Report of Fisheries Investigations

Basic Survey and Inventory of Species Present and Their Distribution in the Upper Colorado River of Texas

by

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May 1, 1956 through April 16, 1957

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Job Completion Report

State of TEXAS

Project No. F-5-R-4 Name: Fisheries Investigations and Surveys of the Waters of Region 3-B.

Job No. B-12 Title: Basic Survey and Inventory of Species Present and Their Distribution in the Upper Colorado River of Texas.

Period Covered: May 1, 1956 through April 16, 1957

ABSTRACT:

The Upper Colorado River was found to be dependent upon run-off for its source of water; was dominated by undesirable species; is not utilized by the public for fishing and is extremely low in actual production of game fish, although the potential is reasonably high. No recommendation is made for immediate management; however, if public waters should be benefited at a later date it is recommended that management practices be employed at that time.

OBJECTIVES:

To gather fundamental data on the above waters in regard to their physical, chemical and biological aspects. To determine the distribution of fish species present, their relative abundance and the ecological factors influencing their distribution.

COOPERATING AGENCIES:

Texas Board of Water Engineers
United States Geological Survey
Upper Colorado River Municipal Water District
Central Colorado River Authority

PROCEDURE:

A. Basic Survey

Standard procedures were employed to secure the information necessary to complete stream survey forms similar to those given by Lagler in his HANDBOOK OF FRESHWATER FISHERY BIOLOGY.

B. Inventory of Species

Thirty-three permanent seining stations were established to obtain adequate sampling of the fishery populations as to their distribution and relative abundance.

1. Because of the stream conditions it was impossible to establish exact seining stations in those portions of the watershed above Ballinger, Texas, however, sixty-eight seining collections were obtained from that portion of the watershed and from portions of the Concho River not included in the North and South Concho River surveys. Bag seines were used where practical, however, eight foot nylon common sense seines were the type found to be most adaptable to stream conditions and were the type most frequently employed.

2. Four gill net stations were established and twelve net collections were obtained. Experimental nets 125 feet long by 8 feet deep, and in 25 foot sections of varying mesh were used. Mesh ranges were from $\frac{1}{2}$-inch to 3-inch, increasing at $\frac{1}{2}$ inch intervals, and each were 25 foot in length.

3. Water analyses, pH, air and water temperatures, and other data pertaining to water quality and conditions were recorded at appropriate intervals of the stream area worked.

4. Where field identification was in doubt individuals were preserved in 10% formalin and examined in the laboratory.

5. The portions of the Upper Colorado River System to be included in this survey are as follows:

a. All contributing watershed from the upper origins of the river system in Andrews, Gaines, Dawson and Martin counties to and including the confluence with the San Saba River in San Saba County.

b. Excepting: those portions of the Concho Rivers above the Tom Green County line (these waters were surveyed and reported on in Jobs A-1, B-1, A-2, and B-2); the San Saba River (inventory work on that stream was done by personnel from Region 7-B, Project F-9-R-4).

FINDINGS:

Of the above described contributing area of about 20,700 square miles, the river above Ballinger and that portion of the Concho River between the Tom Green County line and the confluence represent about sixty-eight percent of the total watershed surveyed. The stream in that area is usually intermittent except where low water dams are fed by sufficient quantities of seepage to stabilize, on a partial basis, stream flow for a limited area below their location. Stream flow resulting from run-off, virtually all significant discharge, is controlled primarily by Lake J. B. Thomas, a 220,000 acre foot capacity reservoir and Colorado City Lake on Morgan Creek that has a total capacity of 30,900 acre feet. The Concho Rivers are controlled by San Angelo Reservoir and by Lake Nasworthy, whose combined capacity is about 350,000 acre feet. Lake Brownwood, a reservoir having a flood control capacity in excess of 185,400 acre feet; Hoards Creek Reservoir, with 25,310 acre feet storage; Oak Creek Reservoir, with 56,000 acre feet capacity, and a number of other lesser reservoirs control and regulate the stream flow for the remaining portions of the watershed. In all there are sixty-eight known reservoirs that have storage capacities greater than ten acre feet and owned by public and private concerns on the watershed. The named reservoirs are discussed under other jobs. For convenience in discussion, the contributing watershed is divided into stream areas that because of the variation in their physical, chemical and biological aspects differ significantly. The more detailed data on hydrology and water quality is included in the tables that follow and the exact locations of the various stations worked are listed under appropiate areas.

Area 1 through 5 - the contributing watershed above Lake J. B. Thomas. This portion of the watershed consists of intermittent pools within the river bed. There are no springs, and the only permanent pools are created by low water dams. Normally there is no stream flow and the only discharges are a result of run-off. The water above Lake J. B. Thomas and that impounded is comparatively pure, having a chloride content from 26 to 120 ppm and a total hardness of from 88 to 122 ppm. It was for this reason that the chosen dam site was selected. Maximum dissolved carbon dioxide recorded in this portion of the stream was 16 ppm; minimum oxygen content determined was 7 ppm; and pH was from 8.4 to 8.6. Maximum turbidity was 11 inches. Excepting bulrushes at the mouth of the lake, no aquatic vegetation is in this area.

Area 6 through 8 - from one-fourth mile below Lake J. B. Thomas dam to a point on the river about three miles below Silver, Texas. The stream is highly saline in nature as a result of exposures of halite and alkali formations. In addition to the quantities of these materials introduced by the erosive action of stream flow; great quantities of these native salts are induced into the stream bed as a result of the seepage and percolative action of ground-water discharges into the stream. The area is usually clear, excepting rare periods of brief duration when run-off occurs, and concentrations of parrot feather, Myriophyllum sp., saw grass, Zizaniopsis sp. and muskgrass, Chara sp. are in dense localities. Total chlorides recorded were from 420 to 5,000 ppm; total hardness from 428 to 1,500 ppm; minimum recorded dissolved oxygen was 6 ppm; maximum carbon dioxide determined was 15 ppm, and pH was from 8.4 to 8.9.

The remaining portions of the Colorado River worked, from three miles below Silver to Ballinger, were intermittent pools dependent entirely upon run-off, except for a stream area of about ten miles that passes through the J. S. Hall Ranch and terminates when it enters gravel deposits about two miles west of Robert Lee, Texas. That section of stream had semi-permanent flow as a result of ground-water movements that were a result of a particular geological condition that is unusual for this part of the Upper Colorado River system. Gravel deposits collected seepage and where these deposits terminated in bedrock the gound-water that was collected was forced upward to the surface by pressure resulting from the build up. The result was surface flow over the bedrock formation. Water quality for that portion of the stream was only slightly saline with recorded chlorides from 12 ppm to 32 ppm. Exact total hardness is not known, but is considered to be less than the previously described stream areas. The water had no recordable turbidity except following run-off, the minimum dissolved oxygen content was 11 ppm, there was no recordable carbon dioxide, and pH was from 7.8 to 8.2. Only bulrushes were found in this area.

Area 9 through 12 - the Concho River from the Tom Green County line to its confluence is a series of pools and riffles with semi-permanent stream flow as a result of geological conditions similar to those described above. The principal difference between this area and the Upper Colorado River above Robert Lee and below Silver is the greater concentrations and deposits of silt in many pools created by low water dams on the Concho System. Water quality for the lower Concho is superior to much of the Colorado; chrolide content is usually about 71 ppm and total hardness about 250 ppm. No oxygen difficiencies were recorded, ranging from 8 to 10 ppm, and carbon dioxide records were from 5 to 12 ppm. The water is normally turbid with readings averaging about 11 inches and pH is from 8.2 to 8.6.

