

JOB COMPLETION REPORT

As required by

FEDERAL AID IN FISHERIES RESTORATION ACT

TEXAS

Federal Aid Project No. F-6-R-10

FISHERIES INVESTIGATIONS AND SURVEYS OF THE WATERS OF REGION 5-B

Job No. B-22 Resurvey of Resaca de la Guerra

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ABSTRACT

The resurvey of Resaca de la Guerra, near Brownsville in Cameron County, Texas, revealed that catfishes and crappies are the most abundant game fishes present. In netting collections, rough fish species, including alligator, spotted and longnose gars, gizzard shad, smallmouth buffalo, river carpsucker, carp, striped mullet, bluegill, freshwater drum and Rio Grande perch, comprised 73.5 per cent of the total fish taken. Smallmouth buffalo and spotted gar were the first and second most abundant species both by numbers and weight.

Over the years, siltation has caused the resaca to become progressively shallower. This has prevented the production of a substantial largemouth bass population. Furthermore, the abundance of bottom feeding rough fishes keeps the water murky. This makes bass feeding difficult or impossible and is reflected in the poor physical condition of largemouth bass. No evidence of the reproduction of largemouth bass was found.

Water quality studies of the resaca indicate a suitable habitat for the survival and rapid growth of red drum (redfish). One specimen of this species, captured in netting, weighed 15 pounds 2 ounces. Apparently it entered the resaca as a juvenile in water pumped from the Rio Grande and grew to its large size within the resaca.

Chemical renovation of the resaca is not recommended since it is presently impossible to prevent the entry of rough fishes from the Rio Grande. Efforts should be made to develop biological controls for these fishes. In addition, fishermen should be encouraged to harvest more catfish and crappie.

JOB COMPLETION REPORT

State of Texas

Project No. F-6-R-10

Name: Fisheries Investigations and Surveys
of the Waters of Region 5-B

Job No. B-22

Title: Resurvey of Resaca de la Guerra

Period Covered: June 15, 1962 through December 31, 1962

Objectives:

To determine the relative abundance of the fish species present in the Resaca de la Guerra in order to formulate plans for fisheries development.

Techniques Used:

Fish populations in the Resaca de la Guerra were sampled with nets and seines from 24 netting and 24 seining stations (Figure 1). Net samples were collected with standard, 125-foot long gill nets constructed of nylon webbing, 8 feet deep, in five, 25-foot long sections of 1-, 1½-, 2-, 2½-, and 3-inch square mesh. The nylon seines measured 4- by 20-feet, with ¼-inch mesh.

Netting and seining stations were visited monthly except that only 12 netting and 12 seining collections were made during June and December. Specimens taken from overnight net sets were weighed in grams and measured in millimeters. In addition to length and weight, sex, stage of gonadal development and incidence of parasites were recorded for each specimen. Seined specimens were preserved in 10 per cent formalin and were later identified and counted in the project laboratory. The common and scientific names of fish species collected are listed in Table 1.

Chemical analyses of surface water samples were not made each month as planned, however, twelve sampling stations were set up and analyses were made whenever possible.

Two conferences were held with the Director, Water and Sewerage Division, and the General Manager, Municipal Public Utilities, City of Brownsville during the course of the study to obtain additional information concerning the resaca. Also, a number of informal discussions were held with interested persons owning land fronting on the resaca, as well as with sports fishermen.

Findings:

