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Report of Fisheries Investigations  
Basic Survey and Inventory of Fish Species Present in Llano Grande and the  
Associated Floodway

by

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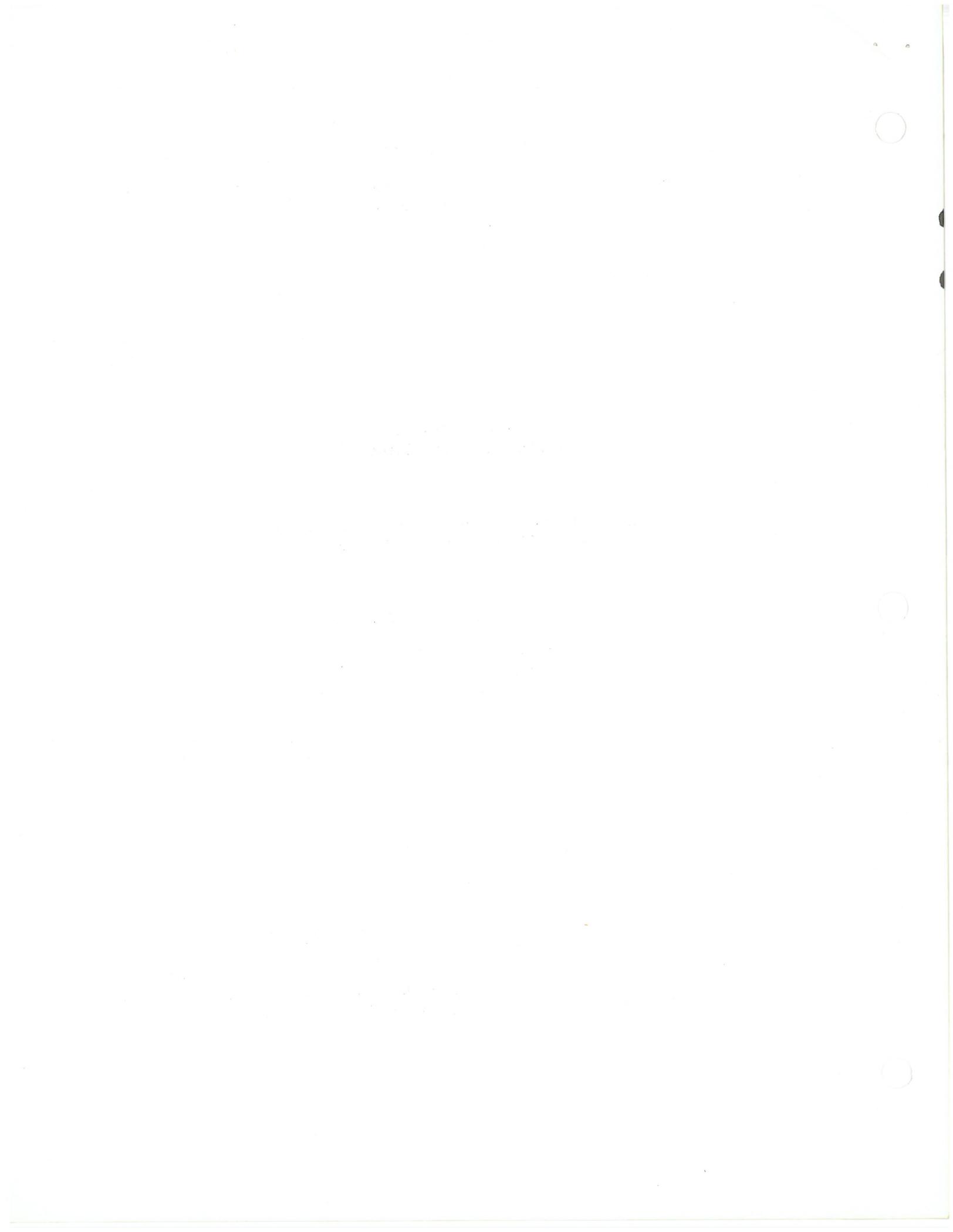
Dingell-Johnson Project F-6-R-6, Job B-12  
July 1, 1958 - December 31, 1958

H. D. Dodgen - Executive Secretary

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Austin, Texas

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## Job Completion Report

State of Texas

Project No. F-6-R-6

Job No. B-12

Name: Fisheries Investigations and Surveys of  
the Waters of Region 8-B.

Title: Basic Survey and Inventory of Fish Species  
Present in Llano Grande and the Associated  
Floodway.

Period Covered:

July 1, 1958 - December 31, 1958

### ABSTRACT:

1. A survey of the chemical and physical characters and the fish population of the floodway was made. Water samples were taken and netting and seining collections were made.
2. The floodway is a slow moving, muddy stream in south Texas with a small watershed, bordered by levees, and subject to flooding from the Rio Grande. Two shallow muddy lakes, Llano Grande and Campacuas, are included in the floodway.
3. It is dependent on rains and irrigation runoff except during floods on the Rio Grande. In October and November, 1958, there was an extreme flood.
4. Typha and Scirpus were very abundant and were the only aquatic plants found, except for Potamogeton in one pond and scattered green algae.
5. Pollution consists of agricultural chemicals from adjacent fields, wash waters from canneries, and domestic sewage.
6. Netting and seining showed a predominantly rough fish population. The effects of the flood on the fish are discussed.
7. A complete kill of the fish, restocking and a future resurvey are recommended.

### PROCEDURE:

Maps and information on the history and uses of the lakes and the floodway were gathered through conferences with the International Boundary and Water Commission (IBWC); Mr. Charles E. Pearre, a member of the Weslaco Rotary Club; Game and Fish Warden W. J. Frazier; and Tom Reed, a commercial fisherman who owns a camp on Llano Grande. Map I, showing the entire floodway system, was made from county maps of the Texas Highway Department and maps of the floodway printed by the IBWC. Maps II and III, of Llano Grande and Campacuas, were made from maps and aerial photos from the IBWC.

General ecological conditions of the lakes, floodway, and surrounding country were observed and noted on six field trips made during the survey. Water samples were taken at nine seining stations (3, 7, 8, 9, 11, 17, 19, 22, 25), and were tested for the principle chemical factors. The results are shown in Table II. Special salinity samples were taken

from the lower reaches of both outlets and tested at the Marine Laboratory at Rockport. Three netting collections were made at each of the six netting stations shown on Maps II and III. Two were made before and one after the flood of October and November. The experimental gill nets used were 125 by 8 feet, with 25 foot sections of 1,  $1\frac{1}{2}$ , 2,  $2\frac{1}{2}$ , and 3 inch square mesh. All fish caught in the gill nets were weighed, measured, and their sex and condition determined. Some species were checked for stomach contents and parasites. Tables III, IV, V, and VI show the numbers and weights of the fish netted. Table VII shows lengths, weights, and "K" factors of the netted fish, and Table VIII shows the netting success. Thirty five seining collections were made with a 20 by 4 foot nylon seine, with  $\frac{1}{4}$  inch mesh, at 25 seining stations as shown on Map I. Ten of the seining collections were made at selected stations after the flood as a recheck. All fish caught in seines were preserved in formaldehyde and brought back to the laboratory to be identified, except in cases of very large numbers of fish being taken, when most of the more numerous species were counted and discarded. The marine species were identified by the biologists at the Marine Laboratory in Rockport. Tables IX and X show the results of the seining.

#### PHYSICAL CHARACTERISTICS:

The floodway system runs for about 85 miles through Hidalgo, Cameron, and Willacy counties in south Texas. Near the lower end of Llano Grande the Main Floodway branches into the North Floodway and Arroyo Colorado. The IBWC has built levees along most of the length of these prehistoric channels of the Rio Grande to channel the floodwaters drained from the Rio Grande and thus protect the heavily populated lower Rio Grande valley from high floods.

At other than flood periods it has a very small watershed, being almost completely dependent on runoff water from adjacent fields and seepage from irrigation canals, although some drainage canals run as far as six or eight miles to empty into the floodway. The land on the watershed is principally flat, irrigated farmland, with vegetables, cotton, and citrus fruit the main crops. Row crops and grazing are the main uses of the land between the levees. Typical coastal prairie is found only near the mouths of the floodway.

