, benthic organisms, fish population and physical characteristics of the Brazos River was conducted. Location of the gravel plant, island, settling pit and sampling stations are shown at river miles (R.M.) in Figure 1. Sampling procedures and methods employed are described by Forshage and Carter (1973).

Results:

The gravel dredging plant under study terminated its operation in February, 1973. Consequently, most of the data collected during this segment is post-operational.

Measurements of chemical variates taken from R. M. 522 were compared to corresponding ones taken from R. M. 519, 518.9, 518.7, 518, 517 and 511.5. No significant changes were observed during the segment in the variability of measurements taken for water temperature, pH, alkalinity, specific conductance, dissolved oxygen, free carbon dioxide and hardness (F-Test; 0.05 level).

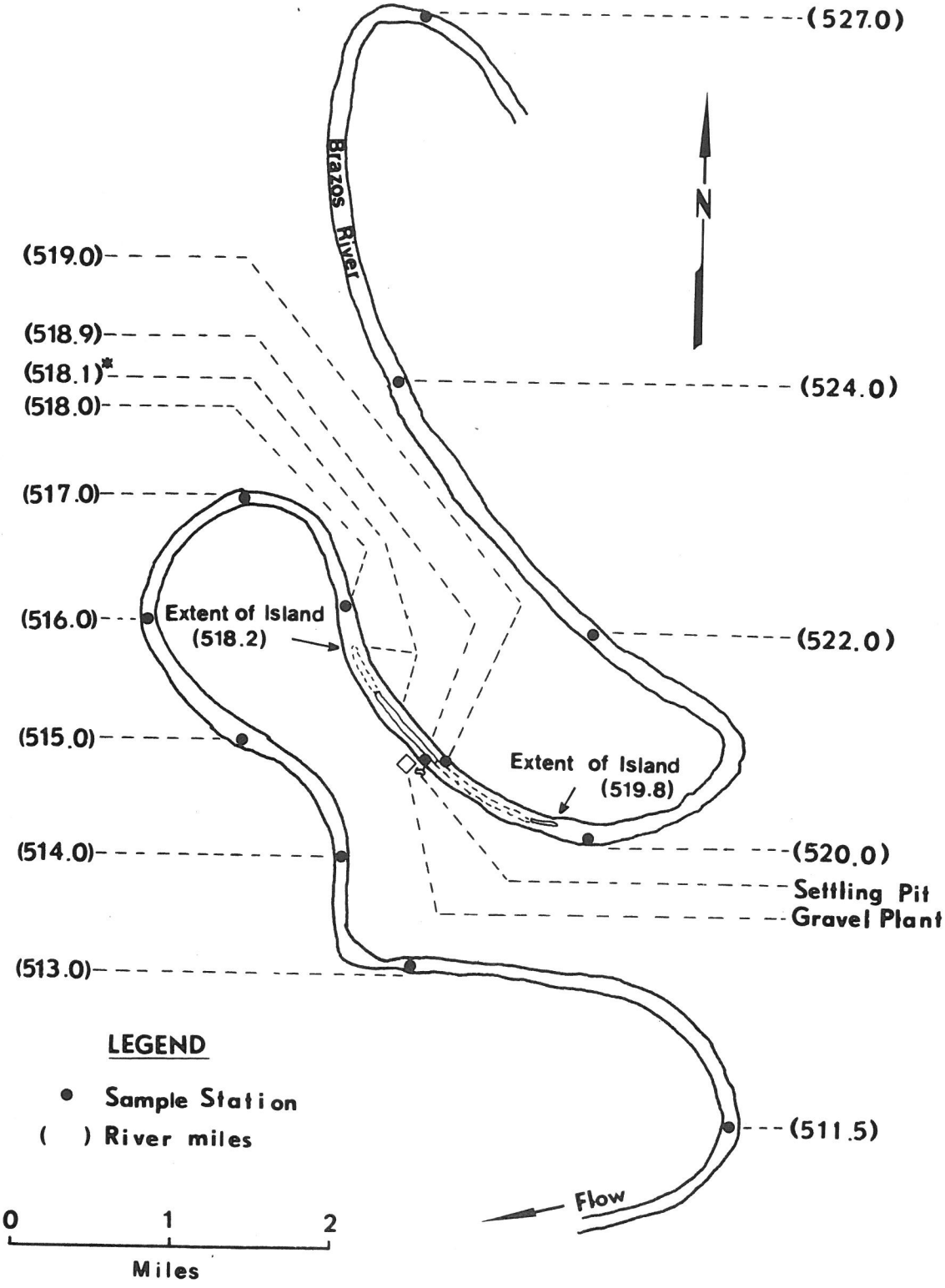

Figure 1. Brazos River in Hood and Somervell Counties, Texas showing gravel plant and sample station sites, 1973 (* = R.M. 518.1 to 518.7).

