

Pecos River

JOB PROGRESS REPORT

As required by

FEDERAL AID IN FISHERIES RESTORATION ACT

TEXAS

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

REGION I-D FISHERIES STUDIES

Job No. 2 Pollution Studies

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April 17, 1969

SUMMARY

Six gravel washing operations are operating in Region I-D. Pollution by siltation occurred on the Pecos River near Grandfalls and is occurring near Del Rio. Both operations are now being monitored by the Texas Water Quality Board and corrective action is being taken.

Dow Chemical Corporation has established a fluorspar mine and mill on the Rio Grande River at LaLinda. Project personnel visited the mill and took water samples in the Rio Grande. Analysis is incomplete.

A fish-kill occurred in July at the Balmorhea State Park swimming pool and at Lake Balmorhea. The suspected causes are insecticides, heavy rain and associated runoff, and drastic oxygen level fluctuations due to a heavy algae bloom.

An extensive fish-kill began in mid-November 1968 on the Pecos River near Sheffield and continued into December. Approximately 70 miles of river and all species of fish were affected. Suspected causes are salinity, agricultural chemicals and wastes, oil field pollution, and possibly unknown chemical action. Drought and retention of water by Red Bluff Lake have reduced water quantity in the river and intensified the effect of any pollutant.

A die-off in Lake Imperial occurred just before Christmas. No definite date or cause is known. Pollution from oil field activities was observed in the field in February. Cold weather occurred just before the die-off.

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April 11, 1969

JOB PROGRESS REPORT

State: Texas

Project No.: F-18-R-4 Name: Region I-D Fisheries Studies

Job No.: 2 Title: Pollution Studies

Period Covered: March 1, 1968 through February 28, 1969

Objectives:

General:

To investigate instances of pollution affecting specific fish populations and to report findings to the State Water Quality Board when remedial action is needed.

Specific:

1. To determine extent of damage to fish populations.
2. To trace the source of pollution.
3. To determine the nature of the pollution.
4. To delimit saline pollution and its effects on fish populations in the Pecos River below Red Bluff Lake and above the Rio Grande.
5. To report instances of violation and negligence to the State Water Quality Board.

Procedures:

General:

Pollution discovered by project personnel or reported to project personnel was investigated through observations, water analysis, fish population sampling, and bioassay. The nature and source of the pollution determined if remedial measures were possible and needed. Saline pollution in the Pecos River was extensively investigated by fishery survey, bioassay, and chemical analysis.

Specific:

1. Cursory observations of sick or dead fish were made to establish the length of a stream or area of a lake affected. Population sampling with nets and/or seines were made to establish number and species of fish surviving and were compared with past samples or "above and below" samples to establish overall changes in the population composition.

2. From the downstream point where dead fish were found, a search was made upstream for evidence as to the source of the pollutant. The nature of the pollutant (if known) might pinpoint the source.

Netted or seined fish were identified in the field where possible. Names of fish used in this report are those accepted by the American Fisheries Society as published in their Special Publication No. 2, 1960, A List of Common and Scientific Names of Fishes From the United States and Canada, Second Edition.

Standard survey gill nets are 150 feet long when constructed. The meshes begin at 1-inch square and progress to 3.5 inches square in 25-foot sections. Large mesh nets are 150 feet long when built and all mesh is 3.5 inches square. The webbing of all nets is 8 feet deep tied down to 6 feet. Nets are constructed so that they sink when set. The lead line follows bottom contours and the floats support the webbing like a fence. Sets are usually made perpendicular to the shoreline in lakes and at an angle downstream and across in rivers.

Dissolved oxygen content was checked in the field using a Kemmerer sampler to extract samples and a Hach kit to make the determinations. Salinity was also determined by both project personnel and the regional chemist.

Findings:

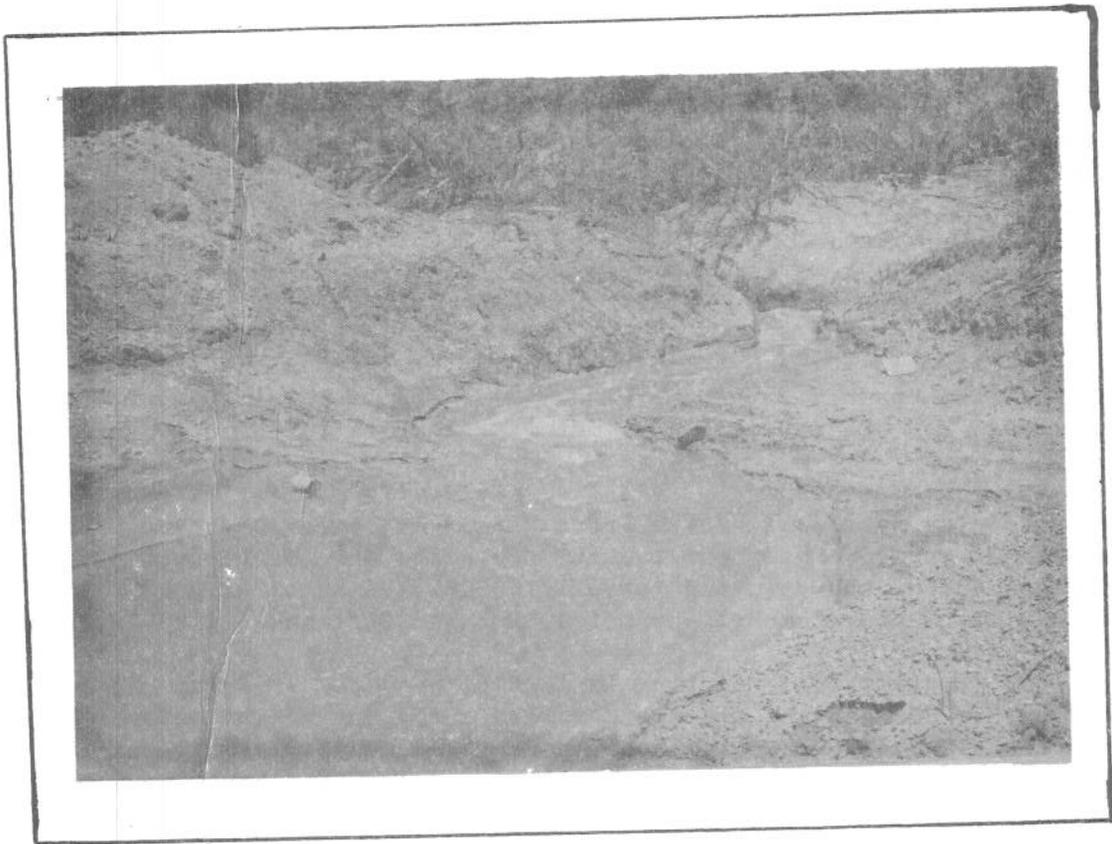
Gravel Washing Operations

There are 4 gravel washing operations near Del Rio. One operation, on Cienagas Creek, has allowed waste water to carry silt into the creek and the creek is choked with silt for considerable distance below the operation. Another operation on Sycamore Creek is discharging waste water back into the creek. All these operations are being monitored by Texas Water Quality Board field personnel.