The Main Floodway is typically a slow moving, shallow stream with dirt banks, which had a thick silt bottom (hip deep in at least one place). The flood scoured out most of the silt, leaving hard bottom over which a thin coating of silt has been redeposited. The shore varies from mud flats to vertical banks two to five feet high with overhanging grass and brush. In one place south of McAllen the stream has been dredged out so that it has steep banks 25 to 30 feet high. Llano Grande is about seven miles long, covers about 220 acres, and has an estimated average depth of five feet. The upper part of Llano Grande, west of Highway 88 crossing, is similar to the Main Floodway. The lower part differs in that it is deeper, up to ten feet or more, and did not have much silt before the flood. Campacuas, at the head of the North Floodway, is about two miles long, covers about 120 acres, and has an estimated average depth of three feet. The North Floodway runs through level ground and generally has low (two or three feet) cut banks with grass and other terrestrial plants overhanging it. The bottom was mostly silt, now scoured out by the flood. The lower ten to fifteen miles tend to be brackish at normal water flow. Arroyo Colorado begins at three dams, or drop structures located south of Mercedes. These dams, with a combined drop of 19 feet (5, 7, and 7 feet respectively), maintain the level of Llano Grande. They were built to keep the water from undermining the Fueste Syphon which passes a large irrigation canal under the floodway at that point. Arroyo Colorado is at

The bottom of a canyon with 30 to 50 foot mud and clay bluffs on both sides. Above Port Harlingen, there are grassy or brushy shores at the bottom of the arroyo. The usual soft silt bottom has now been scoured out. Below the port of arroyo has been dredged out into a ship channel and the banks drop straight from the bluffs into the water. The bluffs become lower and finally disappear near the mouth. The ship channel is salt, brackish, or fresh water depending on the amount of fresh water flow from the floodway.

#### WATER FLOW:

The small tributaries of the floodway (mainly drainage canals) are intermittent, flowing only after rains or runoff from irrigation. There is normally a small flow from the Main Floodway into Llano Grande, thence over the three small dams into the Arroyo Colorado. Campacuas normally has no connection with either Llano Grande or the North Floodway except perhaps through a marsh at its northern (downstream) end. The North Floodway is similar to the Main Floodway in that it depends on rainwater and irrigation runoff, except for the lower reaches which are tidal.

The floodway is connected to the Rio Grande only during floods on the Rio Grande, at which time water may drain into the floodway at either the Mission or Hackney inlet. Water begins to flow into the floodway at the Mission inlet when the Rio Grande rises to 109 feet above sea level from its normal level of about 100 feet. At the Hackney inlet the rise must be from about 80 feet to about 98 feet. Before the construction of Falcon Dam, floodwaters entered the floodway on the average of once every two years. The IBWC now estimates that because of Falcon Dam the floodway will not be flooded more often than once in every four years.

In late September flooding began on the Rio Grande. On October 13, 1958, some water began to trickle into the floodway, the first floodwater to enter since 1949. On October 13th and 14th sandbags were removed from the Hackney inlet and a canal was cut through the high ground at the Mission inlet, letting more water into the floodway. Flooding continued until the first week in December, by which time the flow from the Rio Grande had ceased and the floodway had returned to its normal level. At its peak, the floodwater was about 28 to 30 feet above normal level at Llano Grande, and remained 15 feet above normal for over a month.

#### AQUATIC VEGETATION

Pondweed (Potamogeton) was found at seining station #13 in Floodway Pond #1 (our name), otherwise submerged vegetation was absent due to high turbidity, probably caused by rough fish. Cattails (Typha) and bullrushes (Scirpus), the only emergent aquatic plants noted, were found on much of the shore line of the Main Floodway and Llano Grande. Campacuas is almost completely surrounded by Typha and Scirpus. The North Floodway has a few patches of Typha, but is otherwise bare of aquatic vegetation. Only a few patches of Typha were seen on the upper end of Arroyo Colorado, none on the lower, probably due to salinity and the lack of shallow water. Floodway Pond #1 and #3 and Floodway Farm Pond (our names) have heavy stands of Typha around the edges. On July 8th and 9th there was an algae bloom on the upper part of Llano Grande. Scattered patches of green algae were noted in quiet shallow backwaters of the Main Floodway on July 21. The flood removed many large stands of Typha and Scirpus, in some cases also removing the silt they were rooted in. All the remaining Typha and Scirpus were killed back to the roots, whether by the flooding or the freeze which immediately followed it or by the combination of the two is not certain.

## POLLUTION:

Six or eight years ago the fruit and vegetable canneries began dumping their waste wash water, containing insecticides and other chemicals, into drainage ditches in Weslaco, Donna, and other towns along the floodway. Rains wash these wastes into the floodway where at various times they have apparently caused considerable fish kills. In one case the local game warden was able to trace the pollution back to a particular cannery. Cotton and vegetable fields are frequently treated with insecticides which may also be washed into the floodway and cause fish kills. On a preliminary trip to Llano Grande on February 25, 1958, the Project Leader noted a fish kill consisting mostly of gizzard shad and Rio Grande perch. It was assumed to have been caused by cannery wastes entering the lake from rains a few days earlier. On July 8, 1958, the Assistant Leader noted a fish kill consisting mostly of threadfin shad, 3/4 to three inches long, with a few three inch carp and buffalo. There had been heavy rains three or four days before which may have caused the kill either through washed in insecticides or excessive siltation.

Most of the cities along the floodway have at one time or another dumped sewage into the floodway. The City of Weslaco stopped two or three years ago, but it is reported that the City of Donna is still doing so. The City of McAllen was dumping raw sewage into the floodway on July 24th about 1/2 mile west of the Highway 336 crossing. Game Warden W. J. Frazier, who was of great aid in finding the source of the pollution, said he would take the proper steps to remedy it. No fish were found for at least one mile downstream, and the effects could be seen and smelled for five miles. The stream was not polluted and fish were found above the point where the sewage entered.

## ANNOTATED SPECIES LIST:

Lepisosteus spatula - alligator gar. The largest gar caught, found in both Llano Grande and Campacuas as well as Pond #1. Of the 25 taken, only two were caught after the flood. Apparently many left during the flood. One 2296 gm. specimen had a large gizzard shad in its stomach.

Lepisosteus productus - spotted gar. The most common gar netted, taken in eleven of the twelve nets set before the flood, but only two of the six nets after the flood. Of the 66 specimens caught, only one 964 gm. individual had tapeworms, and another, weighing 936 gm., had visceral roundworms. This is a low incidence of parasitism.

Lepisosteus osseus - longnose gar. Found in both Campacuas and the lower part of Llano Grande before the flood, but only in Llano Grande after it. There seems to be a change in distribution but not in numbers as a result of the flood. One 2240 gm. individual had visceral roundworms, and a smaller one had five shad in its stomach. No gar were caught in Campacuas after the flood, but remains of gar were seen on the bank where fisherman had left them.

Brevoortia patronis - menhaden. Nine specimens caught in seines in the fresh water of the North Floodway, and two in brackish water of Arroyo Colorado. A marine fish that occasionally comes into fresh water.

Dorosoma petenense - threadfin shad. The second most common fish seined before the flood, comprising more than 40% of the seining collections. Only one specimen, seven inches long, was caught in a gill net; the rest were four inches or less, but many were in breeding colors. Only eight were found in the Main Floodway, the rest were in the two lakes, Llano Grande and Campacuas. After the flood they dropped to less than 10% of the

fish taken in seines, and by far the largest part of them were caught in the North Floodway. This species constituted the major food found in the stomachs of game fish and gar. Prior to the start of this investigation, on February 26, 1958, the Project Leader observed four inch threadfins preparing to spawn close to the bank of Llano Grande. Many ripe females and a few nearly ripe males were wriggling in the bermuda grass hanging from the bank into the water. All were in brilliant yellow breeding colors.

Dorosoma cepedianum - gizzard shad. Caught mostly in Llano Grande and Campacuas, but a few were caught in the Main Floodway and the North Floodway. None were taken in seines after the flood, apparently the flooding killed many of the small ones.

Astyanax fasciatus - Rio Grande tetra. Only one adult specimen was seined from Campacuas before the flood, although because of the periodic connection with the Rio Grande many were expected. It is possible that they were preyed upon faster than they could reproduce. After the flood, adults or young or both were found at every station seined. They were restocked sufficiently to become the second most common fish seined, making up over 16% of the total.

Ictiobus bubalus - smallmouth buffalo. Found at all stations in Campacuas and Llano Grande, but not in all nets. While they were apparently reduced in number by the flood, the average weight went up slightly. It is a bottom feeder and stirs up a lot of silt as it feeds, destroying spawning areas for desirable fish which can not spawn on a silty bottom. They are fished for commercially on Llano Grande.

Cyprinus carpio - German carp. Young were caught in seines before the flood only in Llano Grande and Pond #1, but adults were caught in nets at all stations. After the flood the number of adults dropped markedly, but the young were more common. Before the flood 60 were netted, after, only eight were caught. Carp have a commercial value, but are not considered as valuable as buffalo. Carp are also bottom feeders, and stir up silt like the buffalo.

Opsopoeodus emiliae - pugnose minnow. Only one specimen caught in the Main Floodway after the flood. A rare and unimportant species in these waters.

Hybopsis aestivalis - speckled chub. Only one specimen caught in the Main Floodway after the flood. Not an important species.

Notropis braytoni - Tamaulipas shiner. Only one specimen caught in the Main Floodway after the flood. Unimportant in these waters.

Notropis lutrensis - redhorse shiner. Found mostly in running water, but some were found in Llano Grande and Pond #3. More common in the Main Floodway before the flood and in the North Floodway afterward. Of minor importance as a forage fish because of its relative small numbers.

Galeichthys felis - sea catfish. A primarily marine species found in the brackish water of Arroyo Colorado. Ten specimens caught by seine.

