

JOB COMPLETION REPORT

As required by

FEDERAL AID IN FISHERIES RESTORATION ACT

TEXAS

Federal Aid Project No. F-5-R-11

FISHERIES INVESTIGATIONS AND SURVEYS OF THE WATERS OF REGION 1-B

Job No. B-32 Fisheries Reconnaissance

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July 28, 1964

ABSTRACT

Fish populations were examined in 27 public waters of Region 1-B. Three hundred and twenty-eight standard gill net collections, 110 specific gill net collections, 186 standard seining collections, and 71 specific seining collections were taken. Fifty-two species of 13 families were identified from 9,497 fish captured in gill nets and 89,932 fish captured in seines. To measure harvest, the results of 537 creels were determined.

Findings from this effort indicated that fishery management is needed at Fort Phantom Hill Reservoir, Devil's Lake and Lake Walk, Red Bluff and Imperial Reservoirs, the Upper Pecos River, the Upper Colorado River, the Upper Rio Grande River and for San Angelo Reservoir.

Data obtained under previous investigations and current data indicate that management efforts have been successful in achieving initial objectives, that benefits from management may last over 5 years, that contrary to accusations endemic species have not been exterminated through project effort, that endemic species have experienced an expansion of range through project effort, post-management harvest is 10 to 20 times greater than pre-management harvest, and when management fails it is largely due to circumstances beyond control of project personnel. The ineffectiveness of current stocking practices in specific waters is demonstrated and failure of experimental stocking of Lake J. B. Thomas with blue catfish is indicated.

Three species, previously unidentified, were added to the regional checklist, and range extensions were determined for three species.

Reconnaissance work as carried out under this project is entirely too broad in scope, and it is recommended that future reconnaissance work be limited to (a) obtaining information to fill in gaps in project data, (b) carrying out preliminary investigations needed for project planning, and (c) procuring data needed to meet limited objectives such as that required to justify management where unforeseen opportunities arise.

JOB COMPLETION REPORT

State of Texas

Project No. F-5-R-11

Name: Fisheries Investigations and Surveys of the Waters of Region 1-B

Job No. B-32

Title: Fisheries Reconnaissance

Period Covered March 1, 1963 - February 29, 1964

Objectives:

To conduct limited investigations of regional waters in order to maintain current knowledge of the fishery resource and of factors influencing its production and harvest.

Procedures:

The following standard procedures were adapted for all project work.

I. Sampling Fish Populations

- A. A standard gill netting unit is made up of nylon gill netting, measuring 150 feet long by 8 feet deep. The unit is in 25-foot sections. Mesh sizes of these nets increase progressively to larger sizes in following sections, at half-inch intervals, beginning with one-inch mesh sections and terminating with a three and one-half inch section. Bags are created in these nets by means of "tie downs" that are 6 feet long, and that are spaced at 9-foot intervals along the horizontal length of the net.
- B. Any gill net, either with all its mesh the same size or with several sizes whose total components equal 150 linear feet is a specific gill netting unit and data obtained from such sets are designated as such.
- C. A standard seining unit is a 12-foot common seine whose mesh size does not exceed 1/4 inch, and whose mesh size is not consistently less than 1/4 inch.
- D. A specific seining unit is any seining equipment that does not meet the above specifications. Data obtained by the use of such equipment are designated as specific data.
- E. A standard gill net collection is the data from fish captured in an overnight set of one standard gill netting unit.
- F. A standard seining collection is data from fish captured with three hauls of a standard seining unit.
- G. A specific seining collection is the data from fish captured with seines of other than standard construction.

- H. A specific gill netting collection is the data from fish captured in an overnight set with any gill net not meeting standard specifications.
- I. Data from gill netting collections normally included weight, length, sex and gonadal development, stomach contents, and "K" for 50 individuals for each of the primary species.
- J. Data obtained from seining collections was in accordance with the objective of carrying out the work.

II. Basic Data Recorded for Each Field Trip

A. Physical data

1. Turbidity readings to denote major deviations in turbidity.
2. Temperatures (Fahrenheit)
 - a. Water temperatures including area deviations and diurnal and nocturnal variations.
 - b. Air temperatures including minimum and maximum for period during which field activities were carried out.
3. Wind (m.p.h.)
 - a. Estimated speed, direction and variations.
4. Hydrology
 - a. Lake level or volume.
 - b. Stream flow or velocity.
5. Weather and Climatic Conditions.
 - a. Cloud cover.
 - b. Moisture.
 - c. Relative stability of temperatures.
 - d. Barometric pressure.
 - e. Moon phase.
6. Bottom type
7. Cover
8. Vegetation
9. Other ecological conditions or influences and observations. Occurrence of springs, stream gradient, shade of trees, canyon walls, riffles or falls, aquatic organisms.

B. Water quality

1. Where possible data were obtained from qualified cooperating agencies. Most data were obtained from the State Health

Department, the U. S. Geological Survey, Bureau of Reclamation, the International Boundary and Water Commission and from municipal sources.

2. Essential determination of pH, dissolved oxygen, dissolved carbon dioxide, chloride, alkalinity were by the standard analysis procedures outlined in FRESHWATER FISHERY BIOLOGY by Lagler.

Sampling of fish populations in 27 regional waters is specified in Figure 1. The number of standard gill net collections obtained is 28 less than planned. However, the sum of standard and specific gill net collections is 94 units greater than originally specified, or 27 per cent greater than the total quantity of netting planned. Less standard collections were obtained than planned because (a) subdivision and relocation of project facilities and personnel resulted in an initial shortage of material with which to build a sufficient number of standard units, and (b) the time required in purchasing sufficient materials and training new personnel in net construction was greater than anticipated. The number of standard seining collections obtained is less than specified, but total units, both standard and specific, exceed the quantity specified in planning by two units. This deviation from planning was due to unforeseeable local conditions as (a) excessive aquatic vegetation or obstructions in localities, and (b) the recession of most area waters tended to reduce the amount of shore areas where standard seining could be accomplished.

Work planned for Lake Kirby and Lake Abilene was not attempted. The management opportunity temporarily afforded at Lake Nasworthy was deemed more important. (See job completion report for Job 16a47, Project F-14-D-7). Investigations of small lakes at Kent, Sierra Blanca and the Van Horn area were completed. For logistical reasons this work will be reported in the completion report for Job B-34. The investigation of Sand Lake at Pecos was not carried out because the lake dried up.

Results:

References are made throughout this report to a number of species of fish. The following checklist has been prepared to assure correct identification. Scientific and common names are those specified in "A List of Common and Scientific Names of Fishes from the United States and Canada", second edition, American Fisheries Society, Special Publication No. 2, 1960.

longnose gar	<u>Lepisosteus osseus</u>
spotted gar	<u>L. oculatus</u>
alligator gar	<u>L. spatula</u>
gizzard shad	<u>Dorosoma cepedianum</u>
Rainbow trout	<u>Salmo gairdneri</u>
Mexican tetra	<u>Astyanax mexicanus</u>
stoneroller	<u>Campostoma anomalum</u>
Mexican stoneroller	<u>C. ornatum</u>
carp	<u>Cyprinus carpio</u>
Devils River minnow	<u>Dionda diaboli</u>
roundnose minnow	<u>D. episcopa</u>
Rio Grande chub	<u>Gila nigrescens</u>

silvery minnow	<u>Hybognathus nuchalis</u>
speckled chub	<u>Hybopsis aestivalis</u>
golden shiner	<u>Notemigonus crysoleucas</u>
Texas shiner	<u>Notropis amabilis</u>
emerald shiner	<u>N. atherinoides</u>
Chihuahua shiner	<u>N. chihuahua</u>
Rio Grande shiner	<u>N. jemezianus</u>
red shiner	<u>N. lutrensis</u>
bluntnose shiner	<u>N. simus</u>
sand shiner	<u>N. stramineus</u>
blacktail shiner	<u>N. venustus</u>
suckermouth minnow	<u>Phenacobius mirabilis</u>
fathead minnow	<u>Pimephales promelas</u>
longnose dace	<u>Rhinichthys cataractae</u>
river carpsucker	<u>Carpionodes carpio</u>
blue sucker	<u>Cycleptus elongatus</u>
smallmouth buffalo	<u>Ictiobus bubalus</u>
blue catfish	<u>Ictalurus furcatus</u>
black bullhead	<u>I. melas</u>
channel catfish	<u>I. punctatus</u>
flathead catfish	<u>Pylodictis olivaris</u>
plains killifish	<u>Fundulus kansae</u>
rainwater killifish	<u>Lucania parva</u>
mosquitofish	<u>Gambusia affinis</u>
Pecos gambusia	<u>G. nobilis</u>
white bass	<u>Roccus chrysops</u>
warmouth	<u>Chaenobryttus gulosus</u>
green sunfish	<u>Lepomis cyanellus</u>
bluegill	<u>L. macrochirus</u>
reardear sunfish	<u>L. microlophus</u>
largemouth bass	<u>Micropterus salmoides</u>
Guadalupe bass	<u>Micropterus treculi</u>
white crappie	<u>Pomoxis annularis</u>
slough darter	<u>Etheostoma gracile</u>
orangethroat darter	<u>E. spectabile</u>
logperch	<u>Percina caprodes</u>
freshwater drum	<u>Aplodinotus grunniens</u>
red drum	<u>Sciaenops ocellata</u>
tidewater silverside	<u>Menidia beryllina</u>
southern flounder	<u>Paralichthys lethostigma</u>