From a fisheries standpoint the Upper Colorado River System may be regarded as a vast network of intermittent to semi-permanent flow streams, containing in its 20,700 square miles of contributing watershed an extreme complexity of geological formations and soils, having great flexibility and variation in its water quality and quantity because it is controlled entirely by an unreliable and fluctuating source of supply -- that of ground water and run-off resulting from rainfall.

FISH POPULATIONS:

A. Relative Abundance of Species - The following charts include the data obtained by the previously described methods of sampling and are not intended to provide other than general information pretaining to the distribution of species. Specific distribution will be discussed later under the annotated checklist for species identified. To obtain the following data, 26,384 individuals of 12 families and 43 species were examined.

Sampling Locations on the Upper Colorado River

Area No. 1 - Andrews County (above Lake J. B. Thomas)
Shafter Lake
Whalen Lake
Salt Lake
Monument Draw
Seminole Draw
15 small lakes in Mabee Oil Field

Area No. 2 - Gaines County
McKinzee Lake

Area No. 3 - Dawson County
Welch Oil Field
Spraberry Oil Field
Gold Creek
McKenzee Draw
Sulphur Lake
Sulphur Draw

Area No. 4 - Martin County
Mustang Creek

Area No. 5 - Borden County
Gail
Buford
Spade
Smith Ranch
Mouth of river in Lake J. B. Thomas
Mouth of Bull Creek

Area No. 6 - Scurry County
Bridge on Highway 50 (3 miles south of Ira)

Area No. 7 - Mitchell County
2 miles East of Cutberth
Below dam of Colorado City Lake
Bridges in Colorado City
Bridge crossing Farm Road 101 on Harris Ranch (18 miles south of Colorado City)

Area No. 8 - Coke County
Jameson Oil Field (3 miles south of Silver)
½ mile above mouth of Panther Draw (15 miles west of Robert Lee on Tubbs Ranch)
1 mile above mouth of Yellow Wolf Creek (1 mile below Army Dam site on Harris Ranch)
Mouth of Yellow Wolf Creek (8 miles above Robert Lee on Harris Ranch)
1 mile above mouth of Salt Creek on Hale Ranch
Area around bridge on Robert Lee-Sterling City highway
Area around bridge on Robert Lee-San Angelo highway
1 mile south-east of Robert Lee on San Angelo highway
Mouth of Macy Creek (16 miles south-east of Robert Lee in Wendland Oil Field)
Bronte Oil Field (4 stream miles north-west of Bronte)
Bronte-San Angelo highway bridge
2½ stream miles south-east of Bronte-San Angelo highway bridge

Area No. 9 - Runnells County
Maverick Crossing (8 miles south-east of Bronte)
Brookshire Crossing (2 miles south of Maverick-Ballinger highway)
Mouth of Mesquite Creek (5 miles south of Ballinger-Maverick highway on Smith Ranch)
Herring Ranch (17 stream miles north-west of Ballinger)
Eagan Ranch (14½ stream miles west of Ballinger)
Kuhn's Dam (11 miles west of Ballinger off Kristoff School Road)
200 yds. below mouth of Quarry Creek on Forgey Farm at irrigation pump (8 miles west of Ballinger)
Gravel pit 50 yds. north of Brookshire School road (3½ stream miles west of Ballinger)
Mouth of Sand Branch (2 stream miles west of Ballinger)
Ballinger-San Angelo highway bridge
Elm Creek in City Park in Ballinger
4 stream miles south-east of Ballinger
½ mile below mouth of Bear's Foot Creek
100 yds. below oil field crossing at end of pavement on McKinley Ranch (14 stream miles south-east of Ballinger)
Crossing of farm road on Bethel School road (21 stream miles below Ballinger)

Area No. 10 - Concho County
Tony Rasalie Ranch (1½ miles below mouth of Concho River)
Low water crossing on Hafner Ranch ½ mile below Rosalie Ranch

Area No. 11 - Coleman County
Mouth of Grape Creek (1½ miles south of Leaday)
Chaffin Crossing on Cooper Farm (3 miles west of Highway 283)
Mouth of Bull Creek on Linsley Farm (6 miles west of Highway 283)

Area No. 12 - McCulloch County
Elm Creek on Bradley Ranch

Sampling Locations on the Principal Tributaries

Jim Ned Creek

Head Hords Creek
Below Hords Creek Dam
Lake Santana
Lake Sealey

Pecan Bayou

2 miles east of Oplin
Burkett Crossing
Cross Plains highway crossing
Byrd's Store on Ranch Road 589
Wright's Ranch below Brownwood Dam
City Park in Brownwood

Hydrology and Fluctuation of Flow Data for the Colorado River at Colorado City from October 1955 through September 1957

Month	Maximum Discharge c.f.s.	Minimum Discharge c.f.s.	Average Discharge c.f.s.	Number of Days no Flow	Percent of Time no Flow	Run-off in Acre Feet
1955						
October	1340.0	0.0	160.0	5	17	9850
November	0.0	0.0	0.0	30	100	0
December	0.7	0.0	0.1	25	83	3
1956						
January	2.6	0.4	1.0	0	0	62
February	2.6	0.0	1.3	2	7	72
March	0.0	0.0	0.0	31	100	0
April	273.0	0.0	9.1	29	96	541
May	1980.0	0.0	93.6	3	10	5750
June	228.0	0.0	16.8	18	60	1000
July	0.3	0.0	-	27	90	1
August	0.0	0.0	0.0	30	100	0
September	0.0	0.0	0.0	30	100	0
October	102.0	0.0	5.1	20	67	315
November	14.0	0.0	1.3	10	33	77
December	27.0	0.0	3.2	17	57	196
1957						
January	1.8	0.2	0.6	0	0	39
February	1800.0	2.2	99.0	0	0	5500
March	20.0	0.0	2.0	2	7	123
April	4330.0	0.0	332.0	17	57	19750
May	9560.0	2.2	1048.0	0	0	64410
June	3540.0	4.0	205.0	0	0	12210
July	96.0	0.0	9.1	16	53	556
August	74.0	0.0	6.3	13	44	386
September	43.0	0.0	3.6	16	53	214

Drainage area is 4,082 square miles of which 2,590 square miles are probably non-contributing.

The average discharge for a 11 year period is 54,080 acre feet per year.

Hydrology and Fluctuation of Flow Data for the Concho River of the Upper Colorado River System at Paint Rock from October 1955 through September 1957.

Month	Maximum Discharge c.f.s.	Minimum Discharge c.f.s.	Average Discharge c.f.s.	Number of Days no Flow	Percent of Time no Flow	Run-off in Acre Feet
1955						
October	30.0	0.1	3.9	6	28	238
November	-	-	0.3	0	0	18
December	-	-	0.2	0	0	12
1956						
January	13.0	-	3.1	20	67	190
February	8.2	0.2	3.4	0	0	193
March	0.2	0.0	0.1	25	83	7
April	15.0	0.0	0.6	24	80	37
May	2460.0	3.5	212.0	0	0	13040
June	9.4	0.0	1.6	18	60	97
July	8.2	0.0	0.8	24	80	49
August	281.0	0.0	13.8	20	67	850
September	75.0	0.0	5.8	10	33	346
October	3560.0	0.4	170.0	0	0	10470
November	174.0	1.0	28.1	0	0	1670
December	20.0	0.2	3.4	0	0	210
1957						
January	6.5	0.7	5.6	0	0	220
February	8.5	0.7	3.0	0	0	167
March	233.0	0.2	18.2	0	0	1120
April	32200.0	0.3	1695.0	0	0	100900
May	27800.0	52.0	4756.0	0	0	292400
June	7400.0	32.0	576.0	0	0	34270
July	122.0	5.5	23.6	0	0	1450
August	7.0	0.2	1.7	0	0	103
September	1050.0	0.2	64.0	0	0	3810

Drainage area is 5538 square miles of which 275 square miles are probably noncontributing.