The dredging operation caused an increase in turbidity and settleable solids below the washing site (R.M. 518.9) during February. Comparable values to those found above the operation (R.M. 522) had returned by the time the water reached a station less than one mile downstream (R.M. 518). After the dredging operations ceased, turbidity and settleable solids returned to pre-dredging levels.

In 1972 the average depth of the station in the dredged area (R.M. 519) was increased to 3 feet. The maximum depth at this station reached 7 feet while maximum depths at other stations never exceeded 2.5 feet (depth measurements taken at water flow under 1,000 cfs). In the post-dredging period the average depth of this station was reduced to 1.1 feet. This decrease was caused by large amounts of sand washed into the area from upstream and from portions of the island left in the river.

Dredging had an adverse effect on the benthic community (Figure 2). River Mile 519 had an abundant, and diverse population of benthic macroinvertebrates before dredging. After dredging began, large reduction in number of organisms and number of genera occurred. This reduction was due to physical damage of the stream bottom caused by dredging activity. After dredging had stopped, populations did not recover before the end of the study period.

Figure 2 also shows diversity indices($\bar{d}$). Values were calculated by using equations derived from Patten (1962). No statistical difference between mean $\bar{d}$ values for before, during and after dredging time periods occurred (F-test; 0.05 level). Apparently the probability of collecting a specific genus of macroinvertebrates remained fairly constant throughout the study. In other words, all kinds of organisms and their numbers appeared to be affected in a proportional manner at the dredged site. Multiple-plate samplers indicated benthic macroinvertebrates were affected after dredging operations ceased. Number of organisms was reduced 63% in the dredged area (R.M. 518.7) as compared to an upstream site (R.M. 520). The stream recovered rapidly from this point on, and samples from R. M. 518 indicated normal conditions. Number of genera decreased only slightly in the dredged area.

Sport fishes, rough fishes and minnow populations at the dredged site (R.M. 519) were compared to those of an upstream station at R. M. 524 (Figure 3). See Figure 4 for separation of fishes to sport, rough and minnow groups. Rough fish decreased in number and species in the dredged area. Game fish also decreased in number but no change was seen in species composition. Minnows appeared to be affected more than other fishes since a decrease in both number of individuals and species occurred.

III. Significant Deviation:

There were no deviations from the planned schedule.

IV. Conclusions, Evaluations, and Recommendations:

There would appear to be sufficient evidence that the gravel operation on the Brazos River had a limiting effect on benthic organisms. Physical damage to the habitat that caused a change in substrate from a gravel to a sand-silt bottom was mainly responsible.