Introduction

Resaca de la Guerra, also known as Resaca de las Palmas, is an

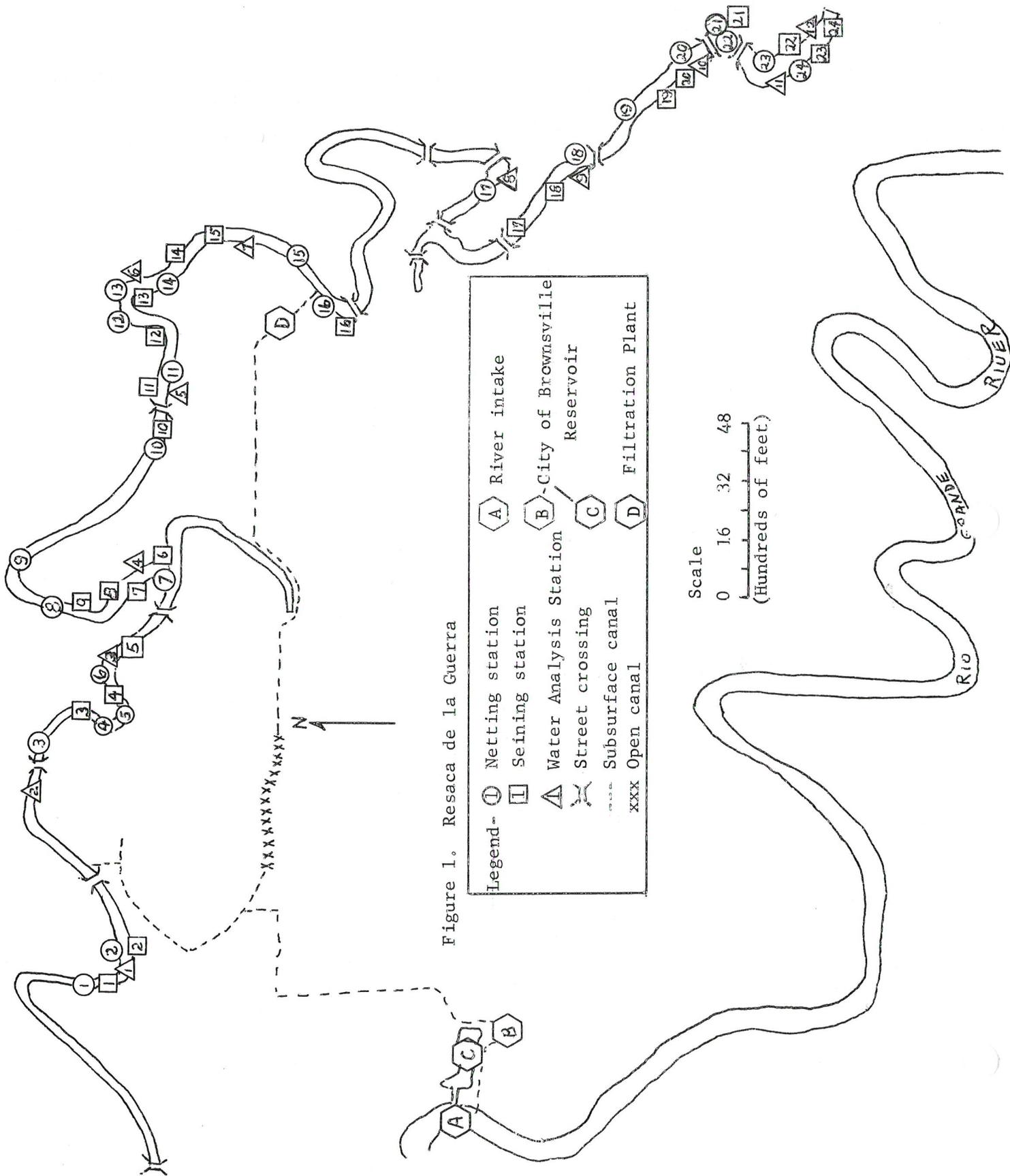


Figure 1. Resaca de la Guerra

Table 1. A List of Fish Species Recorded from Resaca de la Guerra

Common Name	Scientific Name
Alligator gar	<u>Lepisosteus spatula</u> (Lacépède)
Spotted gar	<u>L. oculatus</u> (Winchell)
Longnose gar	<u>L. osseus</u> (Linnaeus)
Threadfin shad	<u>Dorosoma petenense</u> (Günther)
Gizzard shad	<u>D. cepedianum</u> (LeSueur)
Mexican tetra	<u>Astyanax mexicanus</u> (Filippi)
Smallmouth buffalo	<u>Ictiobus bubalus</u> (Rafinesque)
River carpsucker	<u>Carpiodes carpio</u> (Rafinesque)
Carp	<u>Cyprinus carpio</u> (Linnaeus)
Tamaulipas shiner	<u>Notropis braytoni</u> (Jordan and Evermann)
Channel catfish	<u>Ictalurus punctatus</u> (Rafinesque)
Blue catfish	<u>I. furcatus</u> (LeSueur)
Longnose killifish	<u>Fundulus similis</u> (Baird and Girard)
Gulf killifish	<u>F. grandis</u> (Baird and Girard)
Sheepshead minnow	<u>Cyprinodon variegatus</u> (Lacépède)
Mosquitofish	<u>Gambusia affinis</u> (Baird and Girard)
Sailfin molly	<u>Mollienesia latipinna</u> (LeSueur)
Amazon molly	<u>M. formosa</u> (Girard)
Striped mullet	<u>Mugil cephalus</u> (Linnaeus)
Tidewater silverside	<u>Menidia beryllina</u> (Cope)
White bass	<u>Roccus chrysops</u> (Rafinesque)
Largemouth bass	<u>Micropterus salmoides</u> (Lacépède)
Warmouth	<u>Chaenobryttus gulosus</u> (Cuvier)
Redear sunfish	<u>Lepomis microlophus</u> (Günther)
Bluegill	<u>L. macrochirus</u> (Rafinesque)
White crappie	<u>Pomoxis annularis</u> (Rafinesque)
Black crappie	<u>P. nigromaculatus</u> (LeSueur)
Freshwater drum	<u>Aplodinotus grunniens</u> (Rafinesque)
Red drum	<u>Sciaenops ocellata</u> (Linnaeus)
Rio Grande perch	<u>Cichlasoma cyanoguttatum</u> (Baird & Girard)
Naked goby	<u>Gobiosoma bosci</u> (Lacépède)

old stream bed of the Rio Grande which skirts a portion of the northern edge of the City of Brownsville.

A limited survey and inventory of fish species present in the resaca was made in 1958. The recent resurvey, however, is of broader scope in that more biological, chemical and physical data were obtained.