Project personnel examined a gravel washing operation on the Pecos River near Grandfalls, Texas, on May 22, 1968. Areas below, at, and above the operation were observed. Evidence of pollution by siltation was shown by increased turbidity (6 inches secche) near the operation. Turbidity was 5 feet Secchi about 300 yards upstream and about 1.5 miles downstream from the operation. The river was clogged with mud and silt for approximately 150 yards at and below the entrance of the waste water (Figure 1). The conditions were reported to the Regional Office and the operation is presently being monitored by the Texas Water Quality Board field personnel. A large retention pit has been dug to retain wastes and now no materials enter the river from the operation.

There is a gravel washing operation just north of U. S. 290 about 2 miles east of Sheffield in Pecos County. Waste water was being released into an arroyo which joined the Pecos River. Texas Water Quality Board field personnel have visited the operation and corrective actions are underway.

Figure 1



GRAVEL WASHING WASTE WATER

Mining Operations

The Dow Chemical Company has built a fluorspar mill at LaLinda, downriver from Boquillas Canyon on the Rio Grande River in Brewster County. The ore is mined approximately 15 miles south of the mill in Mexico. Fluorspar extraction from the ore is done by crushing, powdering, and flotation. The dried product, calcium fluoride, is a gray talcum-like powder. This powder is trucked across a bridge built by Dow to a railroad terminal in the United States for further disposal.

Water, oleic acid, quebracho, and sodium silicate are used in the flotation process. A large disposal pit permits settling of most of the suspended solids. During warm weather, evaporation prevents waste water from entering the river. During cool weather, some of the excess water flows from the pit into the Rio Grande. Water samples are periodically run by Dow chemists to monitor the effluent. Project personnel obtained water samples above, at, and below the mill to determine water quality. Analysis is incomplete.

The element beryllium was discovered in some of the fluorspar ore. Dow personnel stated that all waste water from beryllium-containing strata is being placed in other retaining structures until chemical tests indicate that the material will not be biologically harmful if it enters the Rio Grande.

Balmorhea Fish-Kill

A fish-kill at Lake Balmorhea and in the springs at Balmorhea State Park was reported on July 22, 1968 (Figure 2). The regional chemist, the park superintendent, and project personnel met at the State Park and conducted a study.

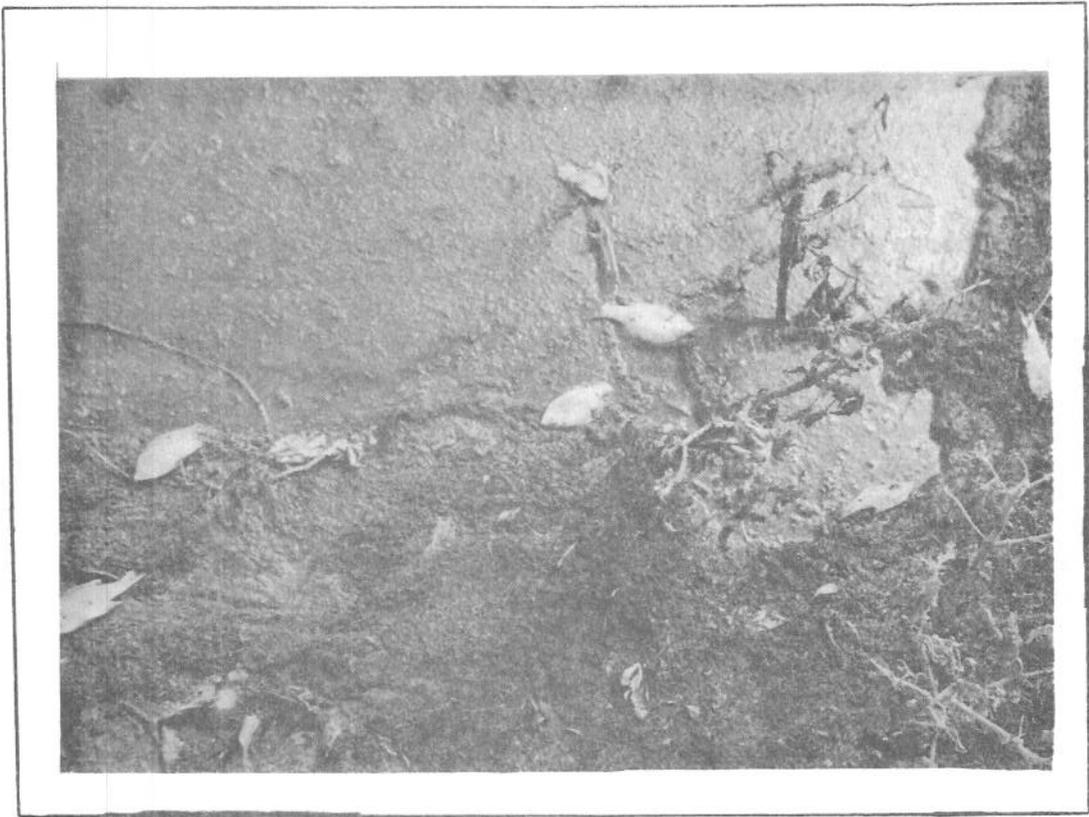
Suspected causes were: (A) Insecticide from an aerial application to cotton fields just west of the State Park. The pilot was executing low level passes and turns. After one typical low pass, one sprayer was still releasing chemical during the turn and insecticide drifted into the pool. The insecticide mixture was 3 parts methyl parathion, 3 parts DDT, and 1 part toxaphene.

(b) Heavy rains, totaling 15 inches, occurred in July. They introduced temperature changes and the springs were murky during the rains. This murky condition is interpreted as caused by surface runoff into the aquifer supplying the spring. Organic and chemical pollutants are thought to have entered the springs by this means. The lake receives water from the springs and from surface runoff.

(c) The sunfish population was spawning when the die-off occurred. During spawning, fish are under stress and often in a weakened condition. Saprolegnia infections occur on weakened fish when scars are obtained by fighting over, or protecting, nesting sites and nests.

(d) Detritus carried by runoff entered the lake and caused oxygen depletion. The lower strata in Lake Balmorhea were devoid of oxygen on July 23 and 24, 1968. Associated conditions must have been present.

Figure 2



BALMORHEA FISH-KILL

(E) A heavy growth of algae was present in the springs on July 22. Super-saturated oxygen conditions occurred in some areas of the springs as a result of the algae growth. The algae could have been removing practically all of the dissolved oxygen from the water at night and on cloudy, calm days.

Discussion

The tests for pesticides indicated DDT present in very small amounts - 0.00045 ppm maximum - in the water. Chronic presence of insecticides would add a continued stress factor which has not been demonstrated. No methyl parathion or toxaphene was present in the samples tested. Methyl parathion detoxifies very rapidly (California Water Quality Criteria, publication No. 3-A, states that the half-life on cotton leaves is less than one hour). The DDT present could be standard for the springs as no prior calibrations have been made. DDT was present in very small amounts - 0.053 ppm maximum - in the fish flesh. This amount is considered too small to account for the kill by itself. No methyl parathion or toxaphene was present in the fish flesh tested. Methyl parathion dissociates very rapidly and its action in fish flesh is unknown.

Conclusions

The above stress factors were acting on the fish population prior to the die-off. Weakened and fungus-infected fish might have begun dying regardless of the presence or absence of insecticides. The timing of deaths indicated that pesticides were possibly the overbalancing agent which accelerated the deaths of many fish. Fish began dying soon after winddrift deposited pesticides in the spring in addition to that possibly present in percolated water.