The average discharge for a 40 year period is 157,800 acre feet per year.

Hydrology and Fluctuation of Flow Data for Pecan Bayou of the Colorado River System at Brownwood from October 1955 through September 1957

Month	Maximum Discharge c.f.s.	Minimum Discharge c.f.s.	Average Discharge c.f.s.	Number of Days no Flow	Percent of Time no Flow	Run-off in Acre Feet
1955						
October	762.0	1.0	189.0	0	0	11640
November	12.0	-	0.9	0	0	53
December	22.0	8.4	13.7	0	0	841
1956						
January	17.0	1.8	8.1	0	0	501
February	2.8	0.7	2.1	0	0	121
March	0.8	0.1	0.3	0	0	20
April	17.0	0.2	5.3	0	0	313
May	22600.0	8.2	1985.0	0	0	122000
June	3.8	0.1	0.9	0	0	54
July	0.9	0.1	0.2	0	0	13
August	57.0	0.1	3.7	0	0	226
September	8.3	0.1	8.8	0	0	228
October	83.0	2.4	9.1	0	0	560
November	46.0	0.1	3.7	0	0	221
December	121.0	0.1	6.3	0	0	387
1957						
January	0.2	0.1	0.2	0	0	12
February	0.5	0.3	0.4	0	0	20
March	69.0	0.3	3.8	0	0	231
April	4730.0	0.3	629.0	0	0	37420
May	12500.0	371.0	4037.0	0	0	248200
June	5510.0	3.8	1033.0	0	0	61500
July	70.0	0.2	5.0	0	0	308
August	2.0	0.2	0.6	0	0	35
September	-	-	0.2	30	100	12

Drainage area is 1956 square miles.

The average discharge for a 32 year period is 120,200 acre feet per year.

Hydrology and Fluctuation of Flow Data for the Colorado River at Winchell, Texas, from October 1955 through September 1957

Month	Maximum Discharge c.f.s.	Minimum Discharge c.f.s.	Average Discharge c.f.s.	Number of Days no Flow	Percent of Time no Flow	Run-off in Acre Feet
1955						
October	3790.0	8.4	421.0	0	0	25910
November	7.7	1.1	2.9	0	0	171
December	1.8	0.2	0.8	0	0	50
1956						
January	21.0	1.1	4.2	0	0	256
February	367.0	5.1	24.7	0	0	1420
March	4.6	0.0	1.6	0	0	96
April	1220.0	0.0	88.8	0	0	5280
May	38000.0	46.0	3079.0	0	0	189300
June	130.0	0.0	33.6	0	0	2000
July	2.7	2.2	51.0	0	0	3140
August	745.0	0.0	66.7	0	0	4100
September	101.0	0.0	17.0	0	0	1010
October	10300.0	0.0	1000.0	0	0	61470
November	1220.0	6.0	194.0	0	0	11540
December	892.0	0.9	78.4	0	0	4820
1957						
January	38.0	1.3	11.0	0	0	678
February	750.0	1.5	103.0	0	0	5730
March	5070.0	4.6	368.0	0	0	22640
April	32200.0	26.0	4167.0	0	0	248000
May	58300.0	333.0	13910.0	0	0	855000
June	27600.0	180.0	4040.0	0	0	240400
July	510.0	29.0	139.0	0	0	8530
August	360.0	13.0	73.0	0	0	4490
September	5020.0	4.6	597.0	0	0	35550

Drainage area is 24,580 square miles of which 11,900 square miles are probably non-contributing.

The average discharge for a 28 year period is 524,200 acre feet per year.

Hydrology and Fluctuation of Flow Data for Brady Creek of the Upper Colorado River System at Brady from October 1955 through September 1957

Month	Maximum Discharge c.f.s.	Minimum Discharge c.f.s.	Average Discharge c.f.s.	Number of Days no Flow	Percent of Time no Flow	Run-off in Acre Feet
1955						
October	0.7	0.0	0.04	25	83	2.6
November	0.0	0.0	0.0	30	100	0.0
December	0.1	0.0	0.02	23	78	1.4
1956						
January	0.0	0.0	0.0	30	100	0.0
February	216.0	0.0	7.89	22	77	454.0
March	0.0	0.0	0.0	30	100	0.0
April	0.7	0.0	0.04	28	93	2.6
May	2650.0	0.1	137.0	0	0	8420.0
June	0.8	0.0	0.08	18	60	5.0
July	0.0	0.0	0.0	30	100	0.0
August	446.0	0.0	2.1	10	33	1230.0
September	3.0	0.0	14.0	25	83	8.3
October	0.0	0.0	0.0	30	100	0.0
November	0.0	0.0	0.0	30	100	0.0
December	0.0	0.0	0.0	30	100	0.0
1957						
January	0.1	0.0	0.02	23	78	1.4
February	0.4	0.1	0.18	0	0	9.7
March	377.0	0.2	31.1	0	0	1910.0
April	4550.0	0.1	482.0	0	0	28670.0
May	4650.0	48.0	853.0	0	0	52460.0
June	384.0	3.1	48.8	0	0	2900.0
July	2.3	0.0	0.34	15	50	21.0
August	0.0	0.0	0.0	31	100	0.0
September	2060.0	0.0	93.9	8	27	5590.0

Drainage area is 575 square miles.

The average discharge for a 18 year period is 20,050 acre feet per year.

Hydrology and Fluctuation of Flow Data for the San Saba River of the Colorado River System at San Saba from October 1955 through September 1957.

Month	Maximum Discharge c.f.s.	Minimum Discharge c.f.s.	Average Discharge c.f.s.	Number of Days no Flow	Percent of Time no Flow	Run-off in Acre Feet
1955						
October	141	21.0	42.4	0	0	2610
November	28	17.0	22.0	0	0	1310
December	33	9.2	24.5	0	0	1510
1956						
January	49	12.0	33.1	0	0	2040
February	264	31.0	64.8	0	0	3730
March	32	6.7	19.8	0	0	1220
April	1250	0.0	423.0	0	0	25190
May	14900	52.0	1292.0	0	0	79440
June	82	0.5	26.7	0	0	1590
July	78	0.0	12.7	0	0	778
August	145	0.0	13.3	0	0	816
September	121	3.7	18.6	0	0	1100
October	29	4.0	11.9	0	0	733
November	21	5.5	11.6	0	0	689
December	135	3.1	16.1	0	0	991
1957						
January	18	12.0	14.9	0	0	916
February	40	14.0	21.2	0	0	1180
March	551	10.0	935.0	0	0	5750
April	14100	18.0	1782.0	0	0	106100
May	20300	196.0	3031.0	0	0	186400
June	1500	90.0	329.0	0	0	19590
July	85	29.0	42.2	0	0	2600
August	30	4.0	16.6	0	0	1020
September	1530	11.0	133.0	0	0	7930

Drainage area is 3,042 square miles.