Ictalurus punctatus - channel catfish. Found in both lakes before the flood, but only in Llano Grande afterward. Of the 17 caught, one specimen, weighing 1361 gms., had fish remains in its stomach, and another smaller individual was infested with visceral roundworms. This is a low rate of parasitic infestation compared with those of Lake Corpus Christi and other lakes in this region.

Ictalurus furcatus - blue catfish. Four specimens caught in both lakes before the flood, 33 taken afterward, most of them in the upper part of Llano Grande. They were apparently restocked from the Rio Grande during the flood. Seven specimens had a total of 39 threadfin shad in their stomachs, with a maximum of 12 shad in one fish. Two fish contained three silversides (Menidia beryllina). Three had unidentifiable fish remains, and one contained a 20 gm. white crappie. Four individuals were infested with roundworms, and one had tapeworms. This is a low incidence of parasitism.

Pylodictus olivaris - flathead catfish. Only one specimen taken in Llano Grande before the flood. A good game fish but too rare in these waters to be of any value.

Lucania parva - rainwater fish. One specimen found in Arroyo Colorado after the flood. An unimportant minnow in these waters.

Fundulus grandis - gulf killifish. Found scattered throughout the whole floodway, even into the brackish water of Arroyo Colorado. Not an important species.

Cyprinodon variegatus - sea pupfish. Found scattered throughout the floodway system including the brackish water of the mouths. More common after the flood. Not important to fishing.

Gambusia affinis - mosquitofish. The most common fish caught in seines, comprising over 44% of the catch before the flood, and over 57% afterward. Taken at every seining station except a polluted station and two brackish water stations. Valuable for the control of mosquitoes, and potentially valuable as a forage fish in the absence of other more desirable forage fish. It is not a preferred food of other fish. Due to the difficulty of identifying species of Gambusia, all specimens were assigned to affinis, the most common species.

Mollienisia latipinna - sailfin molly. Found scattered throughout the floodway system. Less common after the flood, dropping from over 7% to less than 2½% of the total fish seined. Too uncommon on these waters to be more than minor importance.

Mugil cephalus - striped mullet. Two specimens caught in brackish water of Arroyo Colorado before the flood, two taken in fresh water of the North Floodway after the flood. This is primarily a marine fish which wanders into fresh water occasionally.

Menidia beryllina - tidewater silverside. Found in brackish water of Arroyo Colorado and North Floodway, and one each from Llano Grande and Campacuas before the flood. Found only in Llano Grande and the Main Floodway afterward. Also found in the stomachs of blue catfish in Llano Grande after the flood.

Chaenobryttus gulosus - warmouth bass. Only four specimens found, in Llano Grande, Campacuas, and the North Floodway. A good pan fish, but too uncommon in these waters to be of any value.

Lepomis macrochirus - bluegill sunfish. Two caught in seines in the North Floodway after the flood.

Pomoxis annularis - white crappie. Before the flood, Campacuas yielded 23 specimens averaging 149 gms., but only three were caught after the flood. A 1½ pound fish was caught in Llano Grande after the flood. Four of the larger specimens were infested with roundworms. Two had one shad each in their stomachs, and one was found in the stomach of a blue catfish.

Aplodinotus grunniens - freshwater drum. Eight nets at five stations in Llano Grande and Campacuas yielded 14 specimens before the flood. After the flood 25 specimens were caught in four nets. Apparently they were restocked by the flood. Only one fish was infested with roundworms, a surprisingly low incidence.

Leiostomus xanthurus - spot croaker. Only two specimens seined in brackish water near the mouth of Arroyo Colorado. A marine species with no importance in fresh water.

Micropogon undulatus - golden croaker. Two specimens seined from brackish water of Arroyo Colorado. A marine species with no importance in fresh water.

Lagodon rhomboides - pinfish. Found in the brackish water of Arroyo Colorado. A marine species which wanders into brackish water, of no importance in fresh water.

Cichlasoma cyanoguttatum - Rio Grande perch. Caught in most of the floodway system, except North Floodway. It is of some value as bait and is sometimes sought after as a pan fish.

Eucinostomus gula - Mojarra. Only one specimen found in brackish water of Arroyo Colorado. A marine species, not important in fresh water.

Trachinotus carolinus - Pompano. Two specimens caught in brackish water of Arroyo Colorado. A marine species with no importance in fresh water.

#### DISCUSSION:

The IBWC estimates that some water will spill into the floodway from the Rio Grande on the average of once in every four years. Even with Azucar and Falcon Reservoirs to control major upstream floods, heavy rains on the local drainages downstream of these reservoirs can cause high enough flooding to make use of the floodway. Another extreme flood, such as was experienced this year, is unlikely in the foreseeable future. Any flooding from the Rio Grande would allow fish to enter the floodway, but the number entering would probably be small. The rough fish (carp, buffalo, shad, and gar) should not be able to become an appreciable part of the population for several years, presuming a sizable population of game fish (bass and catfish) is already in the lakes. Flooding from the Rio Grande would restock rough fish, Rio Grande tetras, Rio Grande perch, and freshwater drum, but also would bring in a fresh supply of blue catfish along with various minnows.

Apparently Llano Grande was a good fishing lake and was heavily fished years ago, but in the last eight years or so the game fish population has declined, and so has the fishing pressure. The decline in the game fish seems to correspond with the lack of flooding due to the drought. It is possible that periodic flooding from the Rio Grande kept the floodway lakes in some sort of balance by restocking depleted species and providing an outlet for over-abundant species. The recurrent floods probably also kept the bottom swept fairly clear of silt, so that game species which require a hard bottom could spawn. When the flooding stopped, the silt probably built up, and thus the lakes became more suitable for spawning by carp and buffalo. These fish stir up the soft bottom silt and make the bottom less suitable for game fish spawning because of the increased silt. Destruction by predators, including fishermen, would, in conjunction with poor spawning success, greatly reduce the game fish population.

Pollution also may have played a part in reducing the game fish numbers. Domestic sewage and cannery wash water containing insecticides, both poisonous to fish life, were

first discharged into the floodway about eight years ago. Crop dusting and spraying also may have been of considerable importance.

The flood of October and November 1958 removed most of the silt in the floodway, although some has been redeposited. Many of the emergent aquatic plants were removed too. The flood had mixed results on the fish population, increasing some species and decreasing others. Alligator gar and spotted gar were greatly reduced in numbers, but longnose gar were apparently unaffected. Both species of shad were reduced in number, but threadfins suffered the greatest reduction. Rio Grande tetras were restocked by the flood, showing the most notable change in numbers of any species. The number of adult carp and buffalo were reduced, but young carp showed a definite increase. Blue catfish showed a definite increase, especially in an area (Station B) where the silt was swept away, leaving a hard bottom. Channel catfish increased also, but not so much as blue catfish. The flood apparently removed many crappie, but allowed some to travel upstream to Llano Grande from Campacuas where they had been confined. Freshwater drum appeared in larger numbers after the flood.

Six species were found after the flood which were not found before, but four of these were represented by only one specimen each, one by two specimens, and one by seven. They were rare after the flood and could easily have been missed in seining prior to the flood. Eight species which were found before the flood were not found afterward, but seven of these were marine species found in the brackish water of the mouths of the floodway which were not seined after the flood. The eighth species was a rare species and could have been missed in seining. These species are of relatively little importance.

If the two lakes on the floodway are ever to be of any use in sport fishing the floodway must be renovated and restocked. The extreme preponderance of rough fish makes removal of all fish and restocking, rather than just restocking or a partial kill, the only practical means of renovation. With removal of the rough fish the lakes should clear up, the bottom silt should become firm, and aquatic vegetation should re-establish itself. The lakes should become good bass and catfish lakes.

The forage fish that should be stocked for food for the game fish is probably threadfin shad because it reproduces rapidly, but never grows too big to be eaten by the large bass or catfish. Rio Grande tetras should perhaps be stocked, if available, for the same reasons, although they do not reproduce as rapidly. Gizzard shad should not be stocked. It is a good forage fish when small, but will grow too large to be eaten by bass and catfish, and thus can overstock as adults. Red and Tamalipas shiners and Gambusia may be stocked if available. Blue catfish and flathead catfish if available, channel catfish, black bass, and white crappie should be the best game fish to stock.

#### RECOMMENDATIONS:

1. Treatment of the complete floodway with rotenone to eradicate all fish.
2. Restocking with black bass, white crappie, channel catfish, and if available blue catfish and flathead catfish as game fish. Restocking with threadfin shad and Rio Grande tetra as forage fish if available.
3. Resurvey of the floodway a year after the renovation to check the results.

#### SUMMARY:

Netting and seining collections and water samples were taken and general ecological observations were made. The floodway is a slow moving, muddy stream with emergent

vegetation but no submerged vegetation. A large rough fish population was found. The flood of October and November swept out silt and aquatic vegetation, and altered the fish population. Pollution consists of agricultural insecticides, wash water from canneries, and domestic sewage. A complete kill and restocking and a future resurvey are recommended.