Tests should be made to determine whether or not DDT is chronically present in the spring waters. Any change from determined values would be apparent in the event of a future die-off. The springs have a large volume of flow. Much of the chemical introduced by the spray plane would have been removed by the time tests were run. DDT is mentioned frequently and could be used as an indicator. DDT detoxifies slowly and remains indefinitely in the water. If DDT is not chronically present in the spring water, the occurrence of DDT in the chemical analysis is significant. Its presence would indicate that toxaphene and methyl parathion were also present in amounts comparable to the spray mixture, watershed use, percolated residues, and detoxification time.

Synergistic action often occurs between chemicals which increases their efficiency as insecticides (California Water Quality Criteria, No. 3A, page 26). The effect of mixed DDT, toxaphene, and methyl parathion on fish is unknown. Synergistic action, if present, of methyl parathion, toxaphene, and DDT in very small amounts could have been the overbalancing factor in many deaths.

Pecos River Fish-Kill

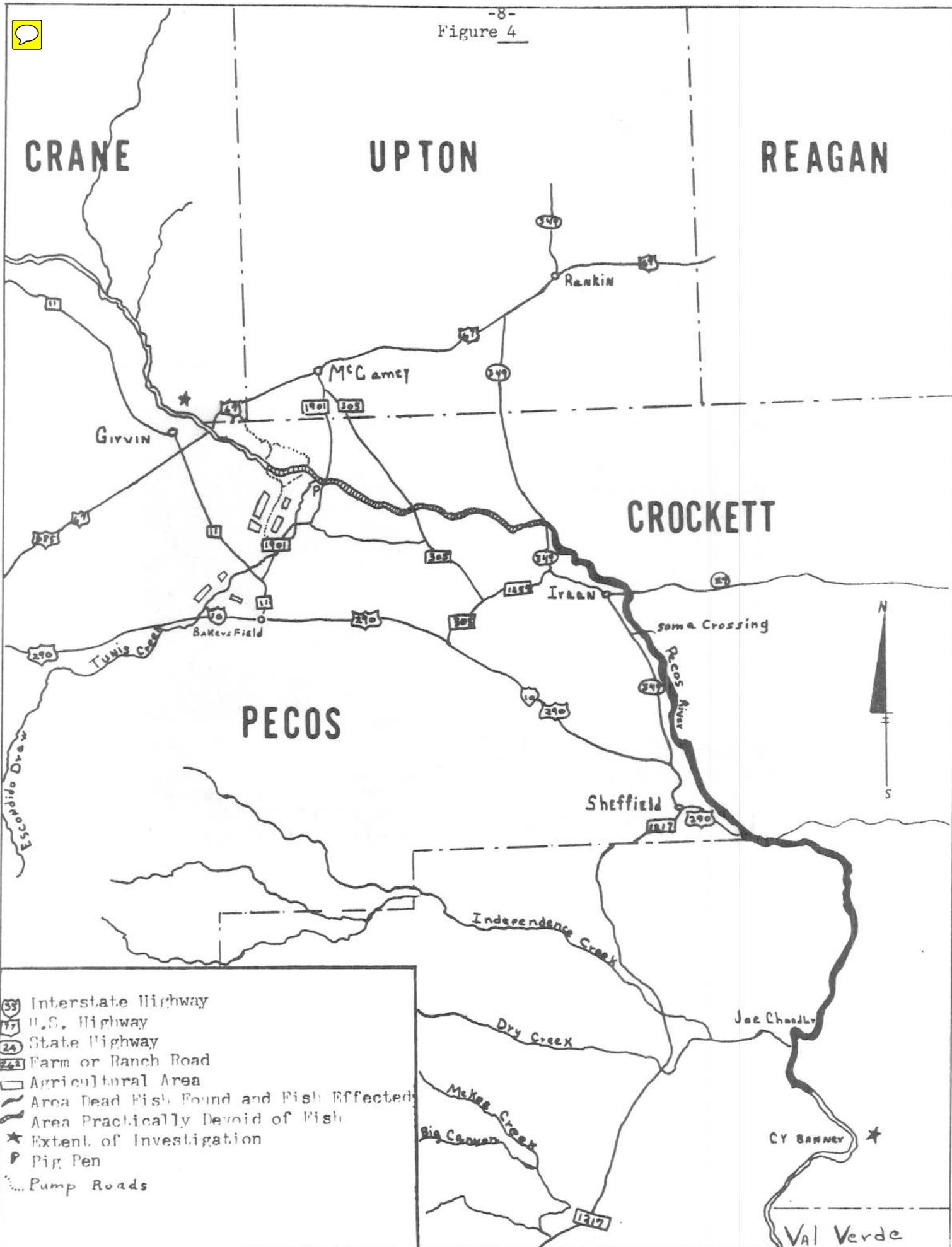
 An extensive fish-kill began in mid-November 1968, on the Pecos River near Sheffield and continued into December. Apparently all species present were affected (Figure 3). The kill extended from about 5 miles below U. S. 67 to below Independence Creek (Figure 4).

Figure 3



PECOS RIVER FISH-KILL EAST OF SHEFFIELD

-8-
Figure 4



- 55 Interstate Highway
- 77 U.S. Highway
- 24 State Highway
- 242 Farm or Ranch Road
- Agricultural Area
- ~ Area Dead Fish Found and Fish Effectuated
- ⋯ Area Practically Devoid of Fish
- ★ Extent of Investigation
- P Pig Pen
- ⋯ Pump Roads

The fish population in the river on Hale's Ranch, just upstream of U. S. 290, was surveyed in September 1967 (Table 1). One green sunfish was taken from 3 standard gill nets after the fish-kill occurred in December 1968. This is interpreted as indicating an almost total kill on his ranch.

The saline water of the Pecos River is much diluted on Mr. Hale's place by flow from fresh water springs. Other springs enter the river downstream from Highway 290 and Independence Creek provides more fresh water. The intensity of the die-off decreased below U. S. 290 and effects terminated between 2 and 8 miles below Independence Creek. Additional spring water enters the Pecos River on the Banner Ranch (Figure 4).

Two standard survey gill nets took fish on the Dudley Ranch, approximately 8 miles below Highway 290 (Table 2). Dead fish were numerous on the Dudley Ranch and the Joe Chandler Ranch above Independence Creek and for 2 miles below Independence Creek. Fish were taken on the Chandler Ranch above Independence Creek (Table 3). These data indicate a heavy, but incomplete, kill which diminished in intensity below U. S. 290.

Table 1

Survey Results From Pecos River at Sheffield September 20, 1967. (3 Standard Survey Gill Nets, 2 Redfish Nets, and 9 Drags With A 20-foot 1/2-inch Mesh Seine.)