The average discharge for a 41 year period is 176,600 acre feet per year.

Water Quality Data for the Upper Colorado River

Location	Date	Air Temp.	Surface Water Temp.	pH	O_2 PPM	CO_2 PPM	Date	Cl PPM	Dissolved Solids	Total Hardness
Colorado River near Colorado City Texas	August 1956	94	86	8.8	-	-	May 1947	6800	13300	1780
	October 1956	76	74	8.6	11	14.5	October 1955	34	228	0
	April 1957	69	69	8.9	7	11	January 1957	3690	7210	1100
Colorado River near Robert Lee, Texas	June 1955	89	79	8.6	5	3	September 1947	245	698	186
	April 1957	74	68	8.1	6.5	9.5	September 1955	418	1300	333
Colorado River near San Saba, Texas	-	-	-	-	-	-	September 1947	225	837	346
	-	-	-	-	-	-	September 1955	830	2010	638
	-	-	-	-	-	-	November 1956	375	1150	459
North Concho River near San Angelo, Texas	June 1956	83	71	7.8	8.5	2.5	September 1947	300	920	352
	July 1957	96	80	7.4	10	6	-	-	-	-

Water Quality Data for the Upper Colorado River
(Continued)

Location	Date	Air Temp.	Surface Water Temp.	pH	O_2 PPM	CO_2 PPM	Date	Cl PPM	Dissolved Solids	Total Hardness
South Concho River near San Angelo, Texas	June 1956	92	82	7.2	7.5	11	September 1947	71	362	208
Bull Creek near Ira, Texas	June 1956	92	80	7.1	5.2	1	April 1956	635	1980	575
Bluff Creek near Ira, Texas	-	-	-	-	-	-	April 1947	532	1400	639
San Saba River near San Saba, Texas	June 1956	84	78	7.6	7	10	September 1947	13	222	192
Mouth of Canyon Creek near Winchell, Texas	-	-	-	-	-	-	April 1947	165	1500	422
Mouth of Deep Creek near Rochelle, Texas	June 1956	82	78	7.2	5.5	10.5	April 1956	105	917	443

Water Quality Data for the Upper Colorado River
(Continued)

Location	Date	Air Temp.	Surface Water Temp.	pH	O_2 PPM	CO_2 PPM	Date	Cl PPM	Dissolved Solids	Total Hardness
Lone Wolf Creek near Colorado City, Texas	-	-	-	-	-	-	April 1956	230	3130	1970
Champlin Creek near Colorado City, Texas	-	-	-	-	-	-	July 1947	228	1180	675
Pecan Bayou near Regency Bridge	August 1956	96	84	8.8	4.5	2.5	-	-	-	-
Jim Ned Creek near Coleman	June 1956	90	78	8.8	6	0	-	-	-	-
Brady Creek (below sewer) near Brady, Texas	June 1956	82	78	8.0	10.4	19	-	-	-	-
(above sewer)	June 1956	86	74	9.0	5.5	17.5	-	-	-	-

Water Quality Data for the Upper Colorado River
(Continued)

Location	Date	Air Temp.	Surface Water Temp.	pH	O_2 PPM	CO_2 PPM	Date	Cl PPM	Dissolved Solids	Total Hardness
Elm Creek near Ballinger, Texas	September 1955	95	84	8.2	3.5	14.5	-	-	-	-
	October 1956	80	73	8.4	7.0	12.5	-	-	-	-
Colorado River near Gail, Texas	July 1956	90	80	8.6	4.7	6	-	-	-	-
Pecan Bayou on Wright Ranch below Lake Brownwood	August 1956	91	82	7.2	1	5	-	-	-	-

Netting and Seining Collections Made on The Upper Colorado River

Collection Station Number 1.
Location: Mouth of Bull Creek
Type of Collection: 6 hauls with 26 ft. bag seine and 6 hauls with common-sense type minnow seine.

Species	April 6, 1955		June 16, 1956	
	No.	%	No.	%
Redhorse shiners	150	58.59	12	8.45
Killifish	14	5.47	31	21.83
Central stoneroller	4	1.56	0	0.00
Gambusia	38	14.84	18	12.68
Shad	12	4.69	6	4.23
River carpsuckers	4	1.56	2	1.41
Longnose gar	1	0.39	0	0.00
Yellow bullheads	24	9.38	14	9.86
Drum	2	0.78	0	0.00
Bluegill	0	0.00	31	21.83
Green sunfish	6	2.35	17	11.97
Longear sunfish	1	0.39	8	5.63
Parrot minnows	0	0.00	3	2.11
Totals	256	100.00	142	100.00

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Collection Station Number 2.
Location: 2 miles below Lake Thomas Dam
Type of Collection: 3 experimental gill nets
Date: June 18, 1956

Species	No.	% by No.	Avg. Wt. (Ozs)	% by Wt.	Avg. K.
Shad	23	39.66	3	17.74	1.58
River carpsucker	11	18.96	19	53.73	2.40
Yellow bullheads	22	37.93	4.5	25.45	1.84
White crappie	2	3.45	6	3.08	3.82
Totals	58	100.00		100.00	

Netting and Seining Collections Made on The Upper Colorado River
(Continued)

Collection Station Number 3.
Location: Highway 350 bridge 2 miles south of Ira.
Type of Collection: 6 hauls with common-sense type seine.

Species	April 16, 1956		August 7, 1956		February 18, 1957	
	No.	%	No.	%	No.	%
Plains killifish	200	76.63	180	71.15	60	60.00
Redhorse shiners	24	9.19	20	7.91	18	18.00
Grey redhorse sucker	2	0.77	0	0.00	4	4.00
Yellow bullhead	18	6.90	37	14.62	4	4.00
Green sunfish	10	3.83	8	3.16	7	7.00
Bluegill	7	2.68	8	3.16	7	7.00
Totals	261	100.00	253	100.00	100	100.00

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Collection Station Number 4.
Location: 2 miles east of Curtbert.
Type of Collection: 6 hauls with common-sense type seine

Species	April 16, 1956		February 18, 1957	
	No.	%	No.	%
Plains killifish	1000	59.35	500	72.46
Gambusia	500	29.67	80	11.59
Redhorse shiners	100	5.93	24	3.48
Parrot minnows	20	1.19	0	0.00
River carpsuckers	20	1.19	2	0.29
Grey redhorse sucker	20	1.19	0	0.00
Green sunfish	10	0.59	60	8.70
Bluegill	10	0.59	20	2.90
Channel catfish	5	0.30	4	0.58
Totals	1685	100.00	690	100.00

Netting and Seining Collections Made on The Upper Colorado River
(Continued)

Collection Station Number 5.
Location: Below Colorado City Lake Dam
Type of Collection: 6 hauls with common-sense type seine

Species	September 12, 1955		August 24, 1956		February 20, 1957	
	No.	%	No.	%	No.	%
Redhorse shiners	1000	74.85	1000	62.97	1000	83.33
Parrot minnows	200	14.97	80	5.04	0	0.00
Gambusia	100	7.48	500	31.49	200	16.67
Shad	4	0.30	0	0.00	0	0.00
Bluegill	30	2.25	8	0.50	0	0.00
Largemouth bass	2	0.15	0	0.00	0	0.00
Totals	1336	100.00	1588	100.00	1200	100.00

Collection Station Number 6.
Location: Two city bridges in Colorado City.
Type of Collection: 6 hauls with common-sense type seine.