Sampling of fish populations resulted in the capture of 9,497 fish by gill nets and approximately 89,932 fish by seines. As indicated above 52 species of 13 families were identified from these collections. The organization of this report follows the primary objectives for making the various studies. To minimize duplication of material already published, general descriptions and locations of the concerned waters are omitted. This information is available in previous reconnaissance reports, and in reports covering original surveys. Objectives for carrying out specific investigations are outlined in Figure 2.

Figure 1. Seining and Gill Netting Collections Taken for Reconnaissance 1963-1964

Area & Specific Waters	Gill Net Collections		Seining Collections		Harvest Creels
	Standard Collections	Specific Collections	Standard Collections	Specific Collections	
I. Reservoirs					
A. Abilene Area					
Ft. Phantom Hill	17	19	5	2	12
B. Colorado City Area					
Lake Colorado City	4	4	4		21
Champion Creek Res.	6	2	2		4
C. Del Rio Area					
Devils Lake	9		4		4
Lake Walk	8		4		6
D. Pecos Area					
Red Bluff Res.	36	14	20		60
Imperial Res.	62		15		12
Lake Balmorhea	53		8		18
E. Snyder Area					
Lake J. B. Thomas	5		4		21
F. Sweetwater Area					
Lake Sweetwater	6		4		63
Oak Creek Res.	12		4		21
Lake Trammel	6		4		
Old Winters Lake				6	16
G. San Angelo Area					
Lake Nasworthy	14	61		14	116
Mountain Creek Res.	6		3		14
Twin Buttes Res.	6		8		118
San Angelo Res.				6	
II. Stream Studies					
A. San Saba River	7		7		31
B. Devils River	6		6		
C. Pecos River	20		16		
D. Rio Grande River	21		16		
E. Nueces River			5		
F. North Llano River			18		
G. South Llano River			15		
H. Middle Concho River	6			8	
I. South Concho River	18		14	7	
J. Colorado River		10		28	
Totals for All Waters	328	110	186	71	537

Figure 2. Organization of Report

- I. Reconnaissance Investigations to Determine Management Needs and Practicality
 - Lake Nasworthy (feasibility of management, population dynamics, productive factors).
 - Fort Phantom Hill Reservoir (management needs and feasibility, sound harvest regulations).
 - Devils Lake (productivity, management planning, harvest regulations).
 - Lake Walk (productivity, management planning, harvest regulations).
 - Red Bluff Reservoir (management needs, population dynamics, harvest regulations).
 - Imperial Reservoir (management needs, population dynamics, basis for harvest regulations).
 - Lake Trammel (management planning, harvest regulations).

- II. Reconnaissance Investigations to Evaluate Management Effort
 - Lake Balmorhea (management results, population dynamics, harvest regulations).
 - Lake Sweetwater (management results, harvest regulations).
 - Oak Creek Reservoir (management results, population dynamics, harvest regulations).
 - Champion Creek Reservoir (management results, regulatory authority).
 - Mountain Creek Reservoir (management results, regulatory authority).
 - Old Winters Lake (management results, harvest regulations).
 - Twin Buttes Reservoir and Watershed (management results, population dynamics, factors influencing harvest).

- III. Reconnaissance Studies to Provide Specific Data
 - Lake Colorado City (unique conditions on production, harvest success, harvest recommendations).
 - Lake J. B. Thomas (survival of exotic species, productivity, harvest regulations).
 - San Angelo Reservoir (testing new equipment for selectivity and gross effectiveness).
 - Devil's River (previously unexamined waters, distribution of species and relative abundance).
 - Upper Rio Grande River (productivity, management problems, ingress and egress).
 - San Saba River (distribution of species).
 - Dove Creek (survival of endemic species, species distribution).
 - West Fork of Nueces (species distribution, previously unexplored waters).
 - South Llano (species distribution and occurrence).
 - North Llano (species distribution and occurrence).
 - Upper Colorado River (relative abundance of species and securing minnows for restocking eradicated waters).

I. Investigations to Determine Management Needs and Practicality

Lake Nasworthy

Background Information

Following the completion of management work on Twin Buttes Reservoir and the Concho River watershed, an extensive reconnaissance was made of Lake Nasworthy and associated waters. Details of findings of that work, completed in January 1963, are reported in completion report B-32, Project F-5-R-10. At that time 54 gill net collections were made from the lake and the stream below the dam. Approximately three-fourths (74.46 per cent) of 2,028 fish captured in 15,025 feet of nets were problematic species. Within 18 months prior to July 1963, the lake was reduced from 12,340 acre feet to 1,678 acre feet. On July 28, 1963 major portions of Lake Nasworthy and associated waters were treated with chemical to eliminate fish life. The details of that work, salvage operations and subsequent restocking are reported in completion report 16a47, Project F-14-D-7. This work, with previous work to clear the Concho River watershed above Twin Buttes dam, is expected to greatly enhance game fish production.

Fish Populations

The work specified in Figure 1 was included to (a) provide last minute assurance of previous findings, (b) obtain data on the effect of this rapid reduction in volume on game fish populations, and (c) provide indications of the initial success of the chemical control effort. Details in the above identified report are summarized as follows: 1. The rapid reduction of the lake volume resulted in a reduction in relative abundance of most game species. Practically no white crappie, white bass, or channel catfish were captured in collections taken immediately prior to the chemical treatment or as a result of the fish kill. These species comprised 17.79 per cent of the January collections. Flathead catfish and largemouth bass were more capable of surviving these conditions. Less than two per cent of the fish destroyed were game species. 2. Post treatment sampling of Lake Nasworthy indicated the work had eliminated existing fish populations. Gill nets, including 14 standard units, set in the lake failed to capture fish. 3. Stocked game fish were surviving and exhibiting adequate growth. (See completion report 16a47, Project F-14-D-7).

Harvest

During the spring months preceding the chemical treatment, fishing was excellent. Creels for the Concho Bass Club indicate an average catch of one pound of fish per man-hour fished. Creels for less experienced fishermen indicated catches were less than one-tenth pound of game fish per man-hour fished. Virtually all significant catches were largemouth bass or flathead catfish and were made between March 1, 1963 and June 6, 1963. Probably the extreme reduction in volume facilitated the spring harvest.



Figure 3. Results of one drag with a 300-foot seine from Lake Nasworthy.



Figure 4. Spawning-size flathead catfish were returned to the lake following eradication effort.

Fort Phantom Hill Reservoir

Background Information

By fall of 1963, management of regional waters had expanded until almost every major area of concentrated human population was benefiting from fishery management efforts through federal aid. Exceptions were the Abilene, Del Rio and Pecos areas. This circumstance, with requests from local authorities that management needs be determined, motivated investigations. Since population sampling had not been included in the past three years work this investigation was needed to meet requirements for regulatory responsibility. Previous survey work beginning in 1956 (see completion report B-18, Project F-5-R-5) and continuing through 1960 (see completion reports B-22, Projects F-5-R-6 and 7 and B-16, Projects F-5-R-6 and 7), indicates the following: (a) Fort Phantom Hill is less productive than Lake Kirby and Lake Abilene. (b) The lake exhibited less stability in game fish production than other lakes. (c) Fort Phantom Hill is relatively unproductive in largemouth bass, and harvest of that species is less than for most lakes. (d) Fort Phantom Hill was occasionally productive in channel catfish and flathead catfish. (e) Fluctuations in the lake level were the principal factors in maintaining moderate production of game species.

Fish Populations

As shown in Tables 1 and 2, high populations of white bass and white crappie exceed previous catches. However, channel catfish were significantly less than comparable collections indicated. Smallmouth buffalo were expanding while relative abundance of other problematic species remained relatively static. Flathead catfish were apparently increasing and sunfish and gizzard shad were decreasing.