NETTING Species	No.	Per Cent	Total Wgt.	Per Cent	Avg. Wgt.	Avg. "K"	SEINING	
							No.	Per Cent
Longnose gar	21	24.70	23.53	27.67	1.12	0.4		
Gizzard shad	26	30.59	15.43	18.15	0.59	2.1	10	2.50
Mexican tetra							5	1.25
River carpsucker	17	20.00	20.69	24.34	1.22	2.5		
Red shiner							230	57.50
Proserpine shiner							74	18.50
Roundnose minnow							54	13.50
Bullhead minnow							2	0.50
Channel catfish	9	10.59	10.02	11.79	1.11	1.7		
Flathead catfish	2	2.35	8.60	10.12	4.30	2.0		
Southern rainwater killifish							1	0.25
Rio Grande killifish							4	1.00
Mosquitofish							15	3.75
Tidewater silversides							1	0.25
Largemouth bass	5	5.88	4.42	5.20	0.88	2.3		
Bluegill	3	3.54	0.67	0.78	0.22	5.3		
Longear sunfish							4	1.00
Rio Grande perch	2	2.35	1.65	1.95	0.83	6.0		
Total	85	100.00	85.01	100.00			400	100.00

Table 2

Pecos River

Dudley's Ranch

December 21, 1968

During Fish-Kill

Fish Taken in 2 Standard Survey Gill Nets. Surface Water Temperature 51°F,
Turbidity 4-feet Secchi, Bottom Dissolved Oxygen at 7 feet 10 ppm.

NETTING Species	No.	Per Cent No.	Total Weight	Per Cent Weight
Longnose gar	2	6.45	2.39	4.72
Gizzard shad	2	6.45	1.86	3.68
River carpsucker	22	70.97	19.50	38.59
Carp	4	12.90	23.59	46.67
Channel catfish	1	3.23	3.20	6.34
Totals	31	100.00	50.54	100.00

Table 3

Joe Chandler's Ranch

December 21, 1968

During Fish-Kill

Fish Taken in 2 Standard Survey Gill Nets. Surface Water Temperature 54°F,
Turbidity 6-feet Secchi, Dissolved Oxygen 9 pp.

NETTING Species	No.	Per Cent No.	Total Weight	Per Cent Weight
Gizzard shad	12	54.54	10.25	46.27
River carpsucker	9	40.91	6.72	30.34
Carp	1	4.55	5.18	23.39
Totals	22	100.00	22.15	100.00

Suspected Causes

1) The Pecos River has always been saline. Chlorides from 3,000 to 8,000 ppm were recorded during field investigation prior to and during the die-off (Table 4). Water quality has definitely become worse throughout the area in 1968 (Figure 5). Close study of Figure 5 will reveal areas of increasing and decreasing salinity. Lack of rainfall on the watershed above Red Bluff has allowed the water level in Red Bluff to recede and the salinity and associated values have become higher. Salinity alone cannot explain the die-off.

2) Agricultural chemicals - such as DDT, toxaphene, methyl parathion, azodrin, and phosphate defoliants - are used extensively in the Bakersfield farming area. These farms (Figure 4) lie along Tunis Creek to the west of the Pecos River and north of Bakersfield. Tunis Creek carries runoff from these farms during rains and, doubtlessly, residual agricultural materials are emptied into the Pecos River. However, water samples taken in December were reported "pesticides negative" in tests done by the Texas Health Department Laboratory in Austin. The laboratory did not analyze fish flesh sent in for analysis, stating that "all fish flesh now contains insecticides and any found would not be indicative".

3) Oil field pollution occurs regularly in the area between U. S. 290 and 67 (Figure 4). Crude oil, salt brine, and a spray of emulsified gases and oil entered the river at various points downriver from U. S. 68 and above U. S. 290 before and during the die-off (Figure 6). Detailed notes and photographs are available at the Del Rio office. Study of the California Water Quality Criteria publication No. 3A, page 231, indicates that crude oil (as such) probably did not directly cause the mortalities. Soluble toxins from the oil field wastes may have been significant. Low dissolved oxygen levels, caused by the oil slicks and chemical oxygen demand, may have been significant at times other than those during the testing period in December. Oil field wastes should be kept out of the river.

4) A hog pen with automatic feeders and associated organic wastes is located on the west bank of the Pecos River just upstream of Ranch Road 1901. Some dead hogs were observed downstream from the area in the river. Conversation with the owner indicated no recent epidemic or extra use of flea and tick toxins or insecticides. Wastes from the pens flow directly into the river during rain runoff.

5) Cold weather caused frost-kill of the salt cedars lining the Pecos River for miles in November, and winds dumped their leaves and twigs into the river. Algae was noted dying and the water was very clear during field investigations in December. Organic decay thus imposed heavy BOD loads on the dissolved oxygen contents of the river water for some time, and the cold weather added a temperature stress. Algae and aquatic plants above U. S. 67 appeared alive and thriving. Below the entrance of Tunis Creek, algae and aquatic plants were sparse. This is interpreted as indicating that pollution from agriculture and the oil fields has altered the river by its chronic presence.

Table 4

Water Samples From Pecos River Fish-Kill

	Highway 67 At Girvin 12-20-68	Bridge 29 12-20-68	Bridge Sewage Effluent 12-20-68	Soma Crossing 12-20-68
pH	8.2	8.2	7.4	8
Conductivity in Micromhos	26,880	25,200	2,013	23,352
Color	20	20	20	20
B.O.D.	1.0	1.0	35	1.5
Ammonia nitrogen	1.0	1.0	35.5	1.0
Nitrites	0.2	0.2	0.2	0.2
Nitrates	0.3	0.3	0.3	0.3
Total phosphates	0.2	0.2	56	0.2
Total solids	15	21	43	10
Fixed solids	6	12	6	-
Volatile solids	9	9	37	-
Chlorides	5,480	5,600	220	4,540
Tannic acid	0.8	1.0	3.0	1.0
Sulfates	3,650	3,290	42	2,800

Float Trip

Fish were observed dead and many were phlegmatic during a float trip down the Pecos River on November 18 through 21, 1968. Oil field pollution was noted at that time. Dead shad and sunfish were found just below State Highway 349 (Figure 4). These dead and dying fish were attributed to oil field pollution, cold weather, salt water, and age (at the time of the trip) as no distressed fish were seen below Soma Crossing.

Whether the death of these fish is associated with later death of other fish downstream is unknown. In the area at Soma Crossing, a dead largemouth bass (Figure 7) was found. This was the only game fish seen on the entire trip. Standard length of the bass was 11.2 inches and his weight was estimated at 1 pound.

Shad were dying in a fairly heavy oil slick at Soma Crossing. They were swimming slowly in circles on their sides. Below Soma Crossing, no dead or phlegmatic fish were seen. Fish seen in the Hale Ranch area were alert and healthy.

Water samples were taken at many sites during the float trip. They have not been analyzed up to the time of this writing.