Species	September 12, 1955		August 24, 1956		February 20, 1957	
	No.	%	No.	%	No.	%
Plains killifish	1000	66.67	1000	66.67	1000	66.67
Gambusia	500	33.33	500	33.33	500	33.33
Totals	1500	100.00	1500	100.00	1500	100.00

Collection Station Number 7
Location: Bridge crossing on Farm Road 101 near Sterling City.
Type of Collection: 4 hauls with common-sense type seine.

Species	June 20, 1956		February 24, 1957	
	No.	%	No.	%
Plains killifish	200	80.00	80	61.54
Parrot minnows	50	20.00	36	27.69
Shad	0	0.00	12	9.23
Grey redhorse sucker	0	0.00	2	1.54
Totals	250	100.00	130	100.00

Netting and Seining Collections Made on The Upper Colorado River
(Continued)

Collection Station Number 8.
Location: Harris Ranch 18 miles southeast of Colorado City.
Type of Collection: 4 hauls with common-sense type seine .

Species	June 19, 1956		February 23, 1957	
	No.	%	No.	%
Redhorse shiner	250	62.20	30	11.76
Gambusia	100	24.86	100	39.22
Plains killifish	50	12.44	125	49.02
Channel catfish	2	0.50	0	0.00
Totals	402	100.00	255	100.00

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Collection Station Number 9.
Location: Silver Crossing at Jameson Oil Field.
Type of Collection: 4 hauls with common-sense type seine.

Species	June 26, 1956		August 20, 1956	
	No.	%	No.	%
Plains killifish	150	50.17	160	15.43
Gambusia	89	29.76	84	8.10
Redhorse shiner	32	10.70	700	67.50
River carpsucker	4	1.34	30	2.89
Channel catfish	6	2.01	61	5.88
Bluegill	18	6.02	2	0.20
Totals	299	100.00	1037	100.00

Netting and Seining Collections Made on The Upper Colorado River
(Continued)

Collection Station Number 10.
Location: W. E. Tubbs Ranch ½ mile above mouth of Panther Draw.
Type of Collection: 6 hauls with common-sense type seine.

Species	October 10, 1955		June 27, 1956		August 20, 1956	
	No.	%	No.	%	No.	%
Plains killifish	100	36.90	65	24.62	0	0.00
Spottail shiner	24	8.86	100	37.88	14	8.00
Parrot minnow	24	8.86	2	0.76	0	0.00
Gambusia	50	18.45	30	11.36	24	13.71
Shad	8	2.95	8	3.03	0	0.00
Gar	0	0.00	2	0.76	0	0.00
Drum	0	0.00	1	0.38	4	2.29
River carpsucker	2	0.73	0	0.00	9	5.15
Yellow bullheads	0	0.00	14	5.30	24	13.71
Sunfish	60	22.14	40	15.15	100	57.14
Channel catfish	2	0.74	0	0.00	0	0.00
Largemouth bass	1	0.37	2	0.76	0	0.00
Totals	271	100.00	264	100.00	175	100.00

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Collection Station Number 11.
Location: 1 mile below Army Dam Site on Harris Ranch.
Type of Collection: 4 hauls with common-sense type seine.

Species	September 20, 1955		August 13, 1956	
	No.	%	No.	%
Roundnose minnow	80	38.65	65	42.76
Central stoneroller	4	1.93	0	0.00
Redhorse shiners	60	28.99	38	25.00
Parrot minnows	24	11.59	20	13.16
Drum	0	0.00	4	2.63
River carpsucker	0	0.00	2	1.32
Sunfish & bluegills	21	10.14	4	2.63
Flathead catfish	6	2.90	2	1.32
Channel catfish	12	5.80	9	5.92
Largemouth bass	0	0.00	8	5.26
Totals	207	100.00	152	100.00

Netting and Seining Collections Made on The Upper Colorado River
(Continued)

Collection Station Number 12.
Location: Bridge at Robert Lee.
Type of Collection: 6 hauls with common-sense type seine.

Species	July 13, 1955		June 27, 1956		August 20, 1956	
	No.	%	No.	%	No.	%
Redhorse shiner	100	35.71	78	48.75	68	34.17
Plains shiner	30	10.72	13	8.13	48	24.12
Gambusia	100	35.71	40	25.00	60	30.15
Green sunfish	24	8.57	12	7.50	0	0.00
Longear sunfish	12	4.29	6	3.75	2	1.01
White crappie	8	2.86	2	1.25	6	3.02
Channel catfish	2	0.71	9	5.62	1	0.50
Largemouth bass	4	1.43	0	0.00	14	7.03
Totals	280	100.00	160	100.00	199	100.00

Collection Station Number 13
Location: Mouth of Macy Creek
Type of Collection: 4 hauls with common-sense type seine.

Species	July 13, 1955		June 27, 1956	
	No.	%	No.	%
Plains shiners	100	44.84	100	45.87
Spottail shiners	50	22.42	30	13.76
Green sunfish	28	12.56	60	27.52
Bluegill	45	20.18	28	12.85
Totals	223	100.00	218	100.00

Collection Station Number 14.
Location: Oil field 4 stream miles northwest of Bronte.
Type of Collection: 6 hauls with common-sense type seine.

Species	July 13, 1955		June 28, 1956	
	No.	%	No.	%
Plains shiners	105	58.34	83	49.40
Redhorse shiners	24	13.33	20	11.90
Bluegill	31	17.22	36	21.43
Green sunfish	18	10.00	29	17.27
Longear sunfish	2	1.11	0	0.00
Totals	180	100.00	168	100.00

Netting and Seining Collections Made on The Upper Colorado River
(Continued)

Collection Station Number 15.
Location: Bronte to San Angelo Highway Bridge.
Type of Collection: 3 hauls with bag seine.

Species	June 22, 1955		July 13, 1955		June 28, 1956		March 12, 1957	
	No.	%	No.	%	No.	%	No.	%
Redhorse shiner	86	23.76	30	17.75	18	13.43	100	48.78
Spottail Shiner	80	22.10	0	0.00	0	0.00	0	0.00
Gambusia	165	45.58	36	21.30	30	22.39	24	11.71
Parrot minnow	0	0.00	14	8.28	0	0.00	4	1.96
Shad	2	0.55	10	5.92	6	4.48	9	4.39
Drum	0	0.00	1	0.59	0	0.00	2	0.97
Gar	0	0.00	1	0.59	4	2.99	0	0.00
River carpsucker	2	0.55	2	1.18	0	0.00	2	0.97
Redhorse sucker	0	0.00	4	2.37	2	1.49	0	0.00
White crappie	0	0.00	8	4.73	14	10.45	2	0.97
Bluegill	12	3.32	21	12.44	14	10.45	28	13.66
Green sunfish	10	2.76	35	20.71	27	20.15	14	6.83
Longear sunfish	2	0.55	0	0.00	11	8.21	6	2.93
Yellowbelly sunfish	0	0.00	0	0.00	2	1.49	4	1.96
Channel catfish	2	0.55	2	1.18	3	2.24	2	0.97
Flathead catfish	0	0.00	1	0.59	1	0.74	0	0.00
Largemouth bass	1	0.28	4	2.37	2	1.49	8	3.90
Totals	362	100.00	169	100.00	134	100.00	205	100.00

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Collection Station Number 16.
Location: Maverick Crossing 8 miles SE Bronte.
Type of Collection: 6 hauls with common-sense type seine.