Harvest

Creels indicate harvest is insufficient, and the fishing reputation of the lake is less than desirable.

Management Efforts and Appraisal

Stocking of game fish from State fish hatcheries and contract netting are the only management devices employed to date. Neither of these efforts have been effective. During the 1962-63 period 65,000 largemouth bass were released in Fort Phantom Hill. Although 532 fish were captured in the 5,400 feet of gill net set during the current segment, only 5 largemouth bass were recaptured. No largemouth bass were captured in seining collections. Although a contract fisherman worked the lake thoroughly in 1958-59, smallmouth buffalo, the species whose harvest was the object of this control work, have increased beyond previous relative abundance. The quantity of water impounded prohibits chemical treatment of the lake at this time, therefore, no remedial measures are recommended.

Table 1. Results of 17 gill nets set for fisheries reconnaissance of Fort Phantom Hill Reservoir
 October 23, 24, 25, 1963

Species	Number	Per Cent by		Average Weight Pounds	Per Cent by Weight	Average "K"
		Number	Weight			
longnose gar	2	.37	1.12	0.48	.39	
gizzard shad	75	14.10	0.10	1.73	1.55	
smallmouth buffalo	105	19.74	1.93	42.80	3.36	
river carpsucker	44	8.27	1.62	11.61	2.64	
carp	18	3.38	2.84	10.79	2.33	
channel catfish	19	3.57	1.57	6.31	1.71	
flathead catfish	11	2.07	6.36	14.77	1.93	
white bass	103	19.36	0.52	11.29	2.56	
largemouth bass	5	.94	1.05	1.11	2.45	
bluegill	9	1.69	0.08	0.16	3.30	
longear sunfish	1	.19	0.06	0.01	3.59	
white crappie	130	24.44	0.30	8.35	2.72	
freshwater drum	10	1.88	0.28	0.59	2.25	
Totals	532	100.00	473.82	100.00		

Table 2. Results of 19 Specific netting units set for fisheries reconnaissance of Fort Phantom Hill Reservoir
 October 23, 24, 25, 1963

Species	Number	Per Cent by		Total Weight Pounds	Average Weight Pounds	Per Cent by		Average "K"
		Number	Weight			Weight	Weight	
smallmouth buffalo	2	12.50	9.00	4.50	8.05			
carp	3	18.75	25.63	8.54	22.93			
channel catfish	6	37.50	35.81	5.96	32.05			
flathead catfish	4	25.00	21.31	5.32	19.07			
freshwater drum	1	6.25	20.00	20.00	17.90			
Totals	16	100.00	111.75		100.00			

Devil's Lake and Lake Walk

Background Information

The original surveys of Devil's Lake and Lake Walk were completed in 1954-55 by personnel of Project F-9-R. (See completion reports B-4, B-15 and B-20 of Project F-9-R). At that time problematic species dominated fish production by 8 to 2. Work on these waters under F-5-R began in 1959 and has continued through 1960, 1962 and 1963. In 1959 problematic species made up less than 57 per cent of fish captured. This percentage was 56.36 in 1960. By 1962 problematic species made up 66.65 per cent and the current percentage is 73.73 per cent.

Expanding current knowledge of these waters is essential to future determination of management potentialities for Amistadt Reservoir. That international reservoir will be created within the next few years by a dam on the Rio Grande River. The new reservoir which will inundate Devil's Lake and Lake Walk will be capable of impounding 5,660,000 acre feet of water, and of covering 87,000 acres. The vital function that Devil's Lake and Lake Walk may serve in providing maximum game fish production for Amistadt is outlined in the following discussion.

If pre-inundation management is omitted it may be impossible to provide adequate numbers of game fish for stocking. Based on current stocking ratios (100 largemouth bass and 100 channel catfish per acre), 17,400,000 fish would be required for adequate stocking of 87,000 acres. If 100 minnows are stocked for each game fish, 1,740,000,000 minnows would be needed. If costs for game fish are assumed not to exceed .1 cent per fish and forage minnows are valued at .01 cent, total costs for stocking alone would be \$191,400.00. If the work were done in the accepted manner, costs could and probably would exceed this figure. All state fish hatcheries could not produce and transport this quantity of fish within a single year. Even if such production were possible, fiscal practicality would not permit serious consideration of such a procedure. The plan under present consideration would involve employing Devil's Lake and Lake Walk to produce a maximum number of brood fish two or three years prior to inundation. A thorough and properly timed management effort should result in production of largemouth bass and channel catfish populations of approximately 100 per acre. The combined surface area for the existing lakes is 635 acres. If the sex ratio for the 127,000 brooder fish is assumed to be one male to one female, reproductive potential for these populations is approximately 635,000,000. An accompanying expansion of desirable forage minnows might be proportionally greater than for game species since more than one spawning should occur within the pre-inundation period. Using rotenone powder, the cost of a chemical treatment for Lake Walk and Devil's Lake at maximum storage, 14,250 acre feet, would be approximately \$19,082.50. It is extremely unlikely that this maximum cost would be incurred. Devil's Lake, the upper lake, can be reduced to less than 3,000 acre feet without hampering operations of the hydroelectric plant located in Lake Walk dam. The lower lake could be reduced to less than 1,000 acre feet without seriously jeopardizing power production. At that volume (4,000 acre feet) the work would cost approximately \$6,270.00. Potential advantages of carrying out the outlined program include (a) the probability of providing more recreation than would otherwise be provided. The brooder-sized fish would be available for public fishing immediately following inundation and control of problematic species should lengthen the duration of benefits,

(b) the procedures would permit more reliable control of harvest and more flexibility in determining when the harvest should logically begin. By employing these methods 377.33 acres of water might be benefited for each acre managed. Optimum conditions might permit this ratio to exceed 1,000 to 1.

Fish Populations

As previously stated, game fish production has decreased during the past five years. However, data taken from Lake Walk over an eight-year period (1955-1963) indicate (a) populations of longnose and spotted gar, gizzard shad, river carpsuckers, channel catfish, and white bass have decreased significantly, and (b) flathead catfish, largemouth bass, and white crappie have increased. In both lakes "K" for channel catfish, largemouth bass and crappie is significantly less than regional averages. Condition for gizzard shad, river carpsuckers and carp are higher than regional averages. Data taken over a 10-year period from Devil's Lake (1953-1963) indicate almost identical population trends.

Harvest

Only ten creels were obtained. According to these data fishing results were negative. However, the fishing reputation for both lakes is moderately good with the upper lake favored in public opinion.

Management Efforts and Appraisal

Lake Walk was chemically treated in April 1957 to reduce gizzard shad populations. However, a comparison of data between the two lakes indicates benefits were of short duration (see Tables 3 and 4).

Table 3. Results of 9 gill nets set for fisheries reconnaissance of Devil's Lake
August 27, 1963

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
longnose gar	15	4.74	16.44	1.10	3.55	.39
spotted gar	7	2.22	5.75	0.82	1.25	.49
gizzard shad	70	22.15	31.25	0.45	6.76	1.70
river carpsucker	64	20.25	79.31	1.24	17.16	2.37
grey redhorse sucker	4	1.27	6.50	1.63	1.41	2.60
carp	13	4.11	118.00	9.08	25.54	2.63
channel catfish	26	8.23	69.69	2.68	15.08	1.51
flathead catfish	3	.95	11.25	3.75	2.44	1.42
white bass	2	.63	2.00	1.00	.43	2.01
largemouth bass	3	.95	1.94	0.65	.42	1.82
Rio Grande perch	1	.32	0.50	0.50	.11	3.36
bluegill	30	9.49	7.00	0.23	1.51	2.93
redbreast sunfish	4	1.27	1.38	0.35	.30	2.67
white crappie	14	4.43	7.00	0.50	1.51	1.99
freshwater drum	60	18.99	104.06	1.73	22.53	2.16
Totals	316	100.00	462.07		100.00	

Table 4. Results of 8 gill nets set for fisheries reconnaissance of Lake Walk
August 28, 1963