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Approved by Marion Toole  
Director Inland Fisheries Division

Date March 9, 1959

## Key to Seining and Water Analysis Stations on Floodway

| Station Number | Location   |
|----------------|--|
| 1.             | Main Floodway, 200 yds. east of Madero road south of Mission.  |
| 2.             | Main Floodway, 2 blocks east of South 10th St. crossing, McAllen.  |
| *3.            | Main Floodway, Highway 281 crossing south of Pharr.  |
| 4.             | Main Floodway, Highway 1426 crossing south of San Juan.  |
| 5.             | Drainage ditch, 3 miles south of Floodway on Highway 281.  |
| 6.             | Main Floodway, Highway 493 crossing south of Donna.  |
| *7.            | Llano Grande, $3\frac{1}{2}$ miles west of Highway 88 crossing, at right angle bend in lake.                     |
| *8.            | Llano Grande, 2 miles west of Highway 88, opposite mouth of slough.  |
| *9.            | Llano Grande, $\frac{1}{3}$ mile west of Highway 88, north shore.  |
| 10.            | Llano Grande, $\frac{1}{3}$ mile east of Highway 88, north shore.  |
| *11.           | Llano Grande, head of lower outlet canal.  |
| 12.            | Llano Grande, $\frac{1}{4}$ mile north golf course footbridge.   |
| 13.            | Floodway Pond #1, $3\frac{1}{2}$ miles west of Highway 88, inside of south levee.                                |
| 14.            | Floodway Pond #3, 3 miles west of Highway 88, inside of south levee.   |
| 15.            | Floodway Farm pond, $1\frac{3}{4}$ miles west of Highway 88, just inside of south levee.                         |
| 16.            | Arroyo Colorado, canal emptying into Arroyo Colorado $1\frac{1}{2}$ miles east of Highway 491 south of Mercedes. |
| *17.           | Arroyo Colorado, Highway 506 crossing south of LaFeria.  |
| 18.            | Arroyo Colorado, $1\frac{1}{2}$ miles east of Highway 77, in Harlingen.  |
| *19.           | Arroyo Colorado, 1 block north of Highway 106, in Rio Hondo.   |
| 20.            | Arroyo Colorado, intersection of Cameron-Willacy county line and Arroyo Colorado.                                |
| 21.            | Arroyo Colorado, 100 yards west of end of Highway 2358.  |
| *22.           | Campecuas Lake, boat launching ramp at park.   |
| 23.            | North Floodway, Highway 107 crossing.  |
| 24.            | North Floodway, County Line Road crossing.   |
| *25.           | North Floodway, Highway 1420 crossing.   |

\* indicates water analysis station.

## Key to Netting Stations on Llano Grande and Campecuas

| Station | Location  |
|---------|---|
| B       | Llano Grande, 150 yards west of seining Station 8.  |
| C       | Llano Grande, $\frac{1}{3}$ mile west of Highway 88 crossing, at seining beach 9.             |
| D       | Llano Grande, $\frac{1}{3}$ mile east of Highway 88 crossing, at seining beach 10.            |
| E       | Llano Grande, 250 yards north of outlet canal.  |
| 1       | Campecuas, $\frac{1}{2}$ mile south of boat launching ramp in park, near fence post in water. |
| 2       | Campecuas, 450 yards north of flume crossing lake, at right angle bend of lake.               |

Table 1. List of Fish Species Caught in Llano Grande and Floodway Plus  
Common Names Used in This Report.

|                                 |                      |
|---------------------------------|----------------------|
| <u>Lepisosteus spatula</u>      | alligator gar        |
| <u>Lepisosteus productus</u>    | spotted gar          |
| <u>Lepisosteus osseus</u>       | longnose gar         |
| <u>Brevoortia patronis</u>      | menhaden             |
| <u>Dorosoma petenense</u>       | threadfin shad       |
| <u>Dorosoma cepedianum</u>      | gizzard shad         |
| <u>Astyanax fasciatus</u>       | Rio Grande tetra     |
| <u>Ictiobus bubalus</u>         | smallmouth buffalo   |
| <u>Cyprinus carpio</u>          | carp                 |
| <u>Opsopoeodus emiliae</u>      | pugnose minnow       |
| <u>Hybopsis aestivalis</u>      | speckled chub        |
| <u>Notropis braytoni</u>        | Tamaulipas shiner    |
| <u>Notropis lutrensis</u>       | red horse shiner     |
| <u>Galeichthys felis</u>        | sea catfish          |
| <u>Ictalurus punctatus</u>      | channel catfish      |
| <u>Ictalurus furcatus</u>       | blue catfish         |
| <u>Pylodictus olivaris</u>      | flathead catfish     |
| <u>Lucania parva</u>            | rainwater fish       |
| <u>Fundulus grandis</u>         | gulf killifish       |
| <u>Cyprinodon variegatus</u>    | sea pupfish          |
| <u>Gambusia affinis</u>         | gambusia             |
| <u>Mollienisia latipinna</u>    | sailfin molly        |
| <u>Mugil cephalus</u>           | striped mullet       |
| <u>Menidia beryllina</u>        | tidewater silverside |
| <u>Chaenobryttus gulosus</u>    | warmouth bass        |
| <u>Lepomis macrochirus</u>      | bluegill sunfish     |
| <u>Pomoxis annularis</u>        | white crappie        |
| <u>Aplodinotus grunniens</u>    | freshwater drum      |
| <u>Leiostomus xanthurus</u>     | spot croaker         |
| <u>Micropogon undulatus</u>     | golden croaker       |
| <u>Lagodon rhomboides</u>       | pinfish              |
| <u>Cichlasoma cyanoguttatum</u> | Rio Grande perch     |
| <u>Gobiosoma bosci</u>          | naked goby           |
| <u>Eucinostoma gula</u>         | mojarra              |
| <u>Trachinotus carolinus</u>    | pompano              |

Table II. Results of Water Analysis of the Floodway System.

| Station | Date    | Water Temp.<br>°F | Air Temp.<br>°F | O <sub>2</sub><br>ppm. | CO <sub>2</sub><br>ppm. | PHTH<br>Alk. | M.O.<br>Alk. | Turb<br>Secchi | Salinity<br>ppm. | pH  |
|---------|---------|-------------------|-----------------|------------------------|-------------------------|--------------|--------------|----------------|------------------|-----|
| 3       | 7/21/58 | *                 | *               | -                      | -                       | 0            | 298          | *              | *                | 7.8 |
| 7       | 7/8     | 82                | 86              | -                      | -                       | 0            | 212          | *              | *                | 7.9 |
| 8       | 7/8     | 82                | 88              | -                      | -                       | 0            | 248          | 5½"            | *                | 8.7 |
| 9       | 7/8     | 82                | 86              | -                      | 0                       | 0            | 246          | 5½"            | *                | 8.7 |
| 11      | 7/9     | 83                | 86              | -                      | -                       | 0            | 174          | 11 "           | *                | 8.8 |
| 25      | 7/24    | *                 | *               | -                      | -                       | 0            | 150          | 5½"            | 2200             | 7.9 |
| 17      | 7/23    | *                 | *               | -                      | -                       | 0            | 196          | 5½"            | *                | 7.9 |
| 19      | 7/24    | *                 | *               | -                      | -                       | 0            | 228          | 10½"           | 9300             | 8.4 |
| 11      | 9/16    | 81                | 80              | 12.6                   | 8.0                     | 0            | 176          | 11 "           | *                | 8.4 |
| 22      | 9/16    | 85                | 83              | 11.0                   | 0                       | 28           | 118          | 8 "            | *                | 8.6 |
| 8       | 9/15    | 86                | 88              | 10.2                   | 8.0                     | 0            | 286          | 4 "            | *                | 8.6 |

\* indicates no test.

- indicates insufficient reagents or faulty technique.

All samples were taken from the surface.