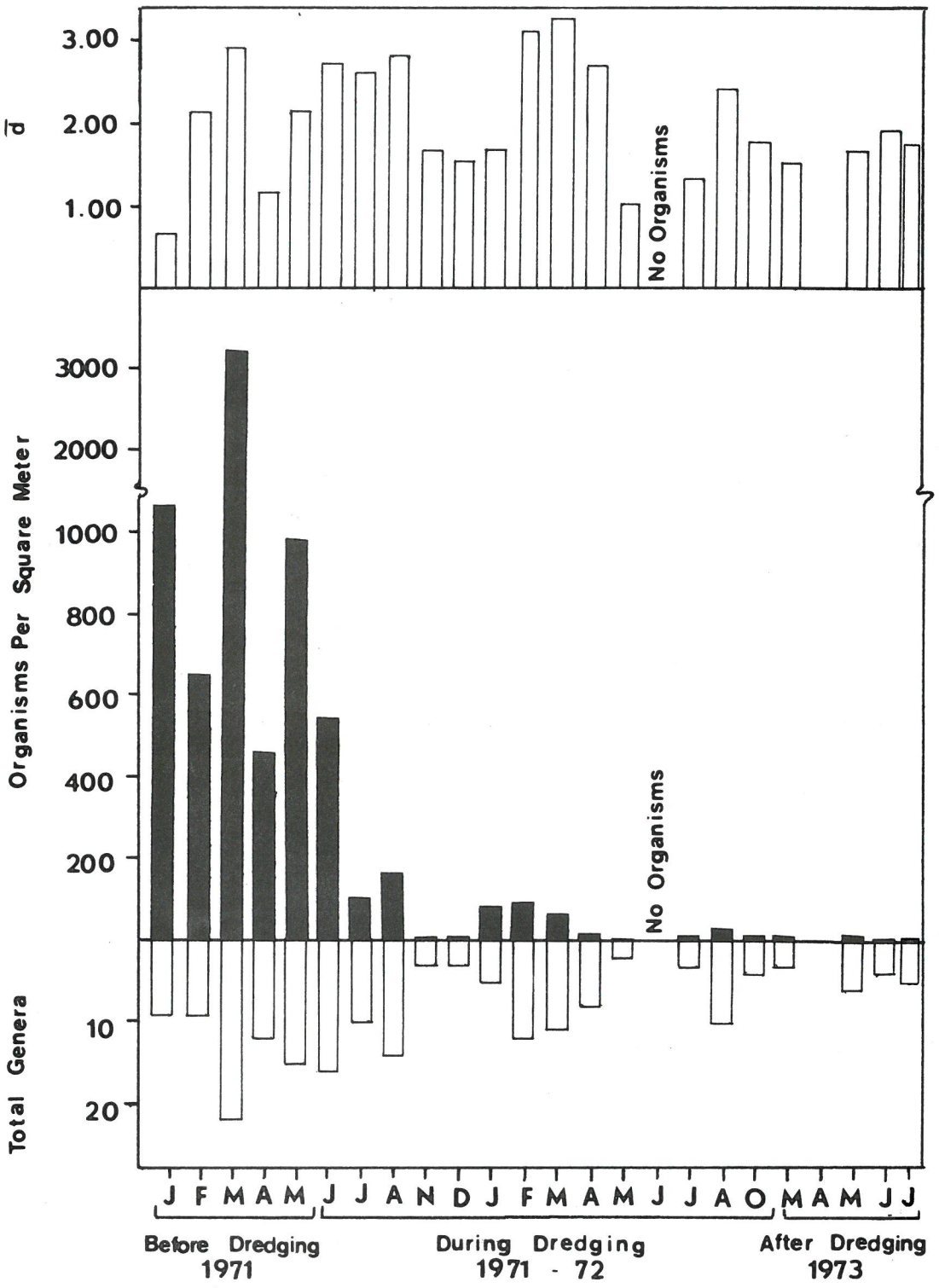

Figure 2. Species indices and populations of benthic macroinvertebrates collected by Surber bottom sampler at River Mile 519 before, during and after dredging, Brazos River, 1971-73.