Physical Description

The resaca heads northwest of the City of Brownsville where water, from two city owned pumps on the Rio Grande, enters the resaca after flowing for about five miles in open and underground canals. The 31-mile long resaca

follows a winding, easterly course, north of the city, through virtually flat terrain and eventually flows into other resacas to the east of Brownsville. Because of the flat terrain, runoff is negligible.

In the 12 miles of Resaca de la Guerra intensively studied during the resurvey (Figure 1), the average width is approximately 60 feet and the average depth is less than 4 feet. Virtually all of the shoreline is privately owned, but the City of Brownsville has flooding easements for water storage. In addition to municipal and industrial use of water, home owners along the resaca are permitted to use water for their lawns. Consequently, water level fluctuations of 2 or 3 feet in 24 hours are not uncommon.

Since the resaca is comparatively narrow and divided by road fills into short sections which are connected by one or two concrete pipes (Figure 2), it appears the high turbidity is due to the activity of bottom feeding fishes rather than wave action. Wave action due to wind is reduced by thick stands of huisache, retama, mesquite, palm and ebony trees along the shoreline (Figure 3). Furthermore, the banks are sharply cut and rise about two feet on the average above normal water level.

In recent years, the production of citrus fruit and cotton in fields adjacent to the resaca has given way to private home developments. This, in turn, has limited public access to the resaca to road crossings.

Fish Collections

Netting - All told, 144 netting collections were made at 24 stations during the study. All nets were set overnight at established stations, in water depths ranging from 1 to 6½ feet, and were picked up the following morning. A total of 2,158 fish of 20 species, weighing 3,109.6 pounds, was taken in the netting collections (Tables 2 and 3).