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
longnose gar	16	6.86	23.00	1.44	7.74	.33
spotted gar	1	.43	1.00	1.00	.34	.48
gizzard shad	42	18.03	20.75	0.49	6.98	2.03
river carpsucker	61	26.18	129.94	2.13	43.75	2.66
grey rehorse suckers	3	1.28	4.00	1.33	1.35	1.98
carp	2	.86	18.88	9.44	6.36	2.59
channel catfish	23	9.87	20.50	0.89	6.90	1.47
flathead catfish	10	4.30	35.88	3.59	12.08	1.52
white bass	7	3.00	3.62	0.52	1.22	2.57
largemouth bass	7	3.00	1.94	0.28	.65	1.72
redear sunfish	1	.43	0.25	0.25	.09	3.38
bluegill	5	2.15	0.62	0.12	.21	3.36
warmouth bass	1	.43	0.19	0.19	.06	2.71
redbreast sunfish	5	2.14	0.62	0.12	.21	3.43
longear sunfish	1	.43	0.25	0.25	.08	3.08
white crappie	8	3.44	3.25	0.41	1.10	2.34
freshwater drum	40	17.17	32.31	0.81	10.88	2.32
Totals	233	100.00	297.00		100.00	

Red Bluff and Imperial Reservoirs

Background Information

Work on these reservoirs is to provide a substantial sport fishery in western waters where saline properties limit game fish production both in variety and quantity. Potentially, these waters are of tremendous recreational importance because of their nearness to heavily populated areas. Both reservoirs are irrigation control reservoirs on the Pecos River. The primary function of Red Bluff is for storage of stream flow. Imperial is employed to control releases into lower portions of the irrigation canal system. Both reservoirs remained below 50 per cent capacity during the period. Sampling of fish populations served to meet legal requirements for regulatory authority and for a basis for determining management feasibility. These data also provided the means of determining relative success of marine transplants. Studies of these waters were initiated in 1955. For details of previous work see completion reports B-17 and B-13, Project F-5-R-5, reports B-22, Projects F-5-R-6, 7 and 8, and B-32, Projects F-5-R-9 and 10.

Fish Populations

Confirming previous findings, data indicate that white bass are the only species that are sufficiently productive and numerous to constitute a significant fishery asset. Current data indicate an expanding white bass population in Imperial Reservoir and a diminishing population in Red Bluff. Expansion and repression of white bass production is apparently controlled by (a) expansion and reduction of reservoir volumes, (b) stream flow entering the reservoirs, and (c) dynamics of the gizzard shad population.

Harvest

Except for white bass few fish are caught. The effects of white bass production on harvest are reflected in toll receipts obtained during periods of high production as compared to years when populations are low. During peak years receipts are more than ten times as great as those obtained during periods of low white bass production.

Management Efforts and Appraisal

The only management employed has been (a) experimental introduction of marine fish, and (b) stocking from State fish hatcheries. The first procedure is regarded as of potential importance; the futility of the second is demonstrated in completion report F-1, Project F-5-R-11.

Table 5. Results of 50 gill nets set for fisheries reconnaissance of Red Bluff Reservoir

Species	Number	Per Cent by		Total Weight Pounds	Average Weight Pounds	Per Cent by		Average "K"
		Number	Weight			Weight	Weight	
longnose gar	142	10.72	21.75	342.34	2.41	21.75	.43	
gizzard shad	636	48.04	12.83	201.84	0.32	12.83	1.83	
smallmouth buffalo	172	12.99	43.34	682.05	3.97	43.34	2.37	
river carpsucker	207	15.63	9.61	151.20	0.73	9.61	2.10	
carp	67	5.06	3.47	54.73	0.82	3.47	2.11	
channel catfish	13	0.98	1.76	27.68	2.13	1.76	1.90	
white bass	64	4.84	5.57	87.63	1.37	5.57	2.56	
largemouth bass	2	0.15	0.37	5.81	2.91	0.37	2.90	
green sunfish	9	0.68	0.13	1.95	0.22	0.13	3.83	
bluegill	2	0.15	0.03	0.53	0.27	0.03	4.10	
white crappie	1	0.08	0.06	1.00	1.00	0.06	4.00	
red drum	9	0.68	1.08	16.88	1.88	1.08	1.96	
Totals	1,324	100.00	100.00	1,573.64		100.00		

Table 6. K-Factor Range, Averages and Distribution of fish taken from Red Bluff Reservoir

													Total Average								
longnose gar	K	.37	.38	.39	.40	.41	.42	.43	.44	.45	.46	.47	.48	.49	17	0.43					
	No. 1	1	2			3	1	6	1	1				1							
gizzard shad	K	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	88	1.83
	No. 1	1	1	1	2	8	8	9	19	14	9	5	2	3	2			3			
smallmouth buffalo	K	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	112	2.37	
	No. 3	7	4	16	13	17	14	10	7	8	1	5	3	1	2			1			
river carpsucker	K	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	95	2.10					
	No. 1	2	5	14	24	20	12	5	5	2	1	3	1								
carp	K	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	39	2.11		
	No. 1	1	2	4	6	1	8	2	6	2	3	2			1						
channel catfish	K	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	13	1.90									
	No. 2	1	4	2	1	1	1	1	1												
white bass	K	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.4	54	2.56
	No. 1	1	1	4	6	2	2	4	6	5	2	8	2	7	1	2	1				
largemouth bass	K	2.9	1	2.90																	
	No. 1																				
green sunfish	K	3.0	3.1	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	9	3.83			
	No. 1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
bluegill	K	3.4	4.8	2	4.10																
	No. 1	1																			
white crappie	K	4.0	1	4.00																	
	No. 1																				
red drum	K	1.7	1.8	1.9	2.0	2.1	2.2	9	1.96												
	No. 2	1	1	4	1																
											Total		440								

Table 7. Results of 62 gill nets set for fisheries reconnaissance of Imperial Reservoir

Species	Number	Per Cent by		Total Weight Pounds	Average Weight Pounds	Per Cent by		Average "K"
		Number	Weight			Weight	Weight	
longnose gar	57	5.44	15.92	93.22	1.64	15.92	.40	
gizzard shad	720	68.84	17.65	103.32	0.14	17.65	1.81	
smallmouth buffalo	18	1.72	3.26	19.07	1.06	3.26	2.37	
river carpsucker	27	2.58	3.18	18.64	0.69	3.18	2.07	
carp	11	1.05	1.58	9.23	0.84	1.58	2.46	
white bass	212	20.27	54.12	316.83	1.49	54.12	2.47	
red drum	1	0.10	4.29	25.06	25.06	4.29	1.96	
Totals	1,046	100.00	100.00	585.37		100.00		

Table 8. K-Factor Range, Averages and Distribution of Fish Taken From Imperial Reservoir

	K	.31	.32	.34	.36	.37	.39	.40	.41	.42	.43	.44	.47	Total	Average							
longnose gar	No. 1	1	1	1	1	1	1	1	2	1	3	4	1	18	0.40							
gizzard shad	K	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	60	1.85							
	No. 2	1	6	8	17	8	8	5	3	1												
river carpsucker	K	1.9	2.2													3	2.10					
	No. 1	2																				
carp	K	2.0	2.1	2.4	2.5	2.7	3.4									8	2.46					
	No. 1	2	1	2	1	1																
white bass	K	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.6	108	2.47
	No. 1	1	1	7	3	14	16	17	12	11	7	3	2	5	3	1	2	1	1			
red drum	K																				1	
	No. 1																				198	

Summation of Food Studies of Fish Taken from Imperial Reservoir

Species	No. Checked	No. With Food	Food Items
	55	43	
			Fish remains 7
			Shad 9
			Silversides remains 13
			Insect remains 4
			Insect larvae 8
			Mud and silt 2

Lake Trammel

Background Information

Lake Trammel is one of three reservoirs that supply Sweetwater and lesser area communities with water. Having completed management designed to restore game fish production in Lake Sweetwater and Oak Creek Reservoir, and with knowledge that these efforts were initially successful, a study of game fish production in Lake Trammel was deemed advisable. The original inventory survey of Lake Trammel was completed in 1959 (see completion report B-24, Project F-5-R-6). The results of that work indicated that channel catfish and bluegill sunfish were the principal game species, and problematic fish were low in relative abundance.

Fish Populations

As shown in Table 9, game fish continue to dominate the lakes production. Black bullheads, the most abundant problematic species according to original survey data, were less abundant and largemouth bass were more abundant. However, the decline of channel catfish (from 19.01 per cent to .60 per cent) and the introduction of river carpsuckers offset these advantages. Sunfish populations exhibited a greater degree of stunting than in 1959 and forage minnows were less abundant.

Harvest

Harvest success has obviously declined, and fishing pressures have been drastically reduced. No creel records were obtained in three trips to the lake by the local game warden.

Management Efforts and Appraisal

The only management procedures employed have been attempts to provide natural controls through the introduction of flathead catfish and population manipulations through opportune stocking. The first of these procedures has not met with recognizable success, and results of the second procedure appear favorable but data are inconclusive.