Species	September 14, 1955		April 22, 1956		October 20, 1956	
	No.	%	No.	%	No.	%
Plains shiner	2	3.39	0	0.00	0	0.00
Parrot minnows	24	40.68	8	13.11	2	4.44
Gambusia	4	6.78	31	50.82	1	2.23
Redhorse shiner	12	20.34	14	22.95	30	66.67
Grey redhorse sucker	0	0.00	0	0.00	2	4.44
River carpsucker	2	3.39	2	3.28	0	0.00
Carp	0	0.00	2	3.28	0	0.00
Roundnose minnow	0	0.00	0	0.00	8	17.78
Rio Grande shiner	0	0.00	0	0.00	2	4.44
Spottail shiner	15	25.42	4	6.56	0	0.00
Totals	59	100.00	61	100.00	45	100.00

Netting and Seining Collections Made on The Upper Colorado River
(Continued)

Collection Station Number 17.
Location: Smith Ranch 5 miles west of Ballinger.
Type of Collection: 4 hauls with common-sense type seine.

Species	September 20, 1955 No.	%
Roundnose minnow	160	95.81
Channel catfish	5	2.99
Flathead catfish	1	0.60
Shad	1	0.60
Totals	167	100.00

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Collection Station Number 18.
Location: Kuhn's Dam 11 miles west of Ballinger.
Type of Collection: 3 experimental gill nets
Date: September 5, 1955

Species	No.	% by No.	Avg. Wt. (Ozs)	% by Wt.
Shad	38	45.24	3	8.42
Redhorse sucker	7	8.33	18	9.31
River carpsucker	6	7.14	23	10.19
Smallmouth buffalo	3	3.57	76	16.84
Drum	4	4.76	12	3.54
Longnose gar	11	13.10	54	43.87
Channel catfish	7	8.33	12	6.20
Longear sunfish	2	2.39	5	0.74
Green sunfish	6	7.14	2	0.89
Totals	84	100.00		100.00

Netting and Seining Collections Made on The Upper Colorado River
(Continued)

Collection Station Number 19.
Location: Bridge in Ballinger.
Type of Collection: 9 hauls with bag seine.

Species	September 14, 1955		July 16, 1956		October 20, 1956	
	No.	%	No.	%	No.	%
Spottail shiner	12	11.22	10	17.24	0	0.00
Redhorse shiner	18	16.83	28	48.28	42	50.00
Parrot minnow	4	3.74	0	0.00	2	2.38
Gambusia	21	19.63	0	0.00	0	0.00
Roundnose minnow	0	0.00	0	0.00	2	2.38
Shad	16	14.95	1	1.72	7	8.33
Longnose gar	0	0.00	1	1.72	2	2.38
Spotted gar	1	0.93	0	0.00	0	0.00
River carpsucker	2	1.87	0	0.00	1	1.19
Bluegill sunfish	14	13.08	6	10.35	11	13.10
Green sunfish	13	12.15	10	17.24	3	3.57
Longear sunfish	2	1.87	0	0.00	2	2.38
Largemouth bass	1	0.93	2	3.45	5	5.96
Channel catfish	3	2.80	0	0.00	7	8.33
Totals	107	100.00	58	100.00	84	100.00

Netting and Seining Collections Made on Tributaries of The Upper Colorado

Collection Station Number 20.
Location: Elm Creek in Ballinger Park.
Type of Collection: 6 experimental gill nets.

Species	No.	% by No.	Avg. Wt. (Ozs.)	% by Wt.	Avg. K
Shad	132	58.41	4.5	14.20	1.68
River carpsucker	68	30.09	34	55.29	2.20
Carp	14	6.20	42	14.06	2.64
Longnose gar	6	2.65	98	14.06	0.31
White crappie	2	0.88	8	0.38	3.82
Channel catfish	4	1.77	21	2.01	1.96
Totals	226	100.00		100.00	

Netting and Seining Collections Made on Tributaries of The Upper Colorado (Continued)

Collection Station Number 20.
Location: Elm Creek in Ballinger Park
Type of Collection: 4 hauls with common-sense type seine.

Species	October 21, 1956 No.	%
Spottail shiner	28	40.58
Gambusia	34	49.28
River carpsucker	7	10.14
Totals	69	100.00

Collection Station Number 22.
Location: Tony Rosalie Ranch 1½ mile below mouth of Concho River.
Type of Collection: 3 experimental gill nets.
Date: October 16, 1955

Species	No.	% by No.	Avg. Wt. (Ozs.)	% by Wt.	Avg. K
Shad	47	37.90	4.5	6.17	1.81
River carpsucker	18	14.52	26	13.65	2.42
Redhorse sucker	9	7.26	28	7.35	2.08
Smallmouth buffalo	14	11.29	106	43.30	3.68
Longnose gar	11	8.87	64	20.54	.33
Drum	6	4.84	12	2.10	2.84
White crappie	16	12.90	7	3.27	3.65
Channel catfish	2	1.61	33	1.93	1.93
Flathead catfish	1	0.81	58	1.69	1.96
Totals	124	100.00		100.00	

Collection Station Number 22.
Location: Tony Rosalie Ranch 1½ mile below mouth of Concho River.
Type of Collection: 4 hauls with common-sense type seine.

Species	September 20, 1955 No.	%	March 29, 1956 No.	%
Redhorse shiners	60	60.00	48	44.86
Spottail shiners	8	8.00	21	19.63
Shad	2	2.00	7	6.54
Drum	2	2.00	0	0.00
Sunfish	28	28.00	31	28.97
Totals	100	100.00	107	100.00

Netting and Seining Collections Made on Tributaries of The Upper Colorado (Continued)

Collection Station Number 23.
Location: Waldrup and Rockwood Crossings.
Type of Collection: 4 hauls with common-sense type seine.

Species	December 15, 1955 No.	%
Redhorse shiners	200	66.01
Green sunfish	71	23.43
Bluegill	12	3.96
Longear sunfish	8	2.64
Largemouth bass	12	3.96
Totals	303	100.00

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Collection Station Number 24.
Location: Winchell Crossing.
Type of Collection: 9 hauls with 26 ft. bag seine.

Species	September 15, 1955 No.	%	October 23, 1955 No.	%	July 16, 1957 No.	%
Spottail shiner	26	19.70	13	8.61	8	3.60
Redhorse shiner	16	12.12	21	13.91	31	13.96
Parrot minnows	0	0.00	6	3.97	0	0.00
Plains shiner	4	3.03	12	7.95	16	7.21
Shad	2	1.51	0	0.00	8	3.60
River carpsucker	0	0.00	2	1.33	4	1.80
Carp	1	0.76	7	4.64	9	4.06
Longnose gar	0	0.00	2	1.32	0	0.00
Bluegill sunfish	26	19.70	47	31.13	48	21.62
Green sunfish	37	28.04	18	11.92	53	23.87
Yellowbelly sunfish	2	1.51	0	0.00	0	0.00
Redear sunfish	0	0.00	0	0.00	11	4.96
Longear sunfish	12	9.09	19	12.58	7	3.15
Spotted sunfish	1	0.76	0	0.00	0	0.00
White crappie	3	2.27	2	1.32	0	0.00
Largemouth bass	2	1.51	0	0.00	14	6.31
Channel catfish	0	0.00	2	1.32	9	4.06
Flathead catfish	0	0.00	0	0.00	4	1.80
Totals	132	100.00	151	100.00	222	100.00