Rough fish including alligator, spotted and longnose gars, gizzard shad, smallmouth buffalo, river carpsucker, carp, striped mullet, bluegill, freshwater drum and Rio Grande perch accounted for 73.5 per cent of the fish collected and 87.4 per cent of their weight. Smallmouth buffalos and spotted gars were the first and second most abundant species both by numbers and weights.

Gizzard shad comprised only 4.3 per cent of fish taken in netting collections, and carp comprised only 2.8 per cent (Table 2). The relatively small numbers of gizzard shad may in part be attributed to the predation by gars and catfish.

Surprisingly, gizzard shad, river carpsucker and carp comprise a relatively lower percentage of the fish population in the resaca than is normal for these species in waters of this area. It appears that this resaca is a more suitable habitat for smallmouth buffalo than for either the gizzard shad, river carpsucker or carp. Recent food habit studies by Dr. W. W. Dalquest, of Midwestern University, reveal that the diet of the smallmouth buffalo consists mostly of animal life, whereas the diet of gizzard shad, river carpsucker and carp consists mostly of plankton and plant material.

Game fish species, including channel and blue catfish, white bass,

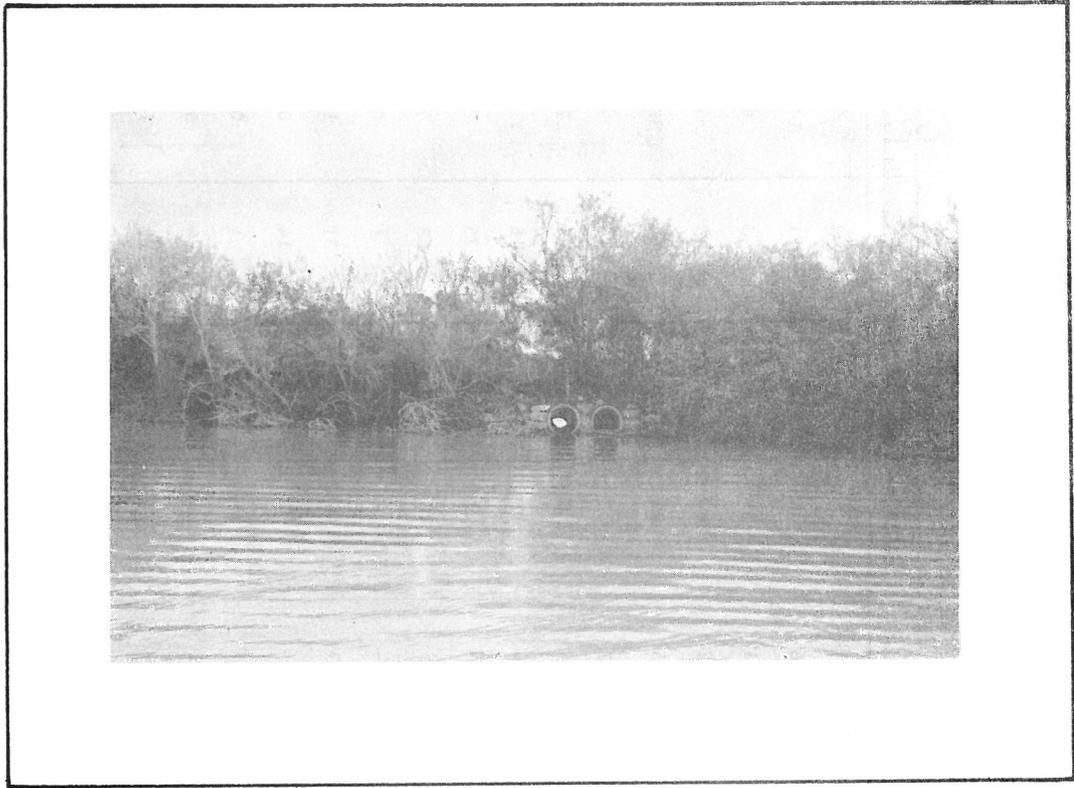


Fig. 2. Drain pipes connect sections of Resaca de la Guerra.