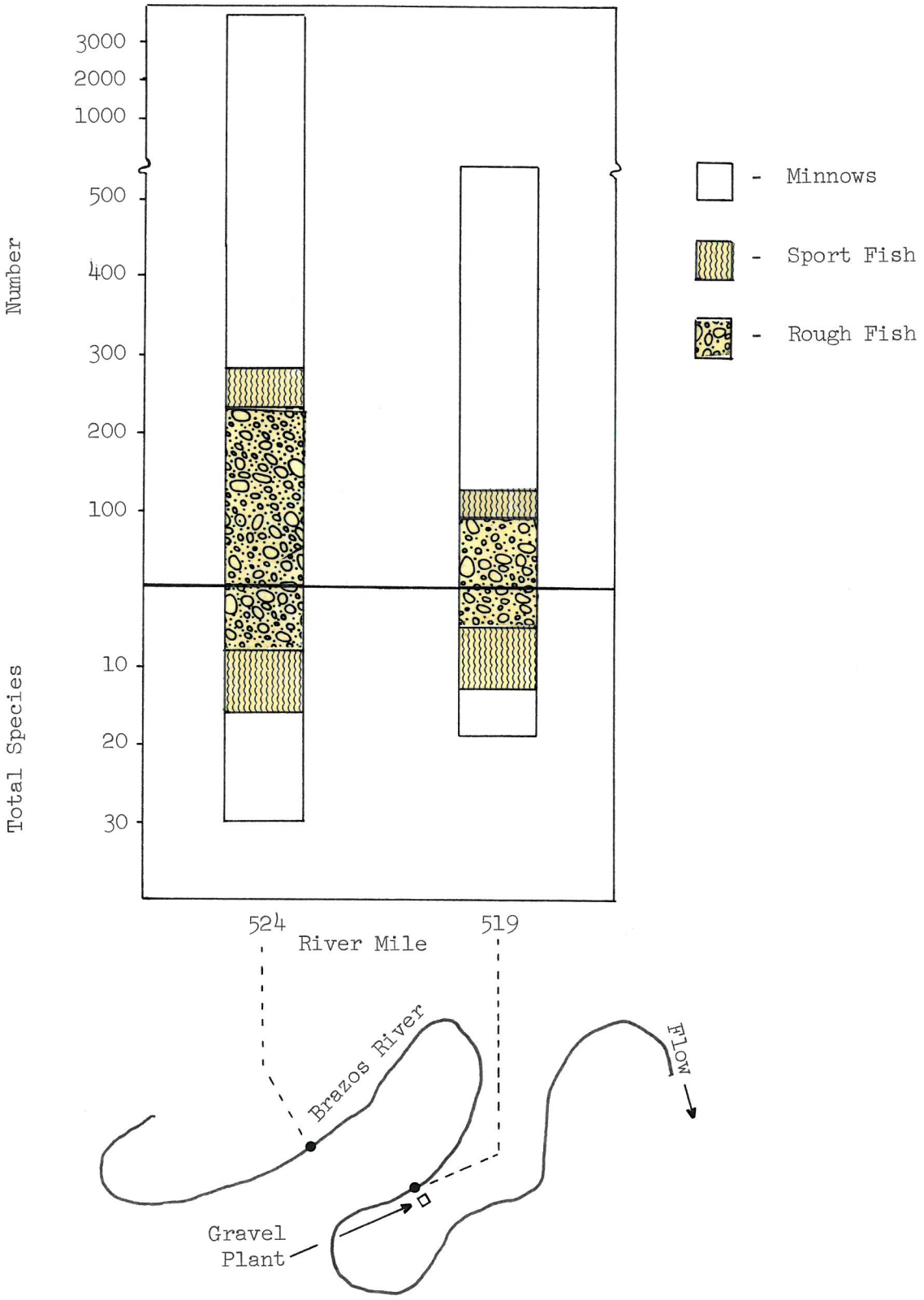

Figure 3. Fish data, Brazos River, 1973 (combined seining and gill net samples).

Figure 4. Checklist of fish species collected from the Brazos River, 1973 (combined seining and gill net samples). Common names obtained from Bailey, et al.

	River Mile	
Minnows	522	519
Speckled chub	X	
Red shiner	X	X
Silverband shiner	X	X
Blacktail shiner	X	X
Mimic shiner	X	
Bullhead minnow	X	X
Stoneroller	X	
Tadpole madtom		X
Blackstriped topminnow	X	
Mosquitofish	X	
Brook silverside	X	X
Mississippi silverside	X	X
Orangethroat darter	X	
Big scale logperch	X	
Sport Fishes		
Channel catfish	X	X
Flathead catfish	X	X
White bass	X	
Bluegill	X	X
Longear sunfish		X
Redear sunfish	X	X
Spotted bass	X	X
Largemouth bass	X	X
White crappie	X	X
Rough Fishes		
Longnose gar	X	X
Gizzard shad	X	X
Threadfin shad	X	
Carp	X	X
River carpsucker	X	X
Gray redhorse	X	X
Smallmouth buffalo	X	X
Freshwater drum	X	X

Observed changes in fish populations were surely due to a combination of factors among which disappearance of sheltered area, decrease in depth and reduction of food organisms were most apparent. Shifting sand and siltation in the dredged area and the immediate area below dredging decreased or destroyed shelters. The result was that fishes had no place to hide and food chains leading to them had been deleteriously affected. Because of this many fishes were either reduced in number or driven out of a considerable stretch of the river.

From the aesthetic point of view, dredging was detrimental. Several miles of the Brazos River were turbid because of the dredging operation, and there was always a dragline in the middle of the river. Trees on the bank were either partly or completely covered by huge piles of sand and gravel. Trees also were cleared to make room for buildings and settling pit. Much of the operational waste (old vehicles, barrels, buildings, etc.) was left on the bank after the gravel operation had closed down.

Our observations in this study and our review of literature bring us to the conclusion that dredging of this type should be halted in the streams of Texas in order to prevent their gradual, but definite biological deterioration.

Gravel dredging operations were completed in February, 1973, but because of the magnitude of the operation, the fisheries in the area is still being affected. A vast sheet of sand created by dredging is slowly moving down stream covering everything in its path, including the gravel areas so vital to production of lower food-chain organisms. It is felt that an additional year of data collection is required to attain the objective of this study, and an additional segment will be required to process data and prepare a final report.

V. Literature Cited

Forshage, A., and N. E. Carter. 1973. Effects of gravel dredging on the Brazos River. Proc. 27 Ann. Conf., Southeastern Assoc. of Game and Fish Comm. (in print).

Patten, B. C., 1960. Species diversity in net phytoplankton of Rariton Bay. J. Mar. Res. 20:57-75.

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