

STATE Texas  
PROJECT NO. F-7-R-1, Job B-2  
PERIOD June 15, 1953 - May  
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## Job Completion Report

by

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### TITLE

Inventory of the Species of Fishes Present in Lake Diversion, Texas.

### OBJECTIVES

To determine the species present and their relative abundance, as well as to determine the ecological factors influencing their distribution.

### TECHNIQUES USED

Six collection stations were established at the lake on July 23, 1953 at sites designed to sample the varied ecological niches present. Two 100-ft. gill nets were set at each station, to sample the population of the larger fishes present. It was intended that each station should be sampled at least once every month, preferably every three weeks, for periods of two days (and two nights) at a time. These plans were adhered to except when violent storms prevented running the stations for short periods of time. The stations were run as follows: July 23-24; July 27-28; August 31, September 9-10; October 12; November 3-5; November 22-23; December 14-16, 1953 and January 5-7; February 2-4; March 8-10 and April 6-9, 1954.

All fishes taken in gill nets were removed and, as soon as was practicable, the specimens were identified, measured, weighed and their sex and stages of gonadal development were recorded. All ripe ovaries and filled stomachs of predacious species were preserved for laboratory analysis. All abnormalities and diseases were noted and, if pathological conditions were apparent, the tissues were removed and sectioned in the laboratory for histological examination. Detailed notes were taken with special emphasis on environmental and ecological data.

The smaller fishes were taken at irregular intervals, with  $\frac{1}{4}$  inch meshed seines, as weather conditions and equipment permitted. Specimens were preserved in formalin for laboratory examination. Variations in water level of the lake and abundance of drowned timber and brush, made it impossible to establish permanent seining stations for comparative sampling of the small fish population.

### FINDINGS

Lake Diversion, located in Archer and Baylor Counties, Texas, is a lake of moderate size (3,420 acres in area at spillway level, 40,000 acre feet in volume). It is relatively old, the dam having been constructed in 1923. Its greatest length is approximately 7 miles; its greatest width about 3 miles and it has a shoreline of roughly 28 miles. The lake is primarily a storage reservoir, of water intended for irrigation.

The source of Lake Diversion water is principally Lake Kemp. Lake Kemp is a much larger lake located eighteen miles, by river, to the westward of the Lake Diversion Dam. The water level of Lake Diversion is kept at a desired level by regulated inflow from the Lake Kemp Dam. Lake Diversion also has a small watershed of its own (See Completion Report, Job C-1). During the present study, following periods of little or no rainfall, the water level of Lake Diversion was not permitted to drop lower than two ft. below the level of the spillway, to avoid waste of possible rainfall. Only rarely, after heavy rains, did the lake level approach the spillway level for short periods of time.

Multicellular aquatic vegetation is not abundant in Lake Diversion. Pondweeds (Potamogeton) appear in shallower waters of protected bays in the late spring and occasionally form masses many yards in diameter, becoming dense enough to impede boat traffic in some places. The submerged Chara was more difficult to evaluate. The bottom-weed makes no trace on the surface of the water. Bottom samples (obtained with an Eckman Dredge) showed Chara to be present at or near all our collection stations. In one area (Duck Bay), the Chara forms enormous mats over the bottom of even quite shallow water. Emergent littoral vegetation is scarce and includes only a few small stands of cattail (Typha latifolia) near the mouths of some creeks.

The water quality is poor, far too "salty" for human consumption. Dissolved solids ranged from 1,420 to 2,800 ppm. during the present study (see Completion Report, Job C-1). The flocculating effect of the salts results in relatively clear water (Seichi disk readings varied from 110 to 440 mm.) Maximum clarity is seldom gained. The lake is exposed to almost constant roiling action of winds. The lake lies in semi-desert "mesquite county," with few cloudy days. As a result of abundant sunlight and water clarity, the plankton fauna is rich in species and individuals and the lake water is highly productive. The surface of the open water reached temperatures as high as 32°C. in summer and as low as 4°C. in winter. During some cold snaps, a skim of ice formed near the shore of shallow, protected waters.

A total of 30 species of fishes was detected in the lake. These fall into three general groups: species of relatively large size and which are present in numbers great enough to cause them to be important, as game species or rough fish, in fisheries management; forage fishes of the "minnow" and "sunfish" type (sunfishes in Lake Diversion rarely exceed 100 grams in weight and are seldom taken or sought by fishermen); casual species, too rare to be of economic importance. Each of these groups is considered separately.