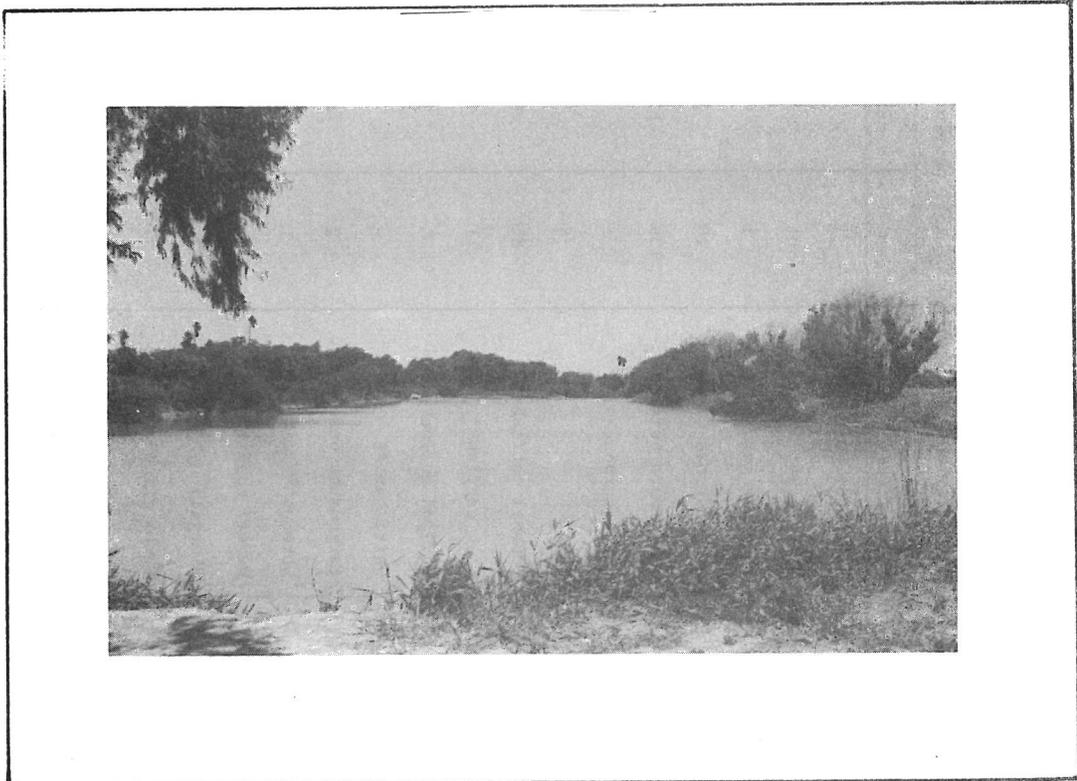


Fig. 3. A typical section of Resaca de la Guerra near Netting Station 3.

Table 2. Results of gill netting (numbers), Resaca de la Guerra, June through December 1962.

Species	June*	July	August	September	October	November	December*	Totals	Per Cent by Number
Alligator gar	1	1	-	1	-	4	-	7	0.32
Spotted gar	61	93	66	44	56	45	16	381	17.66
Longnose gar	1	1	2	-	1	-	-	5	0.23
Gizzard shad	10	10	16	20	2	30	4	92	4.26
Smallmouth buffalo	139	116	110	118	75	86	20	664	30.77
River carpsucker	-	1	-	-	-	-	-	1	0.05
Carp	8	23	8	8	4	9	1	61	2.83
Channel catfish**	81	63	39	34	16	12	1	246	11.40
Blue catfish**	11	28	14	8	4	9	1	75	3.47
Striped mullet	4	19	9	12	5	12	7	68	3.15
White bass**	-	-	-	1	-	-	-	1	0.05
Largemouth bass**	2	10	-	1	9	6	3	31	1.43
Warmouth**	1	7	3	1	-	2	-	14	0.65
Redear sunfish**	1	-	-	-	-	-	-	1	0.05
Bluegill	37	8	14	6	6	11	2	84	3.89
White crappie**	-	-	1	1	9	4	10	25	1.16
Black crappie**	10	41	18	39	18	35	18	179	8.29
Freshwater drum	48	45	26	20	23	22	12	196	9.08
Rio Grande perch	4	-	6	4	6	4	2	26	1.21
Red drum**	-	-	1	-	-	-	-	1	0.05
Totals	419	466	333	318	234	291	97	2158	100.00
* Indicates .12 Gillnets only ** Indicates game fish									
						Game fish		573	26.55
						Rough fish		1585	73.45