Table III. Number of Fish Caught in Nets in Llano Grande and Campacus Before the Flood.

| Species                         | B     | Llano Grande |       | D     | E     | Campacus |        | Total  | Percent | Rank |
|---------------------------------|-------|--------------|-------|-------|-------|----------|--------|--------|---------|------|
|                                 |       | C            | D     |       |       | 1        | 2      |        |         |      |
| <u>Lepisosteus spatula</u>      | 4     | 5            | 5     | 4     | 3     | 2        | 23     | 6.80   | 5       |      |
| <u>Lepisosteus productus</u>    | 7     | 10           | 3     | 3     | 10    | 25       | 58     | 17.16  | 3       |      |
| <u>Lepisosteus osseus</u>       | -     | -            | 5     | 2     | 3     | 13       | 23     | 6.80   | 5       |      |
| <u>Dorosoma petenense</u>       | -     | -            | 1     | -     | -     | -        | 1      | .30    | 10      |      |
| <u>Dorosoma cepedianum</u>      | 1     | -            | 31    | 15    | 8     | 6        | 61     | 18.05  | 1       |      |
| <u>Ictiobus bubalus</u>         | 1     | 9            | 11    | 4     | 3     | 12       | 40     | 11.83  | 4       |      |
| <u>Cyprinus carpio</u>          | 29    | 3            | 9     | 12    | 4     | 4        | 60     | 17.75  | 2       |      |
| * <u>Ictalurus punctatus</u>    | -     | -            | 2     | 4     | 3     | -        | 8      | 2.37   | 8       |      |
| * <u>Ictalurus furcatus</u>     | -     | -            | 1     | -     | 3     | -        | 4      | 1.18   | 9       |      |
| * <u>Pylodictus olivaris</u>    | -     | -            | -     | 1     | -     | -        | 1      | .30    | 10      |      |
| * <u>Chaenobryttus gulosus</u>  | -     | -            | -     | 1     | -     | -        | 1      | .30    | 10      |      |
| * <u>Pomoxis annularis</u>      | -     | -            | -     | -     | -     | -        | 1      | .30    | 10      |      |
| <u>Aplodinotus grunniens</u>    | -     | 1            | 2     | 2     | 21    | 2        | 23     | 6.80   | 5       |      |
| <u>Cichlasoma cyanoguttatum</u> | -     | -            | 10    | 11    | 7     | 2        | 14     | 4.14   | 7       |      |
| Total                           | 42    | 28           | 80    | 59    | 63    | 66       | 338    | 100.00 |         |      |
| Percent                         | 12.42 | 8.29         | 23.66 | 17.46 | 18.64 | 19.53    | 100.00 |        |         |      |
| Game Fish                       | 0     | 0            | 3     | 6     | 26    | 2        | 37     | 10.95  |         |      |
| Rough Fish                      | 42    | 28           | 77    | 53    | 37    | 64       | 301    | 89.05  |         |      |
| % Game Fish                     | 0     | 0            | 3.75  | 10.16 | 41.26 | 3.03     | 10.95  |        |         |      |
| % Rough Fish                    | 100   | 100          | 96.25 | 89.84 | 58.73 | 96.97    | 89.05  |        |         |      |

\* indicates game or pan fish species.

Table IV. Number of Fish Caught in Nets in Llano Grande and Campacuas After the Flood.

| Species                        | B     | Llano Grande |       |       | F      | Campacuas |        | Total  | Percent | Rank |
|--------------------------------|-------|--------------|-------|-------|--------|-----------|--------|--------|---------|------|
|                                |       | C            | D     | E     |        | 1         | 2      |        |         |      |
| <u>Lepisosteus spatula</u>     | -     | 2            | -     | -     | -      | -         | -      | 2      | 1.30    | 9    |
| <u>Lepisosteus productus</u>   | 5     | -            | 3     | -     | -      | -         | -      | 8      | 5.23    | 7    |
| <u>Lepisosteus osseus</u>      | 2     | -            | 12    | -     | -      | -         | -      | 14     | 9.15    | 4    |
| <u>Dorosoma cepedianum</u>     | 25    | 4            | 2     | 4     | 1      | 1         | 1      | 37     | 24.18   | 1    |
| <u>Ictiobus bubalus</u>        | 3     | 3            | 2     | 2     | -      | 1         | 1      | 11     | 7.19    | 5    |
| <u>Cyprinus carpio</u>         | 1     | 4            | -     | 2     | -      | -         | 1      | 8      | 5.23    | 7    |
| * <u>Ictalurus punctatus</u>   | 7     | -            | 2     | -     | -      | -         | -      | 9      | 5.88    | 6    |
| * <u>Ictalurus furcatus</u>    | 22    | 4            | 4     | 1     | 1      | 2         | 1      | 33     | 21.57   | 2    |
| * <u>Chaenobryttus gulosus</u> | -     | -            | -     | 1     | -      | 1         | 1      | 2      | 1.31    | 9    |
| * <u>Pomoxis annularis</u>     | -     | -            | 1     | -     | -      | -         | 3      | 4      | 2.62    | 8    |
| <u>Aplodinotus grunniens</u>   | 3     | 1            | 19    | 2     | -      | -         | -      | 25     | 16.34   | 3    |
| Total                          | 68    | 18           | 45    | 12    | 1      | 9         | 153    | 100.00 |         |      |
| Percent                        | 44.44 | 11.76        | 29.42 | 7.84  | 0.65   | 5.89      | 100.00 |        |         |      |
| Game Fish                      | 29    | 4            | 7     | 2     | 0      | 6         | 48     | 31.37  |         |      |
| Rough Fish                     | 39    | 14           | 38    | 10    | 1      | 3         | 105    | 68.63  |         |      |
| % Game Fish                    | 42.65 | 22.22        | 15.56 | 16.67 | 0.00   | 66.67     | 31.37  |        |         |      |
| % Rough Fish                   | 57.35 | 77.78        | 84.44 | 83.33 | 100.00 | 33.33     | 68.63  |        |         |      |

\* indicates game or pan fish species.

Table V. Grams of Fish Netted From Llano Grande and Campacus Before Flood.

| Species                         | Llano Grande |       |       |       |       | Campacus |        | Total  | Percent | Rank |
|---------------------------------|--------------|-------|-------|-------|-------|----------|--------|--------|---------|------|
|                                 | B            | C     | D     | E     | 1     | 2        |        |        |         |      |
| <u>Lepisosteus spatula</u>      | 5414         | 8704  | 13523 | 7542  | 6039  | 3685     | 44907  | 17.42  | 3       |      |
| <u>Lepisosteus productus</u>    | 7496         | 10263 | 3345  | 2665  | 7304  | 10423    | 41496  | 16.11  | 4       |      |
| <u>Lepisosteus osseus</u>       | -            | -     | 7909  | 3288  | 3034  | 11736    | 25967  | 10.07  | 5       |      |
| <u>Dorosoma petenense</u>       | -            | -     | 55    | -     | -     | -        | 55     | 0.02   | 13      |      |
| <u>Dorosoma cepedianum</u>      | 30           | -     | 7720  | 3835  | 1575  | 1657     | 14817  | 5.76   | 6       |      |
| <u>Ictiobus bubalus</u>         | 1531         | 16556 | 11568 | 3657  | 4224  | 10001    | 47537  | 18.44  | 2       |      |
| <u>Cyprinus carpio</u>          | 22339        | 3368  | 4556  | 18740 | 4396  | 2885     | 56284  | 21.85  | 1       |      |
| <u>Ictalurus punctatus</u>      | -            | -     | 1446  | 3487  | 1418  | -        | 6351   | 2.46   | 8       |      |
| <u>Ictalurus furcatus</u>       | -            | -     | 1588  | -     | 3629  | -        | 5217   | 2.03   | 9       |      |
| <u>*Pylodictus olivaris</u>     | -            | -     | -     | -     | -     | -        | 1701   | 0.66   | 12      |      |
| <u>*Chaenobryttus gulosus</u>   | -            | -     | -     | 1701  | -     | -        | 1701   | 0.66   | 12      |      |
| <u>*Pomoxis annularis</u>       | -            | -     | -     | 30    | -     | -        | 30     | 0.01   | 14      |      |
| <u>Aplodinotus grunniens</u>    | -            | 1899  | 1237  | 1025  | 2975  | 455      | 3430   | 1.33   | 10      |      |
| <u>Cichlasoma cyanoguttatum</u> | -            | -     | 918   | 1144  | 3104  | 560      | 7825   | 3.03   | 7       |      |
| Total                           | 36810        | 40790 | 53865 | 47114 | 37698 | 41402    | 257679 | 100.00 |         |      |
| Percent                         | 14.28        | 15.83 | 20.90 | 18.29 | 14.63 | 16.07    | 100.00 |        |         |      |
| Game Fish                       | -            | -     | 3034  | 5218  | 8022  | 455      | 16729  | 6.49   |         |      |
| Rough Fish                      | 36810        | 40790 | 50831 | 41896 | 29676 | 40947    | 240950 | 93.51  |         |      |
| % Game Fish                     | 0.00         | 0.00  | 5.63  | 11.08 | 21.28 | 1.10     | 6.49   |        |         |      |
| % Rough Fish                    | 100          | 100   | 94.37 | 88.92 | 78.72 | 98.90    | 93.51  |        |         |      |

\* indicates game or pan fish species.