Netting and Seining Collections Made on Tributaries of The Upper Colorado (Continued)

Collection Station Number 25.
Location: Sam McCullum Ranch near Brady.
Type of Collection: 8 experimental gill nets.
Date: July 16, 17, 1956

Species	No.	% by No.	Avg. Wt. (Ozs.)	% by Wt.
Shad	133	44.19	6	14.74
River carpsucker	68	22.59	28	35.16
Carp	6	1.99	51	5.65
Smallmouth bass	12	3.99	81	17.95
Drum	7	2.32	16	2.07
Gar	50	16.61	18	16.62
Redhorse sucker	4	1.33	19	1.40
White crappie	6	1.99	8	0.89
Channel catfish	13	4.32	11	2.64
Flathead catfish	2	0.67	78	2.88
Totals	301	100.00		100.00

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Collection Station Number 26.
Location: Mouth of Deep Creek near Rochelle.
Type of Collection: 3 hauls with bag seine.

Species	June 22, 1956 No.	%
Shad	4	4.60
Plains shiner	18	20.69
Parrot minnows	21	24.14
Redhorse sucker	8	9.19
Sunfish	34	39.08
Largemouth bass	2	2.30
Totals	87	100.00

Netting and Seining Collections Made on Tributaries of The Upper Colorado (Continued)

Collection Station Number 27.
Location: Pecan Bayou at Oplin.
Type of Collection: 3 hauls with common-sense type seine.

Species	No.	%
Shad	4	2.74
Spottail shiner	21	14.38
Redhorse shiner	38	26.03
Gambusia	64	43.84
Sunfish	18	12.33
Channel catfish	1	0.68
Totals	146	100.00

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Collection Station Number 28.
Location: Pecan Bayou at Burkett.
Type of Collection: 3 hauls with common-sense type seine.

Species	No.	%
Shad	2	3.03
Carp	7	10.61
Parrot minnows	30	45.45
White bass	2	3.03
White crappie	14	21.21
Sunfish	11	16.67
Totals	66	100.00

Netting and Seining Collections Made on Tributaries of The Upper Colorado (Continued)

Collection Station Number 29.
Location: Pecan Bayou on Wright Lease below Lake Brownwood Dam.
Type of Collection: 16 hauls with common-sense type seine and 8 hauls with bag seine.

Species	February 19, 1956		February 20, 1956	
	No.	%	No.	%
Shad	16	4.11	34	11.04
Spottail shiner	105	26.99	80	25.97
Redhorse shiner	87	22.37	68	22.08
Golden shiner	8	2.06	2	0.65
Plains shiner	16	4.11	18	5.84
Gambusia	91	23.39	0	0.00
Bluegill	30	7.71	4	1.30
Longear sunfish	24	6.17	14	4.54
Largemouth bass	12	3.09	0	0.00
Drum	0	0.00	4	1.30
Carp	0	0.00	21	6.82
Smallmouth bass	0	0.00	6	1.95
Redear sunfish	0	0.00	21	6.82
Green sunfish	0	0.00	36	11.69
Totals	389	100.00	308	100.00

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Collection Station Number 29.
Location: Pecan Bayou below Lake Brownwood Dam.
Type of Collection: 3 experimental gill nets.
Date: February 20, 1956

Species	No.	% by No.	Avg. Wt. (Ozs.)	% by Wt.
Shad	61	38.61	7	9.83
River carpsucker	23	14.56	23	12.17
Longnose gar	68	43.04	49	76.67
Drum	4	2.53	10	0.92
Channel catfish	2	1.26	9	0.41
Totals	158	100.00		100.00

Netting and Seining Collections Made on Tributaries of The Upper Colorado (Continued)

Collection Station Number 30.
Location: Jim Ned Creek near Lake Sealy.
Type of Collection: 3 hauls with 26 ft. bag seine.

Species	January 19, 1956 No.	%
Redhorse shiner	28	34.57
Parrot minnows	19	23.46
Bluegill sunfish	9	11.11
Green sunfish	14	17.28
Redear sunfish	11	13.58
Totals	81	100.00

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Collection Station Number 31.
Location: Lake Santana
Type of Collection: 3 experimental gill nets.

Species	No.	% by No.	Avg. Wt. (Ozs.)	% by Wt.
Shad	38	52.05	3	12.35
River carpsucker	14	19.18	22	33.35
Carp	9	12.33	49	47.72
White crappie	2	2.74	6	1.29
Redear sunfish	7	9.59	3	2.27
Channel catfish	2	2.74	11	2.38
Largemouth bass	1	1.37	6	0.64
Totals	73	100.00		100.00

Netting and Seining Collections Made on Tributaries of The Upper Colorado (Continued)

Collection Station Number 32.
Location: Lake Sealy
Type of Collection: 3 experimental gill nets.

Species	No.	% by No.	Avg. Wt. (Ozs.)	% by Wt.
Shad	64	58.18	3.5	13.86
River carpsucker	24	21.82	28	41.65
Carp	14	12.73	46	39.87
White crappie	3	2.73	10	1.85
Redear sunfish	2	1.82	5	0.61
Channel catfish	1	0.90	17	1.05
Largemouth bass	2	1.82	9	1.11
Totals	110	100.00		100.00

* * *

Collection Station Number 33.
Location: Mouth of Brady Creek south of Brady.
Type of Collection: 3 hauls with 26 ft. bag seine.

Species	No.	%
Shad	2	1.23
Carp	38	23.46
River carpsucker	2	1.23
Gambusia	60	37.04
Drum	2	1.23
Black bullheads	13	8.04
White crappie	6	3.70
Green sunfish	21	12.96
Longear sunfish	18	11.11
Totals	162	100.00

B. Trends and Influences of the Principal Fishery Populations.

Shiners and minnows - (excepting carp) This group with mosquitofishes, logperches and darters were very numerous comprising 87.71 percent of all individuals captured by seining. However, their dependency upon actual stream flow can be best shown in the tables and the accompanying description of the various areas. For this reason the low water impoundments that have a tendency to stabilize stream flow are of great importance. It would appear that these species are entirely or largely dependent upon stream flow.

Sunfishes - (all Lepomis) It is debatable whether this group as it now exists are beneficial since a relatively few individuals of these denominating populations were large enough to provide acceptable food, and the numbers of the various forage species indicate that they are not necessary or perhaps desirable in that capacity. It is also considered probable that the 72.45 numerical percent obtained by seining is more representative of this groups importance than the 3.98 percent figure obtained through netting. The areas where netting was possible were extremely limited as compared to the areas where seining was possible. For these reasons this group is considered to be a fishery problem rather than a resource of any value.

White crappie, largemouth bass and white bass - These populations are absent from much of the included stream areas and where found are too few or too small for utilization. For practical purposes it may be considered that these species furnish no sport in the streamways. The apparent causes for this condition will be introduced under a later heading.

Catfishes - Virtually all fish that are utilized or utilizable to the sportsmen belong to this group. Combined totals for channel catfish and flathead catfish make up .73 percent by seining and only 2.99 percent by netting. For practical purposes these figures may be used in evaluating the proportion of utilizable fish for the watershed excepting the reservoirs.