Figure 5

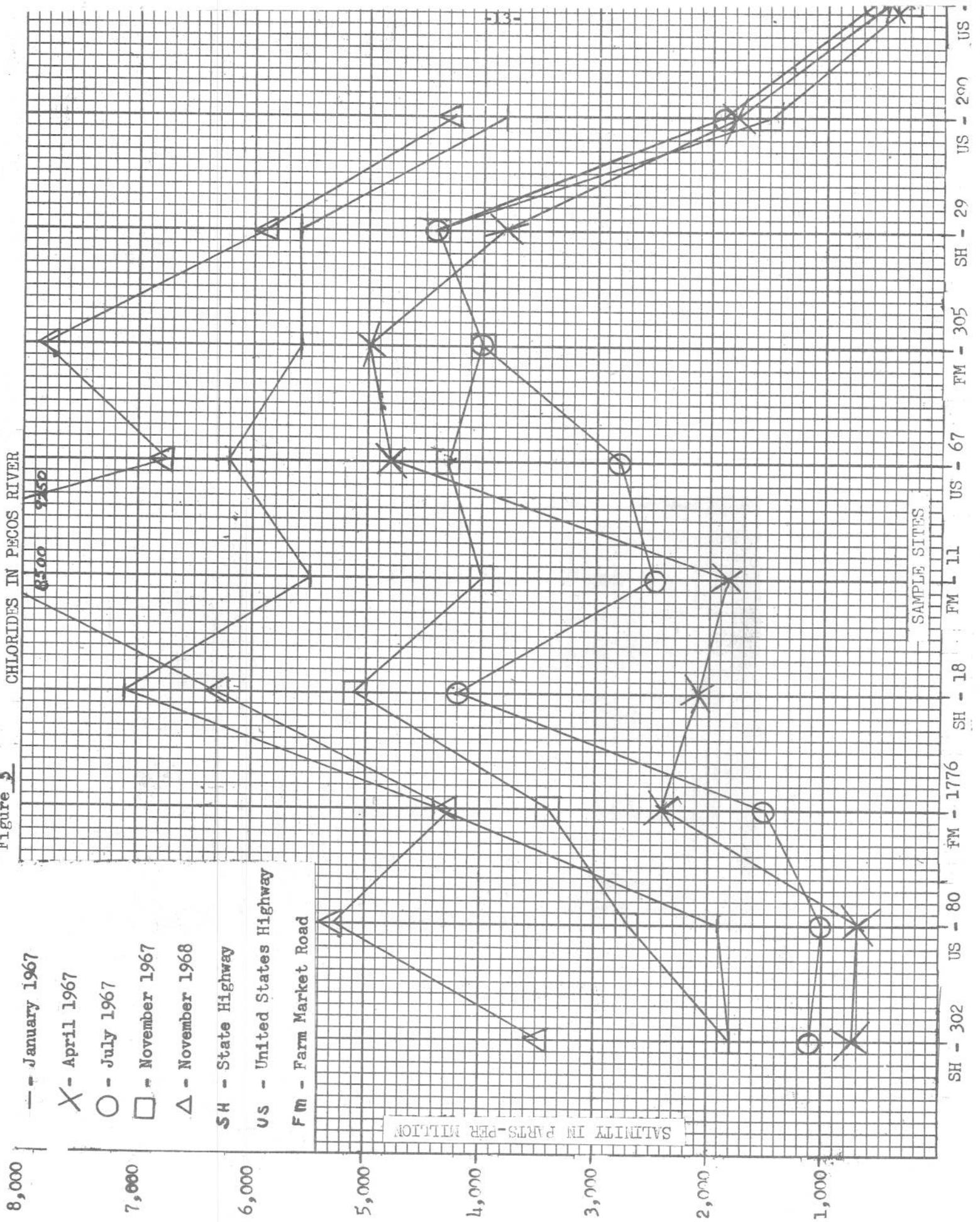
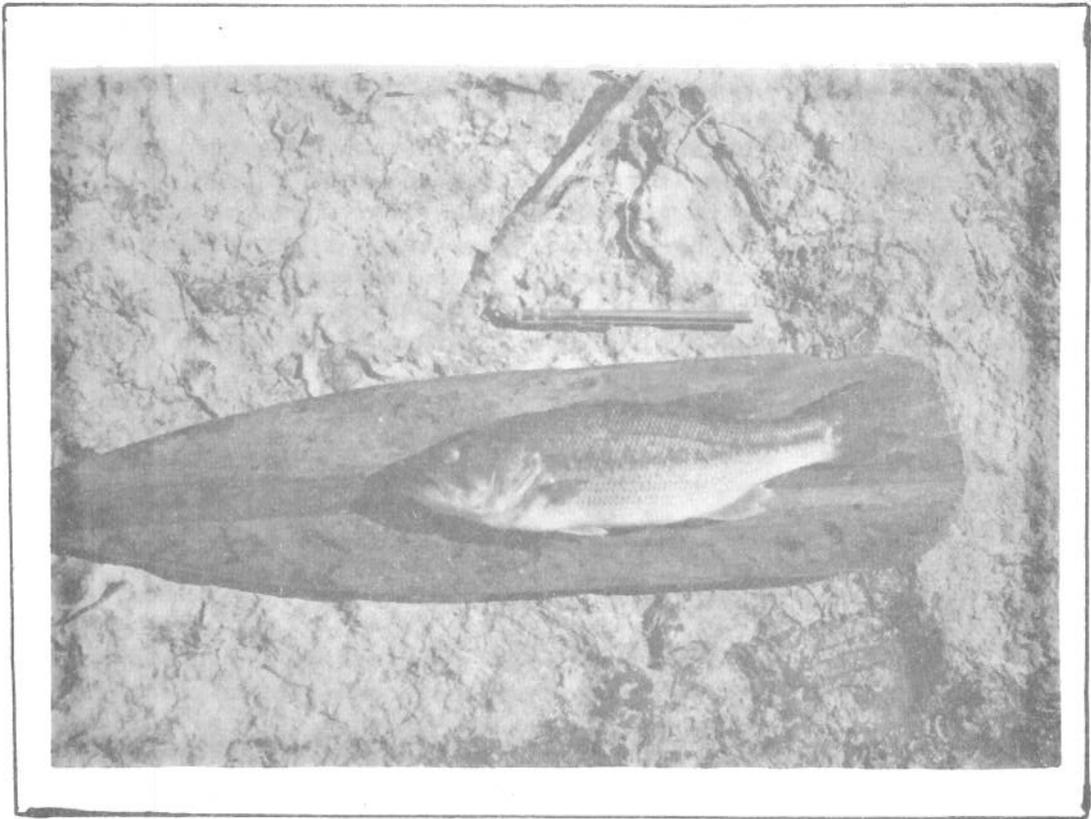


Figure 6



OIL POLLUTION IN PEGOS RIVER

Figure 7



FISH FOUND AT SOMA CROSSING

Discussion on the Pecos River Die-Off

In August 1966, Red Bluff Reservoir filled with water. Irrigation releases and rainfall caused an improvement in the general water quality of the Pecos River system in Texas. Salinities were lower throughout the river in 1967 (Figure 5) than in 1968. This improvement occurred coincidental with the beginning of Project F-18-R-3 and a study of the Pecos River fish population related to water quality. Game fish evidently penetrated upstream into regions formerly unoccupied above U. S. 290 in 1967 when the water quality was better.

Red Bluff Lake has declined in volume and water quality quite drastically in 1968. Chlorides, used as an index, were less than 2,000 ppm at Farm Road 302 in 1967. On November 25, 1968, the chlorides at Farm Road 302 were up to 3,450 ppm. Readings as high as 9,250 ppm chlorides occurred between there and U. S. 290 east of Sheffield on November 25, 1968 (Figure 5). Most probably the worsening water quality, oil field wastes, brine water, rains flushing agricultural chemicals into the river - heavy rains occurred on Thanksgiving Day - and cold weather were sufficient to cause numerous mortalities in the badly polluted zone between U. S. 67 and U. S. 290 (Figure 4).