Table 3. Results of gill netting, in pounds, Resaca de la Guerra, June through December 1962

Species	June*	July	August	September	October	November	December*	Total	Per Cent by weight
Alligator gar	20.8	8.5	-	6.6	-	20.1	-	56.0	1.80
Spotted gar	75.8	122.1	94.0	48.6	76.8	50.9	21.6	489.8	15.75
Longnose gar	1.7	5.8	6.1	-	3.4	-	-	17.0	0.55
Gizzard shad	3.8	3.8	4.2	5.6	0.5	12.1	0.8	30.8	0.99
Smallmouth buffalo	341.1	302.0	304.6	300.1	172.0	216.0	68.7	1704.5	54.81
River carpsucker	-	0.3	-	-	-	-	-	0.3	0.01
Carp	45.5	41.7	9.1	26.6	33.0	21.7	9.9	187.5	6.03
Channel catfish**	68.1	62.1	22.3	21.6	16.7	19.2	8.6	218.6	7.03
Blue catfish**	31.2	18.9	7.8	5.9	1.7	12.3	0.2	78.0	2.51
Striped mullet	2.7	45.3	9.1	24.0	6.8	23.1	10.8	121.8	3.92
White bass**	-	-	-	1.0	-	-	-	1.0	0.02
Largemouth bass**	3.7	3.3	-	0.7	5.1	6.5	2.2	21.5	0.69
Warmouth**	0.1	1.2	0.7	0.1	-	0.2	-	2.3	0.08
Redear sunfish**	0.1	-	-	-	-	-	-	0.1	0.00
Bluegill	5.4	0.8	1.3	0.6	0.6	1.0	0.1	9.8	0.32
White crappie**	-	-	0.6	0.1	1.1	0.8	1.7	4.3	0.14
Black crappie**	3.8	12.3	6.4	7.8	5.8	9.4	4.2	49.7	1.60
Freshwater drum	23.0	18.1	12.4	13.1	11.4	12.1	4.5	94.6	3.04
Rio Grande perch	1.1	0.2	1.2	1.2	1.5	1.2	0.5	6.9	0.22
Red drum	-	-	15.1	-	-	-	-	15.1	0.49
Totals	627.9	646.4	494.9	463.6	336.4	406.6	133.8	3,109.6	100.00
* Indicates 12 nets only						Game Fish		390.6	12.56
** Indicates Game Fish						Rough Fish		2,719.0	87.44

largemouth bass, warmouth, redear sunfish, white crappie, black crappie and red drum comprised 26.6 per cent by number and 12.7 per cent by weight of the fish taken in the nets.

Since largemouth bass comprised only 1.4 per cent of the total number of fish taken in netting collections, and 0.7 per cent of their weight, it is apparent that the stocking of 1,500,000 largemouth bass in the resaca since 1954 has not established a good population. Collectively, channel and blue catfish comprised 14.9 per cent by number and 9.5 per cent by weight of the total netting collections. Thus, catfish are the chief game fish species in the resaca. However, there is also a good crappie population in the resaca. Both white and black crappies were found. Collectively, they comprised 9.5 per cent of the total number of fish taken in netting collections.

It is interesting to note that one red drum, or redfish, and one white bass were taken in the resaca. Apparently both fish entered the resaca via the canal system from the Rio Grande River. This belief is based on the fact that these fish were taken near the inlet from the river. If the red drum did come from the Rio Grande River, it is an almost certain fact that the fish grew to its large size in the freshwater resaca.