Table 9. Results of 6 gill nets set for fisheries reconnaissance of Lake Trammell
October 8, 1963

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
river carp sucker	2	1.19	5.06	2.53	6.65	2.21
golden shiner	5	2.97	0.88	0.18	1.15	1.58
channel catfish	1	.60	1.13	1.13	1.49	2.00
black bullhead	37	22.02	26.19	0.71	34.42	2.29
largemouth bass	13	7.74	21.94	1.69	28.84	2.44
redear sunfish	38	22.62	5.94	0.16	7.81	3.05
bluegill	30	17.86	3.00	0.10	3.94	3.37
warmouth	4	2.38	0.44	0.11	.58	3.81
white crappie	38	22.62	11.50	0.30	15.12	2.38
Totals	168	100.00	76.08		100.00	

II. Reconnaissance Investigations to Evaluate Previous Management Effort

Lake Balmorhea

Background Information

Prior to 1960 Lake Balmorhea was reported to produce good fishing. Survey work initiated in June 1960 indicated that this production was rapidly deteriorating. By October 1961, problematic fish dominated production by more than 9 to 1. Using toxaphene, the lake was treated to eradicate or drastically reduce fish populations in December 1961 (see completion report 16a34, Project F-14-D-6). Post treatment gill net checks failed to capture fish, and the lake was restocked in the spring of 1962. Subsequent checks in 1962 indicated (a) problematic species had been eliminated, and (b) game fish were exhibiting acceptable growth.

Fish Populations

During the second year following the treatment game fish grew rapidly and exhibited excellent condition (see Tables 10 and 11). However, black bullheads were captured in July collections, and carp were captured in November 1963.

Harvest

Beginning in March 1963 and continuing through the following fall, fishing success was excellent. However, the average sizes of fish were less than expected when management was completed 15 months earlier. Employing estimates provided by the concessionaire, the estimated harvest of largemouth bass may have exceeded 30,000 individuals.

Evaluation

The primary objectives for carrying out the management effort was accomplished. Two years following chemical treatment to eliminate fish life, 97.10 per cent of fish captured in gill nets in Lake Balmorhea were game species. An abundance of forage minnows was determined by seining collections. However, the reoccurrence of carp, gizzard shad and black bullheads in netting collections represents the beginning of the long term trend back to predominance of production by rough fish. This is an anticipated procession of events that will require close scrutiny by fisheries personnel.



Figure 5. Condition of gizzard shad taken from Lake Balmorhea prior to management effort.



Figure 6. Rough fish captured in 375 feet of experimental gill net prior to management of Lake Balmorhea.

Table 10. Results of 53 gill nets and 8 specific catfish nets set for fisheries reconnaissance of Lake Balmorhea

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
gizzard shad	1	0.06	0.15	0.15	0.03	2.10
carp	21	1.35	39.51	1.88	8.95	3.15
channel catfish	80	5.14	74.24	0.93	16.82	1.98
black bullheads	23	1.48	30.15	1.31	6.83	2.81
largemouth bass	133	8.56	123.98	0.93	28.08	2.53
green sunfish	993	63.86	127.32	0.13	28.85	3.32
warmouth	304	19.55	46.07	0.15	10.44	3.67
Totals	1,555	100.00	441.42		100.00	

Table 11. K-Factor Range, Averages, and Distribution of Fish Taken from Balmorhea Lake

Species	K	2.1											Total Average									
	No.	1											1	2.10								
shad	K	2.1											1	2.10								
	No.	1											1	2.10								
carp	K	2.4	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7		21	3.15							
	No.	1	4	2	4	1	2	2	2	1	1		21	3.15								
bullheads	K	1.8	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7		21	2.81	
	No.	1	2	1	1	1	1	1	1	2	5	1	1	3						21	2.81	
channel catfish	K	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7						45	1.98	
	No.	4	3	4	9	4	4	4	3	2	2	2	3	1						45	1.98	
largemouth bass	K	1.4	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	120	2.54
	No.	1	1	3	12	5	9	7	13	10	15	10	7	7	5	5	1	1	3	3	120	2.54
green sunfish	K	2.2	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	178	3.32
	No.	1	3	3	3	9	9	17	13	9	10	15	16	17	17	10	7	4	4	2	178	3.32
warmouth	K	4.3	4.4	4.5	4.6	4.7	4.8														157	3.67
	No.	3	3	1	1																157	3.67
	K	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6		
	No.	1	4	7	7	7	11	14	9	12	17	13	19	9	3	4	6	0	3			

Summation of Food Studies of Fish Taken From Balmorhea Lake

Species	No. Checked	No. with Food	Food Items:	Insects	Fish	Crayfish	Toads	Worms	Algae
bullhead catfish	25	9		2					8
channel catfish	22	15		5	13	1	1		4
largemouth bass	138	65		11	67	5	1	6	
green sunfish	48	23		16	5	3			
warmouth	55	17		11	7				
Totals	288	129		45	92	9	2	6	12

Lake Sweetwater

Background Information

Surveys beginning in 1957 and continuing until August 1960 indicated that 0.11 per cent of fish present in Lake Sweetwater were game fish and 99.99 per cent were undesirable species. To renovate game fish production, the lake and its contributing watershed were chemically treated in August 1960. For sixteen months following the treatment, collections from the lake indicated that problematic fish were absent. In December 1961, black bullheads were captured for the first time. Lake Sweetwater was reopened to public fishing on February 15, 1962. Creel census work conducted on that day indicated average catches in retainable fish to be 1.3 fish per man-hour, more than 10 times greater than catches prior to management. From March 1962 to March 1963 further reinfestation of problematic species was undetected. Fishing success remained high and game fish experienced extremely rapid growth. These findings were regarded as extremely favorable results of management work. This is especially true when the general recession of the lake during the post treatment period is considered.

Fish Populations

No further reinfestation of Lake Sweetwater was detected during 1963. Table 12 and Figure 7 indicate expansion and rapid growth of channel and flathead catfish. The expansion of bluegill sunfish and crappie may be beyond desirable limits, but other indications are that few production problems exist.

Harvest

Fishing continues to be excellent. Data from 63 creels indicate a catch of over one fish per man-hour and a significant increase in pounds of fish per man-hour.

Evaluation

Four years following management effort, game fish production was more than 20 times as great as that indicated in pre-management data.



Figure 7. Following management to renovate Lake Sweetwater catfish grew to 8 pounds in 3 years.

Table 12. Results of 6 gill nets set for fisheries reconnaissance of Sweetwater Reservoir
October 2, 1963

Species	Number	Per Cent by		Average Weight Pounds	Total Weight Pounds	Per Cent by Weight	Average "K"
		Number	Weight				
channel catfish	29	11.32	54.48	4.60	133.44	54.48	1.93
black bullheads	54	21.10	25.99	1.18	63.63	25.99	2.39
flathead catfish	3	1.17	4.08	3.33	10.00	4.08	1.84
largemouth bass	6	2.34	4.52	1.84	11.06	4.52	2.45
green sunfish	3	1.17	.15	0.13	0.38	.15	3.52
warmouth	2	.79	.10	0.13	0.25	.10	3.43
bluegill	96	37.50	4.01	0.10	9.81	4.01	2.81
longear sunfish	1	.39	.05	0.13	0.13	.05	5.00
white crappie	24	9.37	3.68	0.38	9.00	3.68	2.58
golden shiner	38	14.85	2.94	0.19	7.19	2.94	1.91
Totals	256	100.00	100.00	244.89		100.00	

Oak Creek Reservoir

Background Information

Reconnaissance work completed under Project F-5-R-9 indicated problematic fish had increased from less than 50 per cent of fish captured in gill nets in 1960 to over 80.95 per cent of collections in 1962. By June 1962, dominance of collections had reached 89.91 per cent. A contour type chemical treatment was carried out between June 14 and June 19, 1962. The purpose of this work was (a) to drastically reduce existing fish populations while they were concentrated in the shallower waters of the lake, (b) to attempt manipulation of fish populations by following the treatment with heavy stocking of cleared waters with hatchery-reared fish, and (c) to provide additional stocking should a significant increase in volume occur. Post-treatment evaluation carried out during 1962-63 indicated (a) the number of fish in Oak Creek Lake had been reduced to approximately 30 per cent of the quantity of fish present before the treatment, (b) river carpsuckers were reduced from 24 per cent of the pre-treatment sample to about 13 per cent of the post-treatment sample. Gizzard shad were reduced from 52 per cent of the pre-treatment sample to about 11 per cent of the post-treatment sample. Largemouth bass increased from about .65 per cent in June to 20.66 per cent in October. An examination of creels indicated a marked increase in fishing success.