#### Large and Important Fishes

Twelve species are considered to belong to this group. Three are predators (all gars); four are rough fishes (gizzard shad, smallmouth buffalo, river carpsucker, European carp); and five are game fishes (channel catfish, white bass, black bass, white crappie and drum). Not all these latter are game fishes in the classical sense. Nevertheless considerable effort is devoted to their capture by sports fishermen and specimens taken, even of the drum, are usually eaten.

The three species of gars, together, make up approximately 5.7% of the large fish population (see Tables 2 and 3 for details) and 17.2% by weight of the larger fishes of the lake. The long-nosed gar is far the more common species. The status of these fishes is obscure. We consider the short-nosed gar and spotted gar to be beneficial in lakes with large populations of rough fishes; the long-nosed gar may be somewhat detrimental to game fishes (see Completion Report, Job B-4 for details of food habits.)

Four species make up the rough fish population of the lake. These forms are extremely abundant, making up, together 64% of the large fish population and 65% of the

population by weight. The gizzard shad is the most abundant form but the smallmouth buffalo and carpsucker are also extremely abundant. The European Carp is far less common (3% of large fish population). The presence of the smallmouth buffalo in the lake is not entirely detrimental for it encourages commercial fishermen, who must, by law, remove from the lake all other rough fishes taken in their nets. Some few individuals angle for the rough fishes in Lake Diversion.

Of the game fishes, the channel catfish, black bass and white crappie are most popular among sports fishermen. The white bass is also very popular but somewhat erratic in its habits. The drum is less desired and usually is taken incidentally to angling for catfish. The sports species make up, together, 31% of the large fish population and constitute 17.8% by weight of the large fish population. The white bass is the most common game fish species (15% of large fish.) Its abundance is not reflected in all fishermen's bags for it is an openwater fish, rarely taken by shore fishermen. Second-most abundant is the crappie. This species is rarely taken in the summer months but is the winter fish on this and nearby lakes. The channel catfish is relatively scarce, as compared with nearby lakes, but is popular with many fishermen. There seems to be relatively little trotline fishing in Lake Diversion. Black bass were not common in our nets but may be more common than our net records indicate. Small black bass, three to six inches in length, were taken in numbers in seine hauls in shallow water. Much angling effort, especially with artificial baits, is directed to this species. The drum, as mentioned, is rarely sought by anglers but is commonly taken, especially by persons fishing on the bottom for catfish. It is usually considered a slightly inferior but suitable table fish.

#### Forage Fishes

Included here are those fishes that, from their small size, are presumed to serve as food for predatory and game fishes. We have no evidence that many of them do so; indeed the young of the larger fishes are far more commonly utilized as food by predatory and game fishes (see Completion Report, Job B-4). None of the forage forms constitute game species although some few bluegills (Lepomis macrochirus) attain a weight of more than 100 grams and are occasionally taken and saved for food by fishermen angling for crappie. A total of 30 bluegills was taken in gill net sets but are excluded from the records of the larger species of fishes.

Of the forage fishes, one species of minnow, Notropis lutrensis, made up up 67.32% of the population. Less common was the parrot minnow (Pimephales vigilax), 9.96%; the ghost minnow (Notropis buchmanii), 5.16%; the longear sunfish (Lepomis megalotis), 5.9% and bluegill (Lepomis macrochirus), 5.3%. None of the other eight species made up as much as 2% of the forage fish population sample.

Special mention should be made of a local concentration of the pupfish (Cyprinodon rubrofluviatilis) at Duck Bay in late September 1953. On this date the water level was low and, along the margin of Duck Bay, the newly exposed shallows were covered with a dense mat of the underwater weed, Chara. For several yards out from the water's edge and in many small bays, a few yards across, the water was quite warm to the touch and only an inch or two deep. These weedy shallows were literally swarming with pupfishes. Several thousand were taken in five seine drags and thousands of others could have been taken. All were small, one-third to one-half grown. Two weeks later only a few were taken in the same locality. These fish are excluded from Table 4 because they represent a highly abnormal concentration. In all of the other seine hauls, including more typical hauls from Duck Bay, the pupfish constituted only 1.89% of the total population.

#### Casual Forms

Five species are included in this heading, as follows: goldeye, bigmouth buffalo, stoneroller chub, flathead catfish and yellow-bellied sunfish.

A single mature goldeye was taken in a gill net. We have taken no other specimens, nor have we heard of specimens taken by fishermen. This species is occasionally present in the Big Wichita River, below the Lake Diversion Dam. Probably the specimen from the lake was introduced with fisherman's bait.

We have heard that the bigmouth buffalo was common in Lake Diversion in the past. At present it is extremely rare. We took no specimens in the course of netting operations but commercial fishermen working on the lake took two, along with several thousand smallmouth buffalo. The reason for the apparent decrease and present rarity of the species is unknown. It may be unable to reproduce successfully in saline waters.