Table 4 shows the length and weight statistics for fish from the resaca.

Table 5 shows the monthly results of gill netting in terms of fish caught per net and per foot of net.

Seining - Results of seining at the 24 stations are shown in Table 6. In all, 11,864 fish of 23 species were seined during the resurvey.

Threadfin shad, bluegill and mosquitofish, in that order, were the most abundant and best distributed species.

The seining stations were selected with respect to habitat and were spaced as uniformly as possible along the resaca. Figure 1 shows the locations of the seining stations.

Annotated Species List

Alligator gar - Seven specimens, weighing a total of 56 pounds, were taken in gill nets during the resurvey. Based on the limited number caught and that they were taken at only four stations, it is apparent that the species is not abundant in the resaca (Table 7).

Analysis of stomach contents revealed unidentifiable fish remains in two stomachs and the remains of a snake in another. One of the specimens examined was parasitized with visceral round worms.

Spotted gar - A total of 381 spotted gars was caught in gill net collections. Seven others were taken in seines. The species was taken at 23 of the 24 netting stations and is the most abundant gar species in the resaca.

Food items were found in spotted gar stomachs in the following frequencies: unidentified sunfish remains - 13 stomachs, shad remains - 3

Table 4. Length-weight Statistics for Fish from Resaca de la Guerra, June through December, 1962

Species	Standard Length (mm.)		Weight (Grams)		"K" Factors	
	Range	Average	Range	Average	Range	Average
Alligator gar	407-1135	771	410-9412	4911	0.60-0.97	0.76
Spotted gar	294-671	482	152-2155	1153	0.10-0.77	0.43
Longnose gar	522-804	663	765-2637	1701	0.47-0.54	0.50
Gizzard shad	124-287	205	38-482	260	1.21-3.02	2.12
Smallmouth buffalo	102-571	336	42-6776	3409	2.07-6.62	4.34
River carpsucker	162-288	245	152-624	388	2.61-3.58	3.09
Carp	201-615	408	242-6350	3296	2.32-3.60	2.96
Channel catfish	141-545	343	48-3912	1980	1.16-2.41	1.78
Blue catfish	170-540	355	70-2495	1282	0.93-2.60	1.76
Striped mullet	159-483	321	90-2466	1278	1.40-3.56	2.48
White bass	211-211	211	438-438	438	4.66-4.66	4.66
Largemouth bass	162-400	281	85-1758	921	1.82-2.93	2.37
Warmouth	111-211	161	47-438	242	2.13-4.70	3.41
Redear sunfish	111-111	111	51-51	51	3.73-3.73	3.73
Bluegill	83-145	114	25-124	74	2.74-5.39	4.06
White crappie	122-207	164	45-258	151	2.26-3.13	2.68
Black crappie	79-241	160	14-380	197	2.24-6.04	4.14
Freshwater drum	124-380	252	44-1616	830	1.57-4.72	3.14
Rio Grande perch	87-151	119	36-177	106	4.43-6.27	5.30
Red drum	738-738	738	6861-6861	6861	1.71-1.71	1.71

Table 5. Success of gill netting, Resaca de la Guerra, June through December, 1962.

Date	Number of nets	Number of feet of net	Number of fish caught	Average number of fish per net	Average number of fish per foot of net	Pounds of fish caught	Average pounds or fish per net	Average pounds of fish per foot of net
June 1962	12	1,500	419	34.92	2.79	627.9	50.23	0.418
July 1962	24	3,000	466	19.42	1.55	646.4	51.71	0.215
August 1962	24	3,000	333	13.88	1.11	494.9	39.59	0.165
September 1962	24	3,000	318	13.25	1.06	463.6	37.08	0.155
October 1962	24	3,000	234	9.75	0.78	336.4	26.91	0.112
November 1962	24	3,000	291	12.13	0.97	406.6	32.53	0.135
December 1962	12	1,500	97	8.08	0.65	133.8	11.15	0.044

Table 6. Results of seining collections, Resaca de la Guerra, June through December, 1962.