Table VI. Grams of Fish Netted From Llano Grande and Campacus After the Flood.

| Species                        | B     | Llano Grande |       | Campacus |       | Total  | Percent | Rank |
|--------------------------------|-------|--------------|-------|----------|-------|--------|---------|------|
|                                |       | C            | D     | 1        | 2     |        |         |      |
| <u>Lepisosteus spatula</u>     | -     | 7200         | -     | -        | -     | 7200   | 7.44    | 5    |
| <u>Lepisosteus productus</u>   | 3469  | -            | 2184  | -        | -     | 5653   | 5.85    | 7    |
| <u>Lepisosteus osseus</u>      | 2722  | -            | 20640 | -        | -     | 23362  | 24.16   | 1    |
| <u>Dorosoma cepedianum</u>     | 1051  | 433          | 114   | 144      | 46    | 1913   | 1.98    | 10   |
| <u>Ictiobus bubalus</u>        | 3941  | 3289         | 3373  | -        | 1134  | 13806  | 14.28   | 3    |
| <u>Cyprinus carpio</u>         | 222   | 3856         | -     | -        | 1134  | 6082   | 6.29    | 6    |
| * <u>Ictalurus punctatus</u>   | 2079  | -            | 1571  | -        | -     | 3650   | 3.78    | 8    |
| * <u>Ictalurus furcatus</u>    | 12703 | 1862         | 1450  | -        | 2523  | 20693  | 21.40   | 2    |
| * <u>Chaenobryttus gulosus</u> | -     | -            | -     | -        | 44    | 202    | 0.21    | 11   |
| * <u>Pomoxis annularis</u>     | -     | -            | 680   | -        | -     | 2145   | 2.22    | 9    |
| <u>Aplodinotus gunniens</u>    | 917   | 183          | 9854  | -        | 1465  | 11975  | 12.39   | 4    |
| Total                          | 27104 | 16823        | 39866 | 144      | 6460  | 96681  | 100.00  |      |
| Percent                        | 28.03 | 17.40        | 41.23 | 0.15     | 6.69  | 100.00 |         |      |
| Game Fish                      | 14782 | 1862         | 3701  | -        | 4146  | 26690  | 27.61   |      |
| Rough Fish                     | 12322 | 14961        | 36165 | 144      | 2314  | 69991  | 72.39   |      |
| % Game Fish                    | 54.54 | 11.07        | 10.23 | 0.00     | 64.18 | 27.61  |         |      |
| % Rough Fish                   | 45.46 | 88.93        | 89.77 | 100.00   | 35.82 | 72.39  |         |      |

\* indicates game or pan fish species

Table VII. Lengths, Weights, and "K" Factors of Fish Netted in Llano Grande and Campacuas.

| Species                         | Standard Length in mm. |         |         | Weight in Grams |         |         | "K" Factor |         |         |
|---------------------------------|------------------------|---------|---------|-----------------|---------|---------|------------|---------|---------|
|                                 | Minimum                | Maximum | Average | Minimum         | Maximum | Average | Minimum    | Maximum | Average |
| <u>Lepisosteus spatula</u>      | 505                    | 890     | 614     | 907             | 5982    | 2084    | 0.60       | 1.01    | 0.85    |
| <u>Lepisosteus productus</u>    | 300                    | 580     | 469     | 161             | 1644    | 714     | 0.50       | 0.92*   | 0.68*   |
| <u>Lepisosteus osseus</u>       | 486                    | 890     | 656     | 510             | 3005    | 1265    | 0.21       | 0.73    | 0.43    |
| <u>Dorosoma petenense</u>       | 142                    | 142     | 142     | 55              | 55      | 55      | 1.92       | 1.92    | 1.92    |
| <u>Dorosoma cepedianum</u>      | 100                    | 305     | 180     | 21              | 539     | 171     | 1.35       | 2.82    | 1.90    |
| <u>Ictiobus bubalus</u>         | 190                    | 415     | 321     | 175             | 2495    | 1203    | 2.42       | 4.90    | 3.39    |
| <u>Cyprinus carpio</u>          | 115                    | 600     | 281     | 50              | 6492    | 917     | 2.18       | 3.36    | 2.84    |
| <u>Ictalurus punctatus</u>      | 175                    | 420     | 295     | 98              | 1361    | 588     | 1.08       | 2.69    | 1.78    |
| <u>Ictalurus furcatus</u>       | 148                    | 480     | 317     | 48              | 2155    | 700     | 1.19       | 2.56    | 1.77    |
| <u>Pylodictus olivaris</u>      | 441                    | 441     | 441     | 1701            | 1701    | 1701    | 1.98       | 1.98    | 1.98    |
| <u>Chaenobryttus gulosus</u>    | 100                    | 156     | 121     | 30              | 158     | 63      | 2.82       | 4.40    | 3.79    |
| <u>Pomoxis annularis</u>        | 100                    | 286     | 209     | 20              | 734     | 181     | 1.99       | 3.34    | 2.82    |
| <u>Aplodinotus grunniens</u>    | 173                    | 345     | 249     | 138             | 1899    | 508     | 2.41       | 4.62    | 2.94    |
| <u>Cichlasoma cyanoguttatum</u> | 85                     | 150     | 119     | 32              | 162     | 98      | 3.72       | 8.81    | 5.42    |

\* One Lepisosteus productus had its tail mutilated and healed, giving a "K" factor of 1.07, it is not included in the average.

Table VIII. Success of Experimental Gill Netting on Llano Grande and Campacuas in Terms of Numbers and Pounds of Fish Caught.

|              | Number of<br>Nets Set | Number of<br>Feet of<br>Nets Set | Number<br>of Fish<br>Caught | Average<br>Number of<br>Fish Per Net | Average<br>Number of<br>Fish Per<br>Foot of Net | Pounds<br>of Fish<br>Caught | Average<br>Pounds of<br>Fish Per<br>Net | Average<br>Pounds of<br>Fish Per<br>Foot of Net |
|--------------|-----------------------|----------------------------------|-----------------------------|--------------------------------------|---|-----------------------------|---|---|
| Before Flood | 12                    | 1500                             | 338                         | 28.17                                | 0.225   | 568.09                      | 47.34                                   | 0.379   |
| After Flood  | 6                     | 750                              | 153                         | 25.50                                | 0.204   | 213.14                      | 35.52                                   | 0.284   |
| Total        | 18                    | 2250                             | 491                         | 27.28                                | 0.218   | 781.23                      | 43.40                                   | 0.347   |

Table IX, Part 1 Seining Collections on Floodway Before Flood.

| Species                         | Station Number and Date |            |           |           |           |          |          |          |           |           |           |            |            |  |
|---------------------------------|-------------------------|------------|-----------|-----------|-----------|----------|----------|----------|-----------|-----------|-----------|------------|------------|--|
|                                 | 1<br>7/21               | 3*<br>7/21 | 4<br>7/21 | 5<br>7/21 | 6<br>7/21 | 7<br>7/8 | 8<br>7/8 | 9<br>7/8 | 10<br>7/9 | 11<br>7/9 | 12<br>7/9 | 13<br>7/10 | 14<br>7/10 |  |
| <u>Lepisosteus spatula</u>      | -                       | -          | -         | -         | -         | -        | 1        | -        | -         | -         | -         | -          | 1          |  |
| <u>Brevoortia patronis</u>      | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| <u>Dorosoma petenense</u>       | -                       | -          | 1         | -         | 3         | 5        | 267      | 15       | 224       | 625**     | 216       | -          | -          |  |
| <u>Dorosoma cepedianum</u>      | -                       | -          | -         | -         | -         | -        | 26       | -        | -         | 3         | -         | -          | -          |  |
| <u>Astyanax fasciatus</u>       | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| <u>Cyprinus carpio</u>          | -                       | -          | -         | -         | -         | -        | -        | -        | 2         | -         | -         | 8          | -          |  |
| <u>Notropis lutrensis</u>       | -                       | -          | 3         | 4         | 29        | 12       | 4        | -        | 5         | 3         | -         | -          | 12         |  |
| <u>Galeichthys felis</u>        | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| <u>Fundulus grandis</u>         | -                       | 3          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| <u>Cyprinodon variegatus</u>    | 19                      | 3          | 1         | -         | 5         | 1        | -        | -        | 2         | -         | 2         | -          | -          |  |
| <u>Gambusia affinis</u>         | 15                      | 15         | 28        | 68        | 14        | 23       | 43       | 736      | 254       | 55**      | 136       | 9          | 14         |  |
| <u>Mollisnesia latipinna</u>    | 1                       | 16         | 12        | 1         | 3         | -        | -        | 1        | -         | 1         | 21        | -          | -          |  |
| <u>Mugil cephalus</u>           | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| <u>Menidia beryllina</u>        | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | 1         | -          | -          |  |
| <u>Chaenobryttus gulosus</u>    | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| <u>Leiostomus xanthurus</u>     | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| <u>Micropogon undulatus</u>     | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| <u>Iagodon rhomboides</u>       | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| <u>Cichlasoma cyanoguttatum</u> | -                       | -          | -         | 4         | -         | -        | 7        | -        | 1         | -         | 4         | -          | -          |  |
| <u>Eucinostoma gula</u>         | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| <u>Trachinotus carolinus</u>    | -                       | -          | -         | -         | -         | -        | -        | -        | -         | -         | -         | -          | -          |  |
| Total                           | 35                      | 37         | 45        | 77        | 54        | 41       | 348      | 752      | 488       | 687       | 380       | 17         | 27         |  |
| Percent                         | 1.00                    | 1.05       | 1.29      | 2.20      | 1.54      | 1.17     | 9.95     | 21.48    | 13.94     | 19.63     | 10.86     | 0.49       | 0.77       |  |

\* No fish at Station 2, polluted.