A single stoneroller chub (*Campostoma anomalum*) was taken in the Lake. It appeared on the surface of the water, apparently sick or dying, during routine seining operations. Very possibly it was the escaped bait of some fisherman.

The flathead catfish should, one might think, be reasonably common in Lake Diversion. We took no specimens of this species in our nets in the course of our work. One small specimen was taken on a hook by a crew member, and two specimens taken by commercial fishermen were examined. We are unable to account for the scarcity of the species but this scarcity is, we feel sure, responsible for the unpopularity of trotlining in the lake.

One specimen of the yellow-bellied sunfish was taken in a seine haul in Byrd Bay. This small individual may have been introduced into the lake as trotline bait. The species may also be represented in the lake by a small resident population. The yellow-bellied sunfish is rare or erratic in its occurrence in north central Texas.

#### Species Absent from Lake Diversion

The large fish population of Lake Diversion seems to be quite representative of North-central Texas. The spotted bass or Kentucky jumper, introduced into Lake Kemp, is absent from Lake Diversion. A shiner (*Notropis oxyrhynchus*) present in large numbers (but apparently not native) in Lake Kemp, is lacking from Lake Diversion. The black bullhead (*Ameiurus melas*) is present in the Wichita River below the Lake Diversion dam and in the irrigation canal below the spillway of the dam but was not taken in the lake. Another shiner (*Notropis percobromus*) was found in the Wichita River both above and below the lake but never in the lake. Apparently this species is a river form, avoiding lakes. Another shiner (*N. venustus*) was found in the Wichita River below the dam but not in the lake.

We have noted the following species of minnows used as live bait by fishermen near the Lake Diversion Dam: golden shiner (*Notemigonus chrysoleucas*), fathead (*Pimephales promelas*), spottail shiner (*Notropis venustus*), goldfish (*Carassius auratus*). The use of this latter is unusual in the area but the other are probably used commonly. Excess minnows are often released by fishermen. Almost certainly the three species first mentioned have been released into the lake many times.

#### SUMMARY

Lake Diversion is located in Archer and Baylor Counties in north central Texas. It is an impoundment (dam constructed in 1923) of 40,000 acre feet at spillway level. During the course of this study (July 23, 1953 - April 20, 1954) the lake was not more than two feet below spillway level and occasionally approached spillway level. The

lake is primarily a storage reservoir for irrigation water. Its level is kept at or near spillway level by water from Lake Kemp (see Completion Report, Job B-1).

The lake waters are heavily polluted with natural salts (1420 -2800 ppm. total solids), relatively clear (turbidity 110-440 mm.) as a result of the flocculation of suspended materials, and rich in plankton due to water clarity and intense sunlight of the semi-desert surroundings. Aquatic vegetation includes considerable Potamogeton and Chara.

Thirty species of fishes were found in the lake. Of these, 12 are large and numerous enough to be important as predators, game fishes, or rough fish species. These include: longnosed gar, spotted gar, shortnosed gar, gizzard shad, smallmouth buffalo, river carpsucker, European carp, channel catfish, white bass, black bass, white crappie and drum. The gars make up 5.7% of the large fish population (17.2% by weight); the rough fishes 64% (65% by weight); the game fishes 31% (17.8% by weight). The white bass and white crappie are the most abundant sports species.

The forage species include 13 species. Of these a minnow (Notropis lutrensis) makes up 67.3% of the population, another minnow (N. buechanani) makes up 5.2%, the parrot minnow (Pimephales vigilax) 10%, the long-eared sunfish (Lepomis megalotis) 5.9% and the bluegill (L. macrochirus) 5.3%. The other species each constitute less than 2% of the population of small fishes.

Five species, the goldeye (Hiodon alosoides), bigmouth buffalo (Ictiobus cyprinellus), stoneroller chub (Campostoma anomalum), flathead catfish (Pilodictus olivaris) and yellow-bellied sunfish (Lepomis auritus) have been taken in the lake but are too scarce to be of economic importance.

Lake Diversion is, chronologically and biologically, an "old" lake, with the rough fish species dominating the population. Improvement of the lake for fishermen would seem to depend on selective control of the rough fish species, especially the gizzard shad and carpsucker.