The continuing deaths below U. S. 290 and Independence Creek are not as easily explained. Conversation with a rancher who observed the reactions of dying fish provides reasons for suspecting chemical pollution. The fish were described as trying to get out of the river onto the bank. All species of fish - many largemouth bass, shad, gar, carp, river carpsucker, sunfish, and channel catfish - were affected in areas of considerable dilution by fresh spring water. Chlorides were 3,500 ppm on Hale's place December 20, 1968. Chlorides fluctuated around 6,000 ppm upstream of his ranch to U. S. 67 on December 20, 1968.

Discussion

Pecos River Problems

The basic problems concerning fisheries on the Pecos River are as follows:

- 1) Loss of water volume because of damming and irrigation. Periods of drought cause salinity to increase throughout the system. The fish population in areas where water volume is reduced are exposed to less quantity fluctuation; however, any pollutant has its effects intensified in the smaller volume of water, and salinities are higher (Figure 5). Those areas which are periodically flushed with irrigation water support better fish populations than other areas (Figures 8 and 9). The water retained by Red Bluff Reservoir is thermally and chemically stratified. Lower strata are more saline than upper strata. Irrigation releases tend to be from upper strata because of the nature of the flow when large releases are made. Slower releases at maintenance flow takes more saline water from deeper strata.

- 2) Natural saline springs flow in some areas, and surface runoff from alkaline soil and salt deposits add to salinity in the Pecos River following rains.

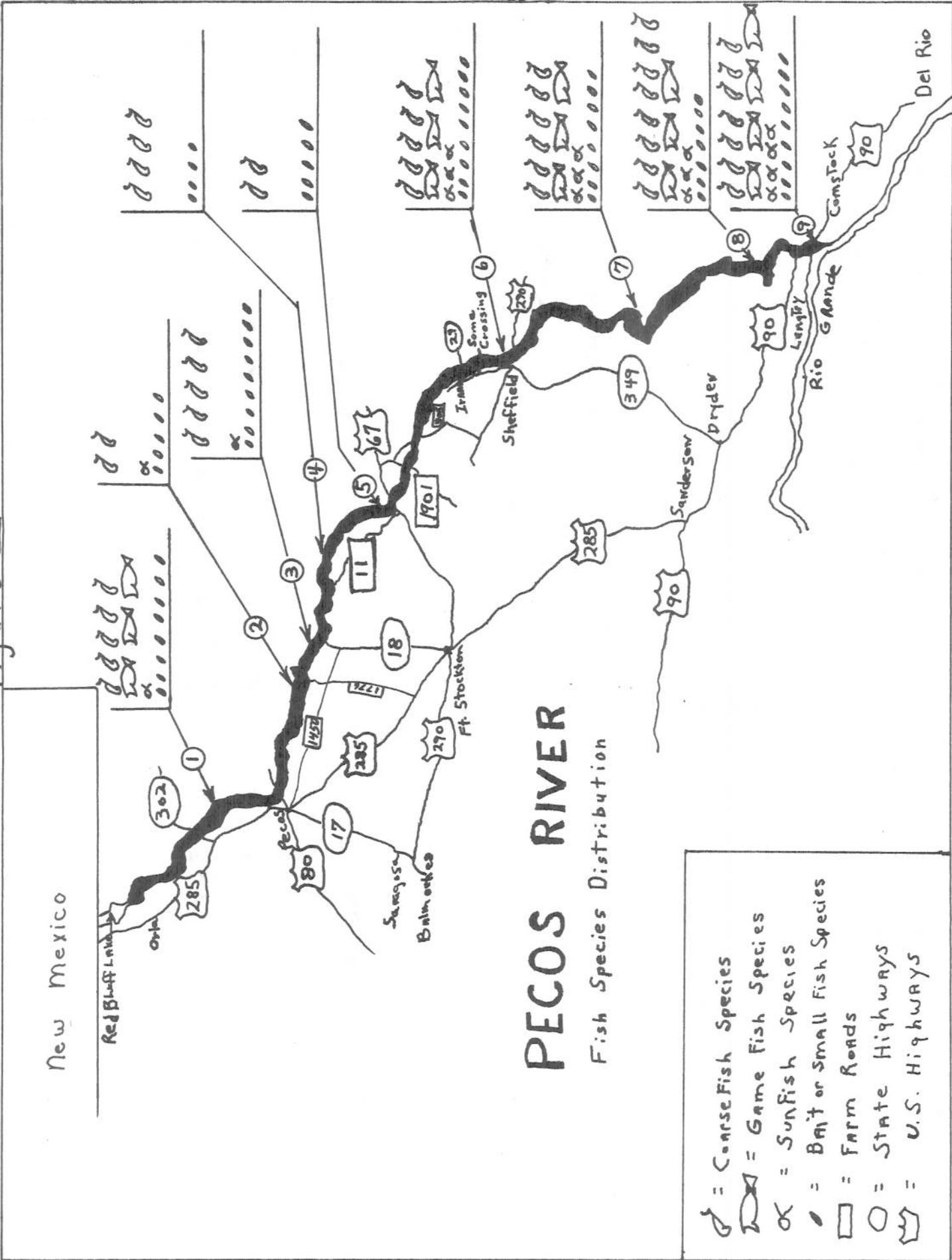
Figure 8



Species	Site Number-----	1	2	3	4	5	6	7	8	9
Alligator gar										♂
Longnose gar			♂	♂	♂	♂	♂	♂	♂	♂
Gizzard shad		♂	♂	♂	♂	♂	♂	♂	♂	♂
Mexican tetra		♂	♂	♂			♂	♂	♂	♂
Blue sucker									♂	
Smallmouth buffalo		♂								♂
River carpsucker		♂		♂			♂	♂	♂	♂
Gray redhorse							♂	♂	♂	♂
Carp		♂		♂	♂		♂	♂	♂	♂
Suckermouth minnow										♂
Rio Grande shiner									♂	
Texas shiner										♂
Blacktail shiner								♂	♂	♂
Red shiner		♂	♂	♂			♂	♂	♂	♂
Proserpine shiner				♂			♂	♂	♂	
Sand shiner								♂		
Roundnose minnow							♂	♂		
Bullhead minnow							♂	♂	♂	♂
Channel catfish		♂					♂	♂	♂	♂
Blue catfish										♂
Black bullhead									♂	
Flathead catfish						♂	♂	♂	♂	♂
Southern rainwater killifish		♂	♂	♂	♂	♂	♂			
Rio Grande killifish		♂		♂		♂				
Plains killifish		♂		♂						
Pecos River pupfish		♂		♂	♂	♂				
Mosquitofish		♂	♂	♂	♂	♂	♂	♂	♂	♂
Tidewater silversides		♂	♂	♂	♂	♂	♂	♂	♂	♂
White bass		♂								
Largemouth bass		♂					♂	♂	♂	♂
Green sunfish		♂		♂			♂	♂		♂
Bluegill							♂	♂	♂	♂
Longear sunfish				♂			♂	♂	♂	♂
Freshwater drum										♂
Rio Grande perch		♂		♂	♂		♂	♂	♂	♂

- 1-16-Mile Dam
- 2-Imperial Diversion Dam
- 3-Blue Ranch
- 4-Blue and Pump Hole Area
- 5-Near McCamey U.S. 67
- 6-Hale's Ranch U.S. 290
- 7-Independence Creek
- 8-Henry Mills - Pandale
- 9-High Bridge

Figure 9



New Mexico

PECOS RIVER

Fish Species Distribution

- ♁ = Coarse Fish Species
- ♁ = Game Fish Species
- ♁ = Sunfish Species
- ♁ = Bait or Small Fish Species
- ▭ = Farm Roads
- = State Highways
- ♁ = U.S. Highways

3) Brine water, crude oil, and byproducts of petroleum operations enter the Pecos River in many areas. Recent legislation has abolished the use of surface disposal pits for brine water and the pits are being leveled by bulldozing. Ruptured flow lines and worn-out stuffing boxes allow crude oil to be spilled, and much is spilled directly into the river due to the proximity of wells (Figure 10).