Fish Populations

By October 1963 gizzard shad had expanded to 61.79 per cent of collections. However, river carpsuckers and carp were less than in pre-treatment collections, and channel and flathead catfish were expanding and in excellent condition. The most notable improvement in game fish production was in white crappie, and the most notable failure was the attempt to increase relative abundance of largemouth bass.

Harvest

Fishing was excellent during 1963. This was not only apparent from creels recorded, but from the obvious satisfaction of individuals who had initially opposed the work. During the spring of 1963 fishing success was estimated at 1.5 fish per man-hour.

Evaluation

Most of the problematic species remain below pre-treatment levels, and gizzard shad are of a utilizable size. Game fish have expanded and exhibit capability of providing further expansion. The success or failure of this management is not yet determined. The continued recession of the lake following the treatment has not provided the increase in growing room needed. If an expansion in volume does not occur prior to the summer of 1964 it is doubtful if long-term benefits will be obtained.

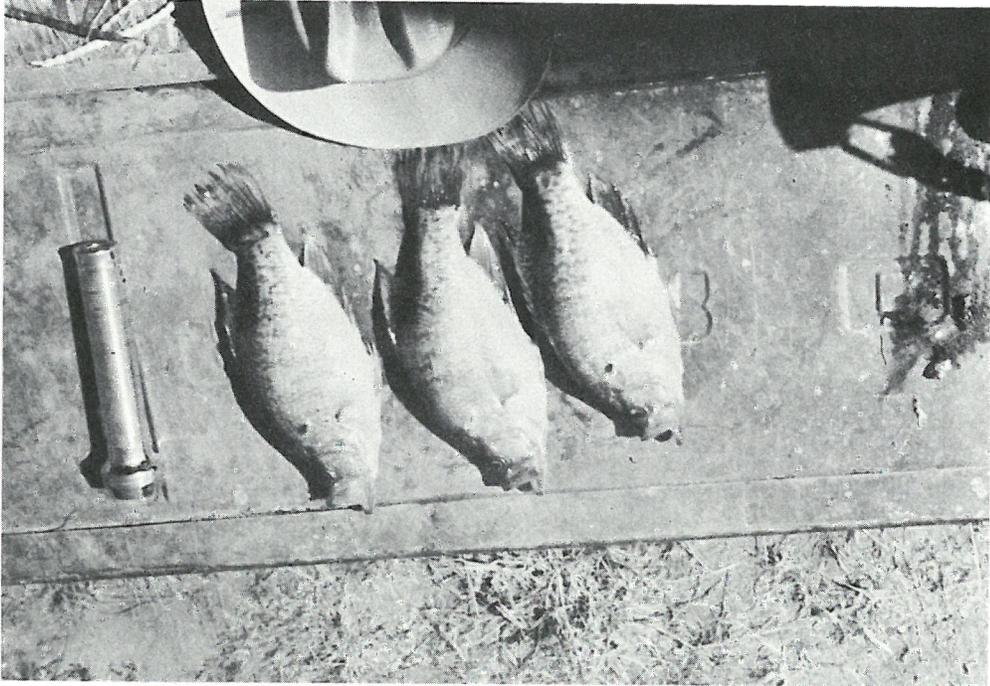


Figure 8. Following management of Oak Creek Reservoir, crappie grew from one-fourth pound to a pound in 10 months.

Table 13. Results of 12 gill nets set for fisheries reconnaissance of Oak Creek Reservoir
October 9, 1963

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
gizzard shad	220	61.79	33.00	0.15	13.46	1.33
river carpsucker	26	7.31	19.13	0.74	7.81	2.04
carp	29	8.14	42.81	1.48	17.48	2.20
channel catfish	9	2.53	25.75	2.86	10.51	1.65
black bullhead	2	.56	0.81	0.41	.33	1.95
flathead catfish	16	4.50	70.87	4.43	28.92	2.11
white bass	1	.28	0.50	0.50	.21	2.18
largemouth bass	6	1.68	5.81	0.97	2.37	2.19
bluegill	1	.28	0.13	0.13	.05	1.60
white crappie	46	12.93	46.19	1.00	18.86	2.68
Totals	356	100.00	245.00		100.00	

Champion Creek Reservoir

Background Information

Following pre-inundation investigations that indicated the basin area and virtually all of the watershed were heavily dominated by rough fish, Champion Creek Reservoir and most of the watershed were treated to eliminate existing fish populations in 1959 (see completion report 16a15, Project F-14-D-3). The principal problematic species detected in the watershed prior to inundation were river carpsuckers, carp, gizzard shad, longnose gar and freshwater drum. The reservoir captured 13,000 acre feet of water in 1959-60, reduced to 10,000 acre feet in 1961 and to 8,000 acre feet in 1962. In spite of these adverse conditions, game fish exhibited remarkable growth. By May 1961, channel catfish averaged nearly 2 pounds and largemouth bass averaged nearly 1 pound. The highest "K" values ever recorded for largemouth bass in this region were obtained from post-treatment collections. To date none of the primary rough fish species have been taken in collections.

Fish Populations

Gill net collections obtained during the current segment indicate a continued expansion in size and numbers of game species. Black bullheads, the only problematic species captured in the five year period following the initial control effort, were less abundant than in previous collections.

Harvest

Although fishing success is good, it is below that for 1962. This is attributed to the increase in submerged aquatic vegetation rather than a reduction in available fish.

Evaluation

This may be the most successful management effort ever carried out under this project. At the end of five years only black bullheads of the principal problematic species have been detected in the reservoir or the impounded watershed.

Table 14. Results of 6 gill nets set for fisheries reconnaissance of Champion Creek Reservoir
 October 3, 1963

Species	Number	Per Cent by		Average Weight		Per Cent by Weight	Average "K"
		Number	Total Weight Pounds	Pounds	Pounds		
channel catfish	1	1.61	2.38	2.38	6.57	1.71	
black bullhead	10	16.13	12.06	1.21	33.31	2.32	
largemouth bass	8	12.90	11.38	1.42	31.44	2.02	
bluegill	40	64.52	9.38	0.23	25.91	3.70	
white crappie	3	4.84	1.00	0.33	2.77	2.09	
Totals	62	100.00	36.20		100.00		

Mountain Creek Reservoir

Background Information

In May 1958, sampling of Mountain Creek Reservoir with gill nets indicated a rough fish population of 88.66 per cent. By September 1960, this dominance had increased to 98.87 per cent. On April 27 and 28, 1961, Mountain Creek Reservoir and approximately four miles of stream were treated to eliminate existing fish life. Gill nets set May 10, 1961, failed to capture fish. Following restocking, five gill nets were set in February 1962. These and subsequent collections indicated (a) that the management effort succeeded in achieving its primary objectives of eliminating river carpsuckers, carp, gizzard shad and other primary problematic species, and (b) game fish were surviving but, with the exception of channel catfish, were growing slower than normally experienced under these conditions. Gill net collections also established that black bullheads had been reintroduced into the watershed. Near the close of 1962, game fish still made up 98 per cent of collections. Excellent harvest was also indicated during this period.

Fish Populations

As shown in Table 15, the lake continues to produce excellent populations of game fish. Flathead catfish introduced in 1962 were expanding and may account for the lack of black bullheads in current collections. Stunted sunfish and crappie present a minor problem. An increase in the volume of the reservoir might turn these non-utilizable fish into an asset.

Harvest

Fishing continues to be good, but may be somewhat poorer than during the previous year. This is not a production problem but one of accessibility. Dense concentrations of marginal vegetation discourage boat launching and shore fishing.

Evaluation

This management effort appears to be highly successful.

Table 15. Results of 6 gill nets set for fisheries reconnaissance of Mountain Creek Reservoir
November 1, 1963

Species	Number	Per Cent by		Average Weight Pounds	Per Cent by Weight	Average "K"
		Number	Total Weight Pounds			
golden shiner	11	7.74	2.50	0.23	4.90	2.13
channel catfish	3	2.11	9.31	3.10	18.28	1.98
flathead catfish	1	.71	11.56	11.56	22.70	1.86
largemouth bass	6	4.22	5.06	0.84	9.94	2.64
green sunfish	4	2.82	0.56	0.14	1.10	3.42
bluegill	71	50.00	6.94	0.10	13.62	3.98
warmouth	36	25.35	10.50	0.29	20.62	4.22
white crappie	10	7.05	4.50	0.45	8.84	3.33
Totals	142	100.00	50.93		100.00	

Old Winters Lake

Background Information

This 50-acre, 250 acre-foot lake was formerly a source of water for the city of Winters. Reconnaissance in the spring of 1961 indicated the reservoir was dominated by carp and gizzard shad. Fishing results at that time were negative. By summer the lake had receded to 30 acre feet. This minor volume was treated with powdered rotenone, and two days later the lake refilled with water. The lake was restocked with largemouth bass, channel catfish and forage minnows. During 1962-63 fishing was excellent, and near the end of that period, catches of 2-pound largemouth bass were common.