Suckers, shad and carp - These populations are grouped because it is considered that they collectively or individually on a locality basis constitute the major fishery problem encountered in the survey. The only effective sampling method as employed during this survey for these species is considered to be gill netting. The above populations made up 73.27 percent nemerically and 59.73 percent by weight of all fishes captured in gill nets. These figures and the nature of the waters involved are considered to be self evident that the areas that might otherwise be suitable for the production of more desirable species as largemouth bass, white crappie, white bass, and catfishes are dominated by these undesirable species to such an extent that successful progagation of the game species is impossible.

C. Distribution of Species.

An annotated checklist with the numbers of the previously described collection stations is regarded as the most suitable method of presenting this portion of the findings of this survey.

Annotated Checklist of Species

Fish Occurring in the Upper Colorado River System of Texas

Lepisosteidae (gars)

Lepisosteus osseus (longnose gar) - the most common and abundant of the two species. Found in greatest concentrations in areas 8 through 16, however, prevalent throughout the watershed where permanent water occurs.

Lepisosteus productus (spotted gar) - rare and extremely limited in distribution; found below Lake Brownwood in area 29 only.

Clupeidae (shad and herrings)

Dorosoma cepedianum (gizzard shad) - most common and widely distributed of all species taken. Actually collected or observed at all stations.

Characidae (tetras)

Astyanax fasciatus (banded tetra) - common from the Concho's to the mouth of the San Saba, rarer as far north as Lake J. B. Thomas. Taken at areas 2, 6, 16, 22 and 24. Apparently this species has established at least a temporary population in much of the watershed.

Catostomidae (suckers and buffalofishes)

Ictiobus bubalus (smallmouth buffalo) - common and abundant in localities. Most common below the confluence of the Concho River.

Ictiobus niger (black buffalo) - rare found in Lake Brownwood and on Tony Rosalie ranch only.

Moxostoma congestum (gray redhorse sucker) - common and distributed throughout the stream system.

Carpiodes carpio (river carpsucker) - common and abundant, the species making up the greatest proportion by weight and the dominating species for the watershed.

Cyprinidae (shiners and minnows)

Cyprinus carpio (carp) - common and distributed throughout the watershed, taken at virtually all seining stations.

Cyprinus auratus (goldfish) - taken at station 4 and at 16, these are regarded as escaped individuals. There is no evidence to support a belief in an established population.

Notemigonus crysoleucas (golden shiner) - although this species was relatively rare in the stream it is known to exist in significant populations in several of the reservoirs and is often released from state hatcheries in restocking programs.

Hybopsis sp.(chub) - accuracy of this identification is definitely questionable but is included with the hope that verification may be obtained at a later date.

Phenacobius mirabilis - (suckermouth minnow) - rare, found on Hall ranch and at station No. 8 cnly.

Notropis deliciosus (sand shiner) - common but localized. Found in areas 1, 8, and 13. (note: N. volucellus previously listed is believed to be a misidentification of this species).

Notropis venustus (spottail shiner) - common but abundant only in the Concho's and that portion of the system above Lake J. B. Thomas.

Notropis lutrensis (redhorse shiner) - the most common and abundant of all shiners on a watershed basis, taken at almost all collection stations.

Dionda episcopa (roundnose minnow) - found on Harris ranch (area 8 only), very abundant in that stream area.

Hybognathus placita (plains minnow) - common but not numerous throughout the watershed.

Pimephales vigilax (parrot minnow) - common but not numerous throughout the watershed.

Campostoma anomalum (steelback) - rare found in areas 8 and 10 only; however, they are more common in the Concho's.

Ameiuridae (catfishes)

Ictalurus punctatus (channel catfish) - common and distributed throughout the watershed.

Ictalurus melas (black bullhead) - rare found in the upper Concho's and in a tank near Lake J. B. Thomas.

Ictalurus natalis (yellow bullhead) - common and found throughout the watershed.

Pylodictus olivaris (flathead catfish) - common but not numerous. Found throughout the watershed.

Cyprinodontidae (killifishes and topminnows)

Fundulus kansae (plains killifish) - common and abundant in areas 4 through 16.

Cyprinodon sp. (killifish) - it is believed that two species of this genus occur, however, identification will require confirmation.

Poeciliidae (mosquitofishes)

Gambusia affinis (common mosquitofish) - common and abundant throughout the watershed.

Gambusia sp. (none) - it is not known which of the other species these individuals may be or if it is an undescribed species. Common but localized to Jim Ned Creek drainage.

Serranidae (basses)

Roccus chrysops (white bass) - common and widely distributed.

Centrarchidae (black basses and sunfish)

Micropterus salmoides (largemouth bass) - rare but widely distributed.

Micropterus treculi (Texas spotted bass) - rare restricted to spring fed areas of the Concho's and Pecan Bayou.

Chaenobryttus gulosus (warmouth bass) - rare but found throughout the watershed.

Lepomis cyanellus (green sunfish) - probably the most numerous species of sunfish throughout the river system. Found at all collection areas.

Lepomis microlophus (redear sunfish) - common but never numerous.

Lepomis macrochirus (bluegill) - second only to green sunfish in abundance and distribution.

Lepomis auritus (yellowbelly sunfish) - rare and never numerous. Taken in the Concho's and from reservoirs primarily.

Lepomis megalotis (longear sunfish) - common but seldom numerous. Taken at all collection areas.

Pomoxis annularis (white crappie) - common and throughout the river system.

Pomoxis nigromaculatus (black crappie) - rare but found in areas below station 16 and on the Pecan Bayou watershed.

Percidae

Hadropterus scierus (dusky darter) - extremely rare found in the spring areas of the Concho's only.

Percina caprodes (logperch) - common but seldom numerous found throughout the watershed.

Etheostoma spectabile (orangethroat darter) - rare in spring areas of Concho's only.

Sciaenidae (drum, croakers and weakfishes)

Aplodinotus grunniens (freshwater drum) - common but not numberous throughout the river system.

Cichilidae (cichlids)

Cichlasoma cyanoguttatum (Rio Grande cichlid) - obviously introduced but taken in the Concho's. There was no evidence of the species elsewhere.

SUMMARY:

1. The 20,700 square mile area comprising the Upper Colorado River watershed is extremely variable in soils, geological formation and usage. The waters are unreliable and are subject to wide variation in quality but are basically very productive. There is no reliable source or sources for the watershed and flow is entirely dependent upon run-off. The only permanent or semi-permanent flow is regulated by a series of reservoirs that are not operated with any consideration being given to the existing or

potential fish populations.

2. The fish populations of the upper Colorado River System are dominated by river carpsuckers, carp, gizzard shad and sunfishes.

3. Minnows and shiners are abundant but are dependent upon restricted areas where stream flow is sufficiently constant to provide that basic need for their successful propagation.

4. Sunfish because of their relatively large numbers and small size are regarded as a fishery problem rather than a valuable fishery resource.

5. Forty-three species of twelve families are located and their relative abundance and distribution were determined.

6. It is recommended that further study be made to determine if any practical means may be determined whereby this resource may be made more productive and more available to the public.

RECOMMENDATION:

Because virtually all of the stream areas worked are not open to public fishing it is not recommended that any fishery management effort be made at this time. However, it is proposed and recommended that if future study indicates that by employing effective fishery management procedures on these streamways the public waters impounded in the reservoirs may be benefited; a suitable and approved program should be put into effect at that time. For that reason it is recommended that the usual resurvey procedure be carried out on this watershed.

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