4) Pollution from agricultural areas. Residual defoliants, insecticides, and other chemicals are washed into the stream by tail water from irrigation and runoff from rains. Fertilizers, (chemical and organic) enter in the same manner.

5) Pollution from livestock feeding operations. There is a pig pen just west of Farm Road 1901 on the banks of the Pecos River. All resulting wastes are washed into the river during rains.

6) Water quality changes are often drastic and sudden. Any rain sufficient to produce runoff adds fresh water (non-saline) and changes the osmotic balance of all organisms living in the river. The general quality of the water in areas which are most highly saline depends on rains and irrigation tail water to reduce salinity.

The area between U. S. Highway 67 and 290 is practically devoid of game fish (Figures 8 and 9). One largemouth bass was found near Soma Crossing during the float trip (Figures 4 and 7). All other game fish - alive or dead - were found above Farm Road 1776 or on or below Hale's Ranch.

Conclusions and Recommendations

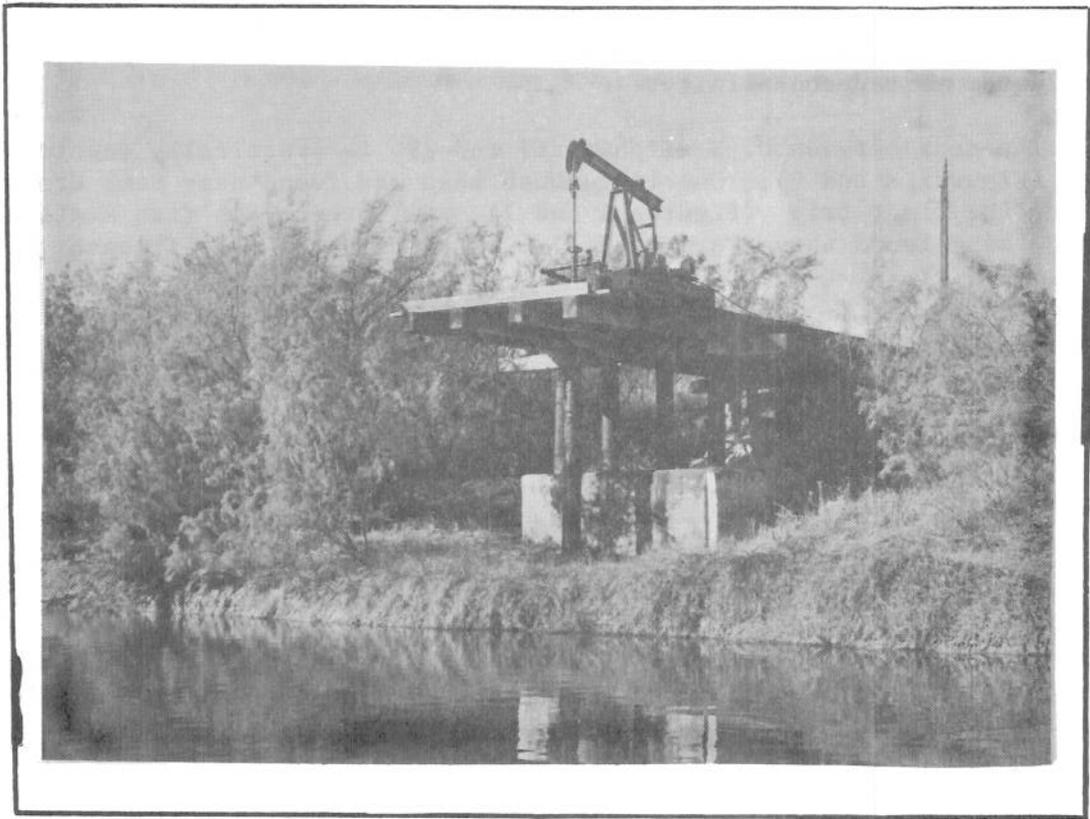
Many years were necessary to develop the conditions present in the Pecos River today. The conditions could and should be better than they are. It is doubtful that the river will ever be non-saline but it is possible to improve it immensely.

All oil field wastes and discharges should be kept out of the river. Salt water of greater salinity than that in which native game fish have survived for 2 years should be kept from the river. Largemouth bass stocked in Lake Imperial lived for approximately 2 years in water with chlorides fluctuating around 3,000 ppm. Factors other than chlorides are important but chlorides are used as an index.

Careful attention to the type of insecticides and defoliants used on the watershed would be advisable. Materials which rapidly detoxify should be used. Hard insecticides - those of long residual effects - should be avoided whenever possible and all irrigation tail water should be retained and monitored for contents before entering the river. All water possible should be returned to the river, however.

Treated sewage water from adjacent towns such as Iraan could be instrumental in improving the water quality (Table 4). Dams on arroyos which would detain runoff and gradually percolate fresh water into the stream could aid in maintaining lower salinities and more stable water quality.

Figure 10



OIL WELL ON BANKS OF PEGOS RIVER

All waters of Region I-D should be monitored for insecticide content annually so that if a fish die-off occurred unexpectedly the presence of additional (or any change in insecticide content) would be measurable. Current news releases concerning DDT in the Great Lakes States indicate that this is imperative. We are lucky here in West Texas that much of our land is ranchland and not so heavily saturated with hard insecticides as other areas.

All livestock feeding operations should retain runoff water and treat it before allowing entry into the Pecos River. Flow from natural saline springs and old unplugged brine wells should be diverted, plugged, or treated to remove salts and returned to the river if possible.

Imperial Die-Off

Notice was received in mid-February that a fish die-off had occurred at Lake Imperial "about 2 weeks ago". Subsequent field examination on February 17 and 18 indicated that the kill occurred approximately in the middle of December or just before Christmas. Netting indicated an incomplete kill (Table 5 and Figure 11).

Numerous waterfowl, decay, wind, and wild animals had removed most of the fish from the scene. Dead fish species observed were largemouth bass, white bass, longnose gar, gizzard shad, river carpsucker, and carp. The concessionaire stated that shad were the most abundant victims, but that many largemouth bass and white bass died. He said he saw few carp and only one was located by project personnel. No channel catfish were seen. Local residents said that some "very cold" weather occurred prior to the kill. No definite date for the kill could be established.

Salinity, cold weather, oil field brine and chemicals, and possibly agricultural chemicals are suspected causes. All could have contributed. The source of the kill is unknown. Of these factors, evidence of oil field pollutants such as pressurized gases, emulsified oil, and brine leaks from a storage tank near the lake were observed in the field February 17 and 18, 1969. Photographs are on file in Del Rio.