\*\* Estimated

Table IX, Part II. Seining Collections on Floodway Before Flood.

| Species                         | Station Number and Date |            |            |            |            |            |            |            |            |            | Total | Percent |            |
|---------------------------------|-------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------|---------|------------|
|                                 | 15<br>7/10              | 16<br>7/23 | 17<br>7/23 | 18<br>7/23 | 19<br>7/24 | 20<br>7/24 | 21<br>7/24 | 22<br>7/23 | 23<br>7/24 | 24<br>7/24 |       |         | 25<br>7/24 |
| <u>Lepisosteus spatula</u>      | -                       | -          | -          | -          | -          | -          | -          | -          | -          | -          | -     | 2       | 0.05       |
| <u>Brevoortia patronis</u>      | -                       | -          | -          | -          | -          | 2          | -          | -          | -          | 9          | -     | 11      | 0.32       |
| <u>Dorosoma petenense</u>       | -                       | -          | -          | -          | -          | -          | -          | 64         | -          | -          | -     | 1420    | 40.57      |
| <u>Dorosoma cepedianum</u>      | -                       | -          | -          | -          | -          | -          | -          | 2          | 2          | 2          | -     | 35      | 1.00       |
| <u>Astyanax fasciatus</u>       | -                       | -          | -          | -          | -          | -          | -          | 1          | -          | -          | -     | 1       | 0.03       |
| <u>Cyprinus carpio</u>          | -                       | -          | -          | -          | -          | -          | -          | -          | -          | -          | -     | 10      | 0.28       |
| <u>Notropis lutrensis</u>       | -                       | -          | -          | 1          | -          | -          | -          | -          | 1          | -          | -     | 74      | 2.12       |
| <u>Galeichthys felis</u>        | -                       | -          | -          | -          | -          | -          | 10         | -          | -          | -          | -     | 10      | 0.28       |
| <u>Fundulus grandis</u>         | -                       | -          | -          | -          | 1          | -          | -          | 7          | 2          | -          | -     | 14      | 0.40       |
| <u>Cyprinodon variegatus</u>    | -                       | -          | 1          | -          | 2          | -          | -          | 7          | 6          | 2          | -     | 3       | 1.55       |
| <u>Gambusia affinis</u>         | 44                      | 3          | 3          | 38         | 23         | -          | -          | 9          | 2          | 16         | 14    | 1562    | 44.62      |
| <u>Mollienisia latipinna</u>    | -                       | -          | 4          | 6          | 2          | -          | 13         | -          | 160        | 10         | 2     | 253     | 7.23       |
| <u>Mugil cephalus</u>           | -                       | -          | -          | -          | 1          | 1          | -          | -          | -          | -          | -     | 2       | 0.06       |
| <u>Menidia beryllina</u>        | -                       | -          | -          | -          | -          | 4          | 1          | 1          | -          | -          | 2     | 11      | 0.31       |
| <u>Chaenobryttus gulosus</u>    | -                       | -          | -          | -          | -          | -          | 3          | -          | -          | 1          | -     | 1       | 0.03       |
| <u>Leiostomus xanthurus</u>     | -                       | -          | -          | -          | -          | -          | -          | -          | -          | -          | -     | 2       | 0.06       |
| <u>Micropogon undulatus</u>     | -                       | -          | -          | -          | -          | 1          | -          | -          | -          | -          | -     | 2       | 0.06       |
| <u>Lagodon rhomboides</u>       | -                       | -          | -          | -          | -          | 5          | -          | -          | -          | -          | -     | 11      | 0.31       |
| <u>Cichlasoma cyanoguttatum</u> | -                       | 5          | 1          | -          | -          | -          | 6          | -          | -          | -          | -     | 22      | 0.63       |
| <u>Eucinostoma gula</u>         | -                       | -          | -          | -          | -          | -          | -          | 1          | -          | -          | -     | 1       | 0.03       |
| <u>Trachinotus carolinus</u>    | -                       | -          | -          | -          | 2          | -          | -          | -          | -          | -          | -     | 2       | 0.06       |
| Total                           | 44                      | 8          | 9          | 45         | 31         | 24         | 13         | 104        | 173        | 40         | 21    | 3500    | 100.00     |
| Percent                         | 1.25                    | 0.23       | 0.26       | 1.29       | 0.88       | 0.69       | 0.37       | 2.97       | 4.94       | 1.15       | 0.60  | 100.00  | 100.00     |

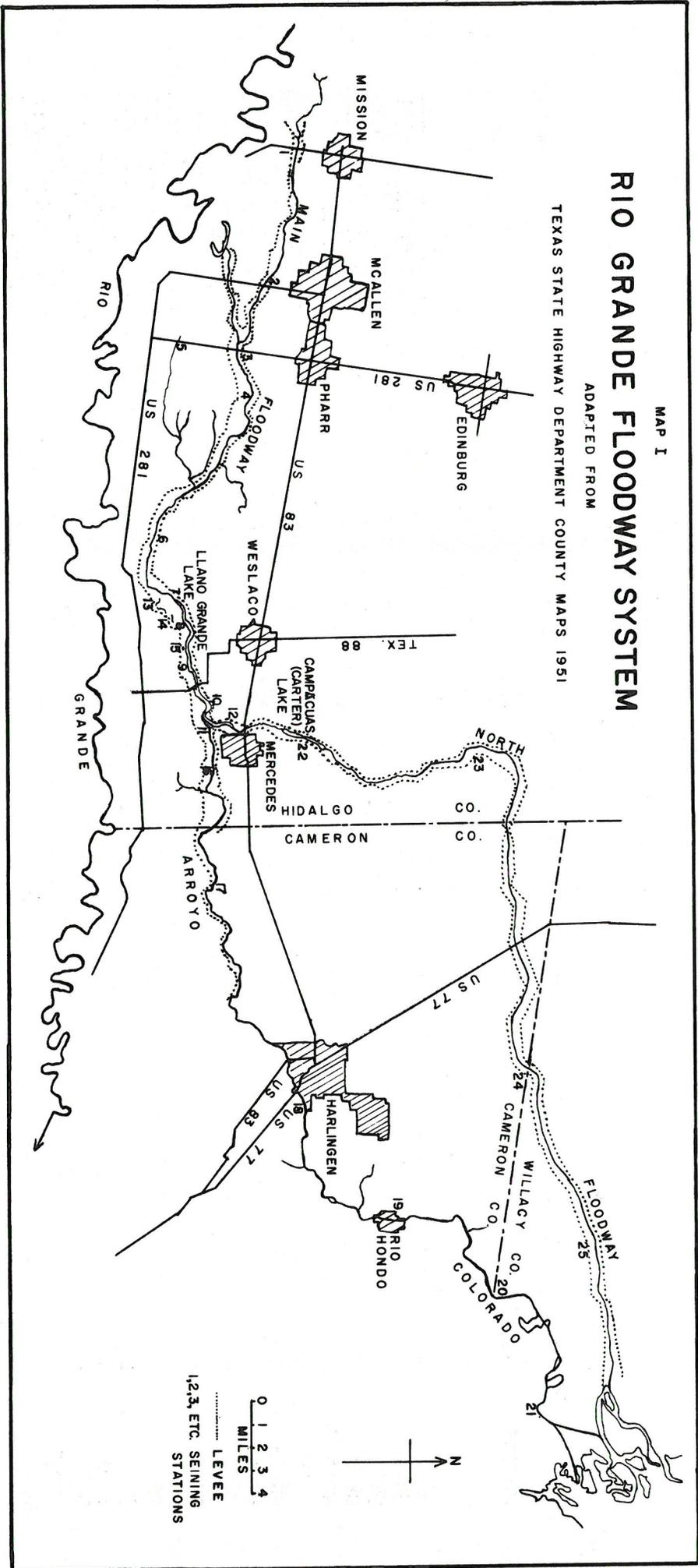
Table X. Seining Collections on Floodway After Flood.