Fish Populations

Seining with a 300-foot, 1-inch mesh seine indicated rough fish species dominated the lake by April 1963. However, largemouth bass and channel catfish captured were in excellent condition.

Harvest

Fishing success was good to excellent. However, success was less consistent than experienced in 1962.

Evaluation

Data are inconclusive. It is possible that equally favorable results might have been obtained if only restocking were carried out. However, the improvement of the lake was positive and recognized as such by the public. The cost of the work was less than \$100.00.

Twin Buttes Reservoir and Watershed

Background Information

Twin Buttes project is an irrigation, flood control impoundment that severs the South and Middle Concho River watersheds immediately above Lake Nasworthy. A preimpoundment survey of the basin areas and the watershed was completed in 1962 and indicated that most of the stream area was heavily dominated by rough fish (see completion report for B-33, Project F-5-R-10). Data indicated that none of the tributaries contained less than 93 per cent problematic species and that 88 per cent of the total weight of collections were rough fish. A watershed renovation effort was carried out in July and August 1962, and restocking was completed in the fall of that year (see completion report 16a39, Project F-14-D-6). During the fall of 1962 the basin above the diversion dam on the South Concho River filled to 3,000 acre feet capacity. The remainder of the basin and the Middle Concho River watershed impounded approximately 1,200 acre feet. Since that time both volumes have receded significantly.

Fish Populations

Tables 16 through 21 indicate rapid growth and excellent condition for all fish captured in post-treatment gill net collections. These data also indicate that game fish dominate populations of the Middle Concho River watershed, but that carp dominate waters of the South Concho.

Harvest

Creels indicate high fishing success in all managed waters. Over 100 creels were examined and indicated fish per man-hour was 1.3 fish. It is deemed probable that more fish were captured from these waters in the 1963-64 period than from the same waters in the past five years.

Evaluation

Final evaluation of this management effort will not be possible for several years, and will largely depend upon timely occurrence of run-off. However, data indicate that where work was uninhibited, effective control of problematic species was at least temporarily achieved. Endemic species were not exterminated. Data also indicate that where opposition and lack of cooperation was encountered, the effort was drastically and adversely affected.

Table 16. Results of 4 gill nets set for fisheries reconnaissance of Charles Schriner Ranch on Dove Creek August 22, 1963

Species	Number	Per Cent by		Total Weight Pounds	Average Weight Pounds	Per Cent by		Average "K"
		Number	Weight			Weight	Weight	
redhorse suckers	8	13.11	43.63	25.69	3.21	43.63	2.24	
channel catfish	6	9.84	35.24	20.75	3.46	35.24	1.56	
largemouth bass	19	31.14	13.91	8.19	0.43	13.91	1.92	
bluegill	14	22.95	2.65	1.56	0.11	2.65	3.22	
redbreast sunfish	11	18.04	3.82	2.25	0.20	3.82	3.55	
warmouth	3	4.92	.75	0.44	0.15	.75	3.51	
Totals	61	100.00	100.00	58.88		100.00		

Table 17. Results of 4 gill nets set for fisheries reconnaissance of Laudermilk Dam on Spring Creek
August 22, 1963

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
flathead catfish	2	10.52	0.81	0.41	6.41	1.55
largemouth bass	10	52.63	9.19	0.92	72.76	2.91
redear sunfish	6	31.58	2.25	0.38	17.82	4.37
bluegill	1	5.27	0.38	0.38	3.01	4.70
Totals	19	100.00	12.63		100.00	

Table 18. Results of 4 gill nets set for fisheries reconnaissance of South Concho-Gardner Dam
August 20, 1963

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
river carpsucker	1	.66	3.13	3.13	4.78	2.62
carp	133	88.67	53.18	0.40	81.37	2.60
channel catfish	4	2.67	4.31	1.08	6.59	1.67
largemouth bass	10	6.66	4.31	0.43	6.60	2.05
warmouth	1	.67	0.25	0.25	.38	3.58
bluegill	1	.67	0.18	0.18	.28	3.20
Totals	150	100.00	65.36		100.00	

Table 19. Results of 4 gill nets set for fisheries reconnaissance of Christoval Park on South Concho River August 16, 1963

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
gizzard shad	1	.60	0.81	0.81	.27	1.88
grey redhorse suckers	1	.61	2.13	2.13	.72	2.38
carp	137	83.54	285.00	2.08	96.46	2.46
channel catfish	6	3.66	2.13	0.36	.72	1.27
flathead catfish	2	1.22	1.44	0.72	.48	1.51
largemouth bass	9	5.49	2.13	0.24	.73	1.71
redear sunfish	4	2.44	0.38	0.10	.12	2.82
bluegill	1	.61	0.13	0.13	.05	3.49
warmouth	1	.61	0.19	0.19	.06	2.93
redbreast sunfish	2	1.22	1.13	0.57	.39	3.58
Totals	164	100.00	295.47		100.00	

Table 20. Results of 2 gill nets set for fisheries reconnaissance of Otto Ranch, on South Concho River
September 5, 1963

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
redhorse suckers	5	20.83	13.38	2.68	62.20	1.68
black bullheads	4	16.67	2.81	0.70	13.06	2.07
largemouth bass	2	8.33	2.25	1.13	10.46	1.49
warmouth	2	8.33	0.50	0.25	2.33	3.32
bluegill	6	25.00	1.63	0.27	7.57	3.83
longear sunfish	5	20.84	0.94	0.19	4.38	3.33
Totals	24	100.00	21.51		100.00	

Table 21. Results of 6 gill nets set for fisheries reconnaissance of Three Rivers Reservoir (Branch of the South Concho River) November 13, 1963

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
longnose gar	1	.56	3.75	3.75	1.62	.44
river carpsucker	13	7.39	11.50	0.88	4.99	2.71
golden shiner	2	1.14	0.31	0.16	.13	2.30
carp	123	69.88	200.81	1.63	87.10	2.95
channel catfish	2	1.14	1.81	0.91	.79	1.49
flathead catfish	2	1.14	4.63	2.32	2.00	1.73
white bass	9	5.11	2.00	0.22	.87	2.30
largemouth bass	9	5.11	4.56	0.51	1.98	1.94
bluegill	15	8.53	1.19	0.08	.52	3.68
Totals	176	100.00	230.56		100.00	

III. Reconnaissance Studies to Provide Specific Data

Lake Colorado City

Background Information

Initial survey of Lake Colorado City was completed in 1959-60. Findings indicated (a) unusually high channel catfish populations tended to concentrate in the lower half of the reservoir where public fishing was prohibited and where water temperatures were maintained at a higher degree than upper waters by circulation through a hydroelectric power plant, (b) this phenomenon also tended to concentrate waterfowl in the restricted area which in turn resulted in an increase in local fertility. The reconnaissance effort carried out was to maintain data on the effects of this phenomenon, to capture brooder fish to be used in experimental introductions, and to meet legal requirements for regulatory responsibility (see completion report B-27, Project F-5-R-7).

Fish Populations

Current data indicate a decrease in the concentration of channel and flathead catfish, a slight increase in the concentration of other game species, and a rapid expansion in the concentration of river carpsuckers. This change may be the result of a recently adopted practice of the Texas Electric Service of injecting chlorine into the discharge from the plant to discourage fish from entering plant structures.