Table 5

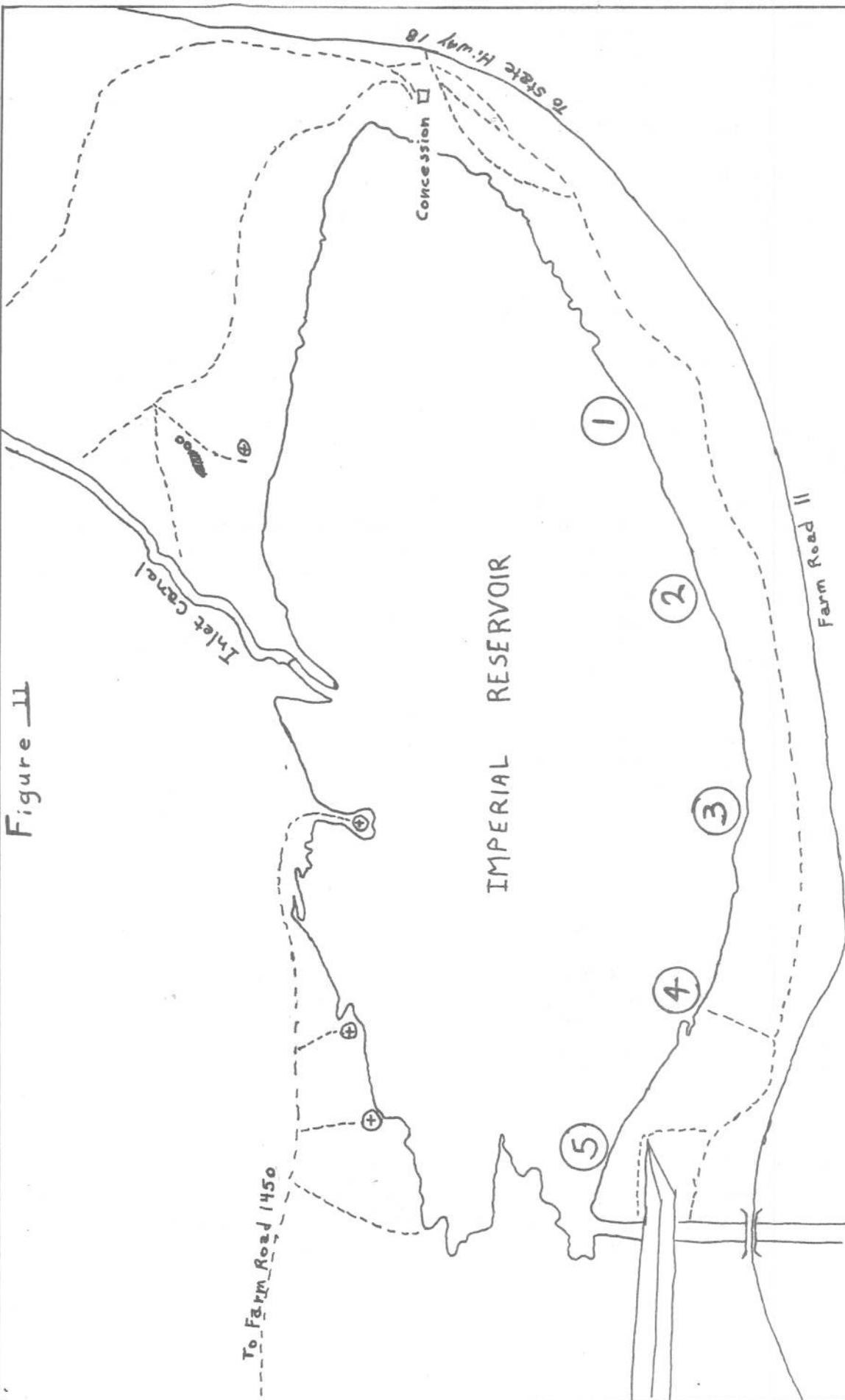
Imperial Reservoir - February 17, 1969

Survey Results From a Standard Survey With 4 Standard Survey Gill Nets, One Largemesh Gill Net, and 2 Drags With a 40-foot 1/4-inch Mesh Seine.

NETTING Species	No.	Per Cent Total		Per Cent Avg.		SEINING	
		No.	Weight	Wgt.	"K"	No.	Per Cent
Gizzard shad	46	61.33	15.27	47.37	0.33	2.3	
River carpsucker	10	13.33	7.11	22.06	0.71	2.7	
Carp	13	17.34	2.01	6.24	0.15	3.4	
Red shiner							32 69.56
Tidewater silversides							14 30.44
White bass	6	8.00	7.84	24.33	1.31	3.2	
Totals	75	100.00	32.23	100.00			46 100.00



Figure 11



Netting Sites



Approximate Scale In Miles

- (+) = Oil Pumps
- oo = Oil Tanks
- = Open Oil and Saffwater drainage
- = Lake Roads

Credits

Most of the field work and data accumulation for this job was done by Ronald R. Anderson, assistant project leader, prior to his resignation. Detailed notes are available on all phases of the study. Compilation and tabulation of data were by Joe Vasquez and J. W. Aley, Technicians.

Prepared by George Henderson, Jr.
Project Leader

Approved by Marion Toole
Coordinator

Date April 17, 1969

Leo D. Lewis
Inland Fisheries Supervisor

Appendix A

Checklist of Species Taken in Surveys in the Pecos River

COMMON NAMES

Alligator gar
Longnose gar
Gizzard shad
Mexican tetra
Blue sucker
Smallmouth buffalo
River carpsucker
Gray redhorse
Carp
Suckermouth minnow
Rio Grande shiner
Texas shiner
Blacktail shiner
Red shiner
Proserpine shiner
Sand shiner
Roundnose minnow
Plains minnow
Bullhead minnow
Channel catfish
Blue catfish
Black bullhead
Flathead catfish
Southern rainwater killifish
Rio Grande killifish
Plains killifish
Pecos River pupfish
Mosquitofish
Tidewater silversides
White bass
Largemouth bass
Warmouth
Green sunfish
Bluegill
Longear sunfish
Freshwater drum
Red drum
Rio Grande perch

SCIENTIFIC NAMES

Lepisosteus spatula
Lepisosteus osseus
Dorosoma cepedianum
Astyanax mexicanus
Cycleptus elongatus
Ictiobus bubalus
Carpiodes carpio
Moxostoma congestum
Cyprinus carpio
Phenacobius mirabilis
Notropis jemezanus
Notropis amabilis
Notropis venustus
Notropis lutrensis
Notropis proserpinus
Notropis stramineus
Dionda episcopa
Hybognathus placita
Pimephales vigilax
Ictalurus punctatus
Ictalurus furcatus
Ictalurus melas
Pylodictis olivaris
Lucania parva
Fundulus zebrinus
Fundulus kansae
Cyprinodon sp.
Gambusia sp.
Menidia beryllina
Roccus chrysops
Micropterus salmoides
Chaenobryttus gulosus
Lepomis cyanellus
Lepomis macrochirus
Lepomis megalotis
Aplodinotus grunniens
Sciaenops ocellata
Cichlasoma cyanoguttatum