Table 1. Check List of Fishes of Lake Diversion

Species	Large and Important	Forage Fishes	Casual Forms
<u>Lepisosteus osseus</u>	X		
<u>Lepisosteus productus</u>	X		
<u>Lepisosteus platostomus</u>	X		
<u>Dorosoma cepedianum</u>	X		
<u>Hiodon alosoides</u>			X
<u>Ictiobus cyprinellus</u>			X
<u>Ictiobus bubalus</u>	X		
<u>Carpionodes carpio</u>	X		
<u>Cyprinus carpio</u>	X		
<u>Phenacobius mirabilis</u>		X	
<u>Notropis buechanani</u>		X	
<u>Notropis deliciosus</u>		X	
<u>Notropis lutrensis</u>		X	
<u>Pimephales vigilax</u>		X	
<u>Hybognathus placita</u>		X	
<u>Campostoma anomalum</u>			X
<u>Ictalurus punctatus</u>	X		
<u>Pilodictus olivaris</u>			X
<u>Fundulus kansae</u>		X	
<u>Cyprinodon rubrofluviatilis</u>		X	
<u>Gambusia affinis</u>		X	
<u>Morone chrysops</u>	X		
<u>Micropterus salmoides</u>	X		
<u>Lepomis auritus</u>			X
<u>Lepomis cyanellus</u>		X	
<u>Lepomis macrochirus</u>		X	

Table 1. Check List of Fishes of Lake Diversion (continued)

Species	Large and Important	Forage Fishes	Casual Forms
<u>Lepomis megalotis</u>		X	
<u>Lepomis microlophus</u>		X	
<u>Pomoxis annularis</u>	X		
<u>Aplodinotus grunniens</u>	X		

Table 11. Percentage Composition and Sex Ratios of Large and Important Species of Fishes from Lake Diversion, as Determined from Gill Nets Only.

Species	Total	% of Total	% Males	% Females
<u>Lepisosteus osseus</u>	73	5	44	56
<u>Lepisosteus platostomus</u>	5	.3	60	40
<u>Lepisosteus productus</u>	6	.4	33	67
<u>Dorosoma cepedianum</u>	443	30	51	49
<u>Ictiobus bubalus</u>	185	12	71	29
<u>Carpionodes carpio</u>	287	19	60	40
<u>Cyprinus carpio</u>	42	3	51	49
<u>Ictalurus punctatus</u>	38	3	37	63
<u>Morone chrysops</u>	206	15	52	48
<u>Micropterus salmoides</u>	41	3	22	78
<u>Pomoxis annularis</u>	107	7	49	51
<u>Aplodinotus grunniens</u>	49	3	37	63

Table 111. Weights, Percentage Composition by Weight, and Mean Weights of Large and Important Fishes from Lake Diversion, as Determined from Gill Nets.

Species	Weight	% of Total	Mean Weight
<u>Lepisosteus osseus</u>	228.23 lbs.	15.9	3.99 lbs.
<u>Lepisosteus platostomus</u>	12.60 lbs.	.7	2.52 lbs.
<u>Lepisosteus productus</u>	11.27 lbs.	.6	1.88 lbs.
<u>Dorosoma cepedianum</u>	277.86 lbs.	15.4	.63 lbs.
<u>Ictiobus bubalus</u>	455.56 lbs.	25.2	2.47 lbs.
<u>Carpionodes carpio</u>	360.94 lbs.	19.9	1.27 lbs.
<u>Cyprinus carpio</u>	81.44 lbs.	4.5	1.94 lbs.
<u>Ictalurus punctatus</u>	51.56 lbs.	2.8	1.36 lbs.
<u>Morone chrysops</u>	150.62 lbs.	8.3	.73 lb.
<u>Micropterus salmoides</u>	45.08	2.5	1.10 lbs.
<u>Pomoxis annularis</u>	45.06	2.5	.42 lb.
<u>Aplodinotus grunniens</u>	31.09	1.7	.63 lbs.

Table IV. Percentage Composition of Forage Fishes of Lake Diversion, As Determined from Seine Samples Only.

Species	Total	Percent
<u>Phenacobius mirabilis</u>	4	.16
<u>Notropis buchanaui</u>	137	5.64
<u>Notropis deliciosus</u>	5	.20
<u>Notropis lutrensis</u>	1,636	67.32
<u>Pirephales vigilax</u>	242	9.96
<u>Hybognathus placita</u>	45	1.85
<u>Fundulus kansae</u>	5	.2
<u>Cyprinodon rubrofluviatilis</u>	46*	1.89
<u>Gambusia affinis</u>	27	1.11
<u>Lepomis cyanellus</u>	6	.25
<u>Lepomis macrochirus</u>	130**	5.35
<u>Lepomis megalotis</u>	144	5.93
<u>Lepomis microlophus</u>	3	.12

\* - Several thousand pupfish were taken in Duck Bay in five seine hauls on September 20, 1953. Because these hauls represent a non-typical, unusual, concentration, the specimens are not included here.

\*\* - Not included are some thirty bluegills taken in gill nets at the established gill net stations.