Table 22. Results of 4 gill nets set for fisheries reconnaissance of Lake Colorado City
 July 25, 1963

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
gizzard shad	42	26.58	6.81	0.16	3.40	1.58
river carpsucker	41	25.95	45.94	1.12	22.93	2.11
carp	18	11.39	23.88	1.33	11.93	2.50
channel catfish	24	15.19	23.13	0.96	11.55	1.63
flathead catfish	9	5.70	80.38	8.93	40.13	1.84
largemouth bass	10	6.32	16.19	1.62	8.08	2.12
green sunfish	1	.64	0.13	0.13	0.07	1.91
bluegill	3	1.90	0.19	0.06	0.09	2.64
white crappie	10	6.33	3.63	0.36	1.82	2.30
Totals	158	100.00	200.28		100.00	

Table 23. Results of 5 gill nets set for fisheries reconnaissance of Lake J. B. Thomas
June 12, 1963

Species	Number	Per Cent by		Total Weight Pounds	Average Weight Pounds	Per Cent by		Average "K"
		Number	Weight			Weight	Weight	
river carpsucker	81	26.04	36.00	103.81	1.28	36.00	2.06	
gizzard shad	123	39.55	6.50	18.75	0.15	6.50	1.38	
carp	20	6.43	10.97	31.63	1.58	10.97	2.04	
channel catfish	27	8.68	3.26	9.38	0.35	3.26	1.26	
flathead catfish	15	4.83	35.09	101.19	6.75	35.09	1.81	
white bass	8	2.57	2.58	7.44	0.93	2.58	1.81	
largemouth bass	5	1.61	4.49	12.94	2.59	4.49	2.16	
bluegill	9	2.89	.30	0.88	0.10	.30	2.68	
white crappie	23	7.40	.81	2.31	0.10	.81	1.60	
Totals	311	100.00		288.33		100.00		

Lake J. B. Thomas

Background Information

Lake J. B. Thomas is the largest, and from the standpoint of existing public recreation, the most important reservoir west of the San Angelo area. Original surveys carried out from 1954 through 1957 indicated the reservoir was very productive in game fish. The most recent sampling of fish populations was completed in 1960. The purposes of this reconnaissance were (a) to determine the success or failure of stocking blue catfish in the lake (see completion report E-2, Project F-5-R-8), (b) to obtain up-to-date information to meet regulatory responsibility, and (c) to detect fishery problems.

Fish Populations

No blue catfish were captured. As shown in Table 23, channel catfish, white bass, and white crappie are less numerous than in 1960. Gizzard shad and river carpsucker were twice as abundant (see Figure 19, completion report B-22, Project F-5-R-8).

San Angelo Reservoir

Explanation

The purpose of work outlined in Figure 1 was to determine the effectiveness and utility of a 300-foot, 1-inch mesh seine as a sampling device. The results of this work indicate the equipment has limited application. However, more than twice as many white bass, river carpsuckers and gizzard shad were captured in this effort than were secured in gill nets during the extensive reconnaissance survey conducted the previous winter.

Stream Studies

A. Studies in Relative Abundance and Productivity

Devil's River

As indicated in Table 24, Devil's River is highly productive in channel catfish, flathead catfish, and largemouth bass. However, relative abundance of longnose gar, river carpsuckers, and grey redhorse suckers is excessive. Seining collections near Dolan Springs resulted in the capture of Devil's River minnow, the first record of this species from project work.

Upper Rio Grande River

Capture of blue catfish and blue sucker indicate a range extension for these species. The low production of game species indicates the need for management effort (see Table 25).

Upper Pecos River

The capture of blue suckers indicate a range extension for that species. The dominance of these waters by problematic species indicates the need for management.

B. Studies in Species Distribution and Exploration of Previously Unexamined Waters

San Saba River

The range for orangethroat darters and blacktail shiners is extended as a result of these seining collections. Game fish appeared to be abundant in areas examined.

Head Springs of Dove Creek

This work confirmed continued existence of endemic species and extended the known range of emerald shiners and slough darters.

Headwaters of the West Fork of the Nueces River

Seining collections indicated a range extension of blacktail shiners and Rio Grande cichlids.

Headwaters of the South Llano River

Seining collections captured the sand shiner for the first time in regional collections, and indicated an extension of range for blacktail shiners.

North Llano River

Seining collections indicate a range extension for the Texas shiner.

Upper Colorado River

Seining effort was to secure native minnows for release in waters cleared for fishery management.

Table 24. Results of 6 gill nets set for fisheries reconnaissance of H. K. Fawcett Ranch on Devil's River
August 29, 1963

Species	Number	Per Cent by		Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
		Number	Weight				
longnose gar	37	23.27	67.06	1.81	24.23	.29	
gizzard shad	17	10.69	22.81	1.34	8.25	1.75	
river carpsucker	42	26.41	65.13	1.55	23.53	1.99	
grey redhorse sucker	26	16.35	26.25	1.01	9.49	1.93	
carp	1	.63	20.00	20.00	7.23	2.64	
channel catfish	14	8.81	22.50	1.61	8.13	1.83	
flathead catfish	10	6.29	48.00	4.80	17.35	1.70	
largemouth bass	9	5.66	4.06	0.45	1.47	2.02	
redear sunfish	1	.63	0.38	0.38	.13	3.25	
Rio Grande perch	1	.63	0.44	0.44	.16	1.47	
longear sunfish	1	.63	0.06	0.06	.03	3.55	
Totals	159	100.00	276.69		100.00		

Table 25. Results of 21 gill nets set for fisheries reconnaissance of the Upper Rio Grande River

Species	Number	Per Cent by Number	Total Weight Pounds	Average Weight Pounds	Per Cent by Weight	Average "K"
longnose gar	24	16.21	58.10	2.42	27.64	.42
blue sucker	3	2.03	11.32	3.77	5.38	1.50
river carpsucker	104	70.27	107.71	1.04	51.25	2.33
carp	8	5.40	7.03	0.88	3.34	2.57
channel catfish	2	1.36	4.57	2.29	2.18	1.20
blue catfish	5	3.37	8.21	1.64	3.90	1.32
flathead catfish	2	1.36	13.25	6.63	6.31	1.60
Totals	148	100.00	210.19		100.00	

Table 26. K-Factor Range, Averages, and Distribution of fish Taken From the Rio Grande

	K	.31	.33	.34	.37	.40	.41	.42	.43	.44	.45	.47	.48	.49	.54	Total	Average
longnose gar	No. 1	1	1	1	2	1	1	1	1	1	2	1	2	1	1	17	0.42
blue sucker	K 1.4	1.5	1.6													3	1.50
river carpsucker	K 1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.8	2.9						23	2.33
carp	K 2.3	2.4	2.7	3.0	3.1	1.4										7	2.57
channel catfish	K 1.0	1.4														2	1.20
blue catfish	K 1.2	1.4														5	1.32
flathead catfish	K 1.5	1.7														2	1.60

Summation of Food Studies of Game Fish Taken from the Rio Grande

Species	No. Examined	No. with Food	Food Item:	Insect Remains
channel catfish	2	0		
blue catfish	5	1		
flathead catfish	2	0		1
Totals	9	1		1

Conclusions:

1. Past investigations and data from Section I indicate the following:
 - a. Management effort for Lake Nasworthy was needed and initially successful.
 - b. Game fish production in Fort Phantom Hill Reservoir is less than is desired. Management will probably be needed by the time a significant reduction in volume will justify costs.
 - c. Devil's Lake and Lake Walk may offer the means of promoting game fish production in Amistadt Reservoir.
 - d. Game fish production in Red Bluff and Imperial Reservoirs is below acceptable standards both in quantity and variety. Effective management is needed.
 - e. Lake Trammel is a productive public water, but introduction of river carpsuckers indicates a threat to future productivity.
2. Previous study and data from Section II indicate the following:
 - a. Past management efforts have been effective in meeting primary objectives and usually result in production benefits.
 - b. Benefits may extend beyond 5 years or be drastically reduced within a year, depending on circumstances and conditions beyond project control.
 - c. Harvest is greatly increased through management.
 - d. Where cooperation is received, management effort is usually effective. Where lack of cooperation is encountered, results suffer.
 - e. Charges that endemic species have been exterminated as a result of management under this project are totally false.
3. Previous investigations and data from Section III indicate the following:
 - a. Endemic species have not been exterminated but have expanded their distribution as a result of project efforts.
 - b. Three species previously unrecorded in project data were captured and identified.
 - c. Range extensions for three species were detected, indicating a greater tolerance of habitat variation than previously known.
 - d. Introduction of blue catfish into Lake J. B. Thomas has been unsuccessful.
 - e. Fishery management is needed for the Upper Pecos River, the Upper Colorado River, the Upper Rio Grande River, and for San Angelo Reservoir.

Recommendations:

Future reconnaissance efforts should be reduced. Most functions specified or implied should be carried out under separate and full time job classification. Field work to provide a basis for sound harvest regulations should be more specific and designed to provide more substantial data on means and methods of harvest. For that reason, field work to provide a basis for harvest regulations should be included under Job B-28. More finite evaluation of management results is needed and warrants job or project classification. Factors influencing game fish production cannot be determined by reconnaissance as currently carried out, and factors influencing harvest are relatively unknown. It is recommended that in the future the reconnaissance function be limited to (a) filling in gaps in project data, (b) carrying out preliminary investigations needed for project planning, and (c) procuring data needed to meet limited objectives such as that required to justify management were unforeseen opportunities arise.

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Date July 28, 1964

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