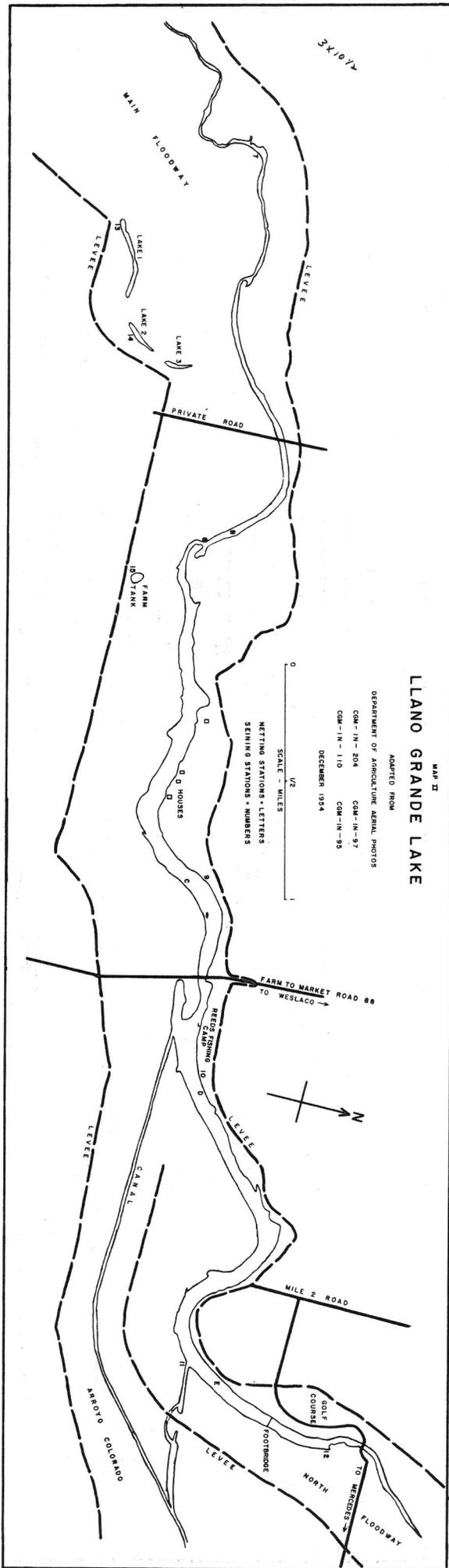
| Species                         | Station Number and Date |            |            |            |             |             |             |             |             |             |        |        |        |   |     |       | Total | Percent |
|---------------------------------|-------------------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|--------|--------|--------|---|-----|-------|-------|---------|
|                                 | 1<br>12/15              | 3<br>12/15 | 6<br>12/15 | 8<br>12/17 | 11<br>12/17 | 17<br>12/16 | 19<br>12/16 | 22<br>12/16 | 23<br>12/16 | 24<br>12/16 |        |        |        |   |     |       |       |         |
| <i>Dorosoma petenense</i>       | -                       | 1          | -          | 5          | 9           | 1           | -           | -           | 106         | -           | -      | -      | -      | - | -   | 122   | 9.35  |         |
| <i>Astyanax fasciatus</i>       | -                       | 19         | -          | 17         | 50          | 6           | -           | 18          | 87          | 1           | -      | -      | -      | - | -   | 214   | 16.41 |         |
| <i>Cyprinus carpio</i>          | -                       | 4          | -          | 7          | 3           | -           | -           | -           | 25          | -           | -      | -      | -      | - | -   | 39    | 2.99  |         |
| <i>Opsopoeodus emiliae</i>      | -                       | -          | -          | -          | -           | -           | -           | -           | 7           | -           | -      | -      | -      | - | -   | 7     | 0.53  |         |
| <i>Hybopsis aestivalis</i>      | -                       | 1          | -          | -          | -           | -           | -           | -           | -           | -           | -      | -      | -      | - | -   | 1     | 0.08  |         |
| <i>Notropis braytoni</i>        | -                       | 1          | -          | -          | -           | -           | -           | -           | -           | -           | -      | -      | -      | - | -   | 1     | 0.08  |         |
| <i>Notropis lutrensis</i>       | -                       | -          | -          | 1          | 1           | -           | -           | -           | -           | -           | -      | -      | -      | - | -   | 9     | 0.69  |         |
| <i>Lucania parva</i>            | -                       | -          | -          | -          | -           | 1           | -           | -           | -           | -           | -      | -      | -      | - | -   | 1     | 0.08  |         |
| <i>Fundulus grandis</i>         | 0                       | 0          | 0          | 0          | 0           | 0           | 0           | 2           | -           | -           | -      | -      | -      | - | 4   | 0.31  |       |         |
| <i>Cyprinodon variegatus</i>    | 49                      | 2          | -          | 1          | 6           | -           | -           | 16          | 30          | 2           | -      | -      | -      | - | 110 | 8.43  |       |         |
| <i>Gambusia affinis</i>         | 13                      | 3          | -          | 385        | 127         | 44          | 4           | 8           | 52          | 4           | 33     | 2      | -      | - | 750 | 57.52 |       |         |
| <i>Mollenisia latipinna</i>     | 5                       | 5          | -          | 1          | 5           | 1           | 2           | 7           | 5           | 2           | -      | -      | -      | - | 31  | 2.37  |       |         |
| <i>Mugil cephalus</i>           | -                       | -          | -          | -          | -           | -           | -           | -           | -           | -           | -      | -      | -      | - | 2   | 0.16  |       |         |
| <i>Menidia beryllina</i>        | -                       | -          | -          | 1          | 2           | -           | -           | -           | -           | -           | -      | -      | -      | - | 4   | 0.30  |       |         |
| <i>Lepomis macrochirus</i>      | -                       | -          | -          | -          | -           | -           | -           | -           | -           | -           | -      | -      | -      | - | 2   | 0.16  |       |         |
| <i>Cichlasoma cyanoguttatum</i> | -                       | -          | -          | -          | 4           | -           | -           | -           | -           | -           | -      | -      | -      | - | 6   | 0.46  |       |         |
| <i>Gobiosoma boscii</i>         | -                       | -          | -          | -          | -           | -           | -           | -           | -           | -           | -      | -      | -      | - | 1   | 0.08  |       |         |
| Total                           | 67                      | 36         | 46         | 418        | 207         | 53          | 51          | 66          | 322         | 38          | 1304   | 100.00 | 100.00 |   |     |       |       |         |
| Percent                         | 5.13                    | 2.76       | 3.53       | 32.06      | 15.87       | 4.07        | 3.91        | 5.06        | 24.69       | 2.92        | 100.00 |        |        |   |     |       |       |         |

# RIO GRANDE FLOODWAY SYSTEM

MAP I

ADAPTED FROM TEXAS STATE HIGHWAY DEPARTMENT COUNTY MAPS 1951





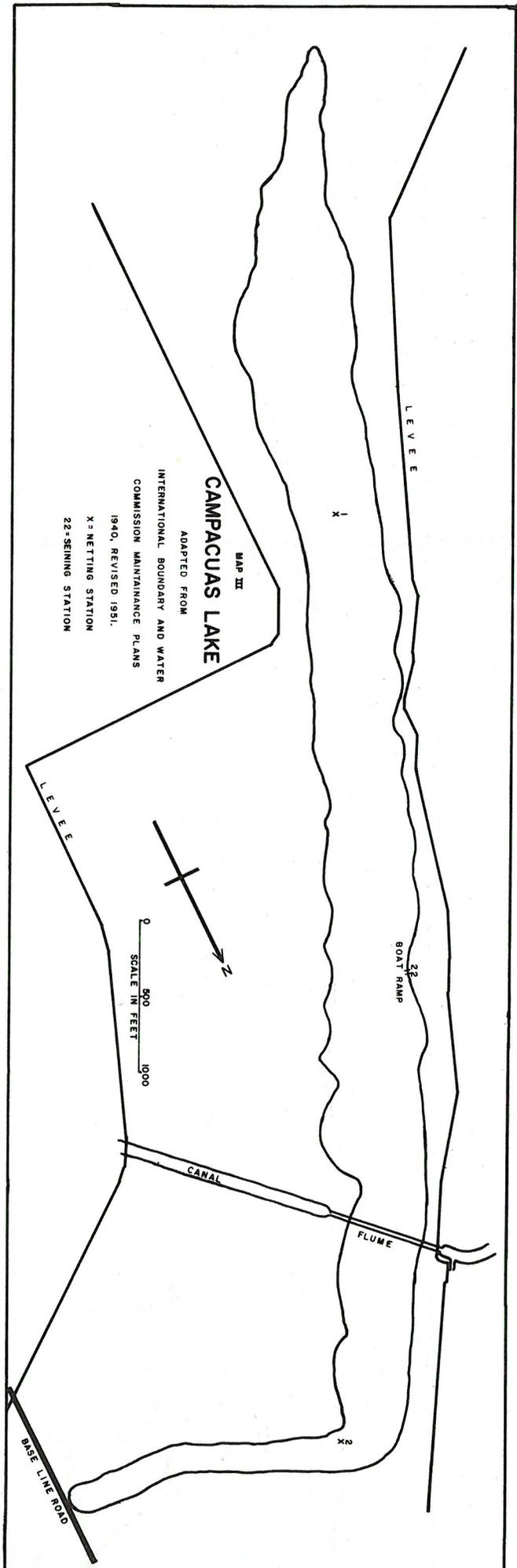
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**MAP II**  
**LLANO GRANDE LAKE**

ADAPTED FROM  
DEPARTMENT OF AGRICULTURE AERIAL PHOTOS  
GM-IN-204 GM-IN-97  
GM-IN-110 GM-IN-95  
DECEMBER 1954

SCALE - MILES  
0 1/2

MEETING STATIONS - LETTERS  
SEMINING STATIONS - NUMBERS



### CAMPACUAS LAKE

MAP III  
ADAPTED FROM  
INTERNATIONAL BOUNDARY AND WATER  
COMMISSION MAINTENANCE PLANS  
1940, REVISED 1951.  
X = NETTING STATION  
22-SENNING STATION