Species	Stations																								Totals	Per Cent of total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Spotted gar	2	4							1																7	0.06
Threadfin shad	33	24	42	25	653	10	295	559	218	396	436	57	185	4	27	222	71	78	189	1	4	16	3545	29.88		
Gizzard shad	7	2	4		9		3	8		3	146	2	2	4	4	5	2		2	2	6	9	14	232	1.96	
Mexican tetra	8	1																						9	0.08	
Carp								1			1													1	0.01	
Tamaulipas shiner				1			1	1	38		6	36	2	2	2	1								48	0.40	
Channel catfish											3	2												48	0.40	
Longnose killifish																								8	0.07	
Gulf killifish																					8			4	0.03	
Sheepshead minnow	66	64	263	14	87	15	54	192	36	60	109	73	133	4	5	7	1	45	27	78	306	140	24	2095	17.66	
Mosquitofish					2		1	1													5			9	0.08	
Sailfin molly					55		21	163	42	4	3	358	3	31	4	1		5	12	4	112	13	3	921	7.76	
Amazon molly																					132			135	1.14	
Striped mullet	88	16	9	10	5	5	79	84	26	9	22	14	128	4	7	18	22	15	19	2	125	113	20	840	7.08	
Tidewater silverside	2	4	1	1	2		1				2	1	1	2	2	4	2	5	6	6	3	3	2	42	0.35	
Largemouth bass	4	2			2		1																	23	0.19	
Warmouth	106	264	129	66	217	4	26	17	40	16	137	108	233	256	84	60	68	55	52		744	479	188	3349	28.23	
Bluegill									2							1								4	0.03	
White crappie	8	8	1	1			3			1	4	2	1	4	3	1	1	2	2					42	0.35	
Black crappie									1		1									3				5	0.04	
Freshwater drum	11	21	13	5	24	3	17	14	5	2	99	31	19	17	15	24	66	9	5	47	6	2	455	3.84		
Rio Grande perch			1						1		2	5	5				1			1	1			19	0.16	
Naked goby																										
Totals	335	413	547	124	1056	15	97	781	900	372	490	326	335	745	369	149	342	297	221	306	416	1199	763	266	11,864	100.00

Table 7. Numbers of fish taken at gillnet stations Resaca de la Guerra, 1962.

Species	Stations																				Totals					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		21	22	23	24	
Alligator gar	3		1								1	2													7	
Spotted gar	11	7	14	8	12	11	22	18	42	32	24	14	24	34	21	19	18	14	11	15	1		7	2	381	
Longnose gar					1	1							1	3	3	3	1	1	2	4					5	
Gizzard shad	16	22	1		10	6	5	4	7	1					2	24	18	13	21	20	5	2			92	
Smallmouth buffalo	17	19	33	28	55	15	58	50	51	59	47	59	14	28	28	24	18	13	21	20	5	2			664	
River carpsucker															1										1	
Carp	19	17		1	2	2	1	4	5	3	1	2				2					2	2			61	
Channel catfish					10	4	14	18	51	21	38	18	4	3	6	3	9	9	8	7	3	7	1	2	246	
Blue catfish				10	1		1	1	3		15		5	2	3	11	12	3	2	2	2	2			75	
Striped mullet				1		2	2	2	4	4	3	7		2	5	2	1			2	3	2	18	10	68	
White bass																									1	
Largemouth bass					2	1		2			1		1				5	4	2	2	1		6	3	31	
Warmouth	6	2				1					1												1	1	14	
Redear sunfish									1																1	
Bluegill	41	25	1	3	2	2		1				1	1	1	1	2	2	1	1	8	1	1	3	3	84	
White crappie					1	1										6	6	1	5	8	1	3			25	
Black crappie	1	7	3	1	19	19	5	16	12	6	12	3	9	6	16	8	15	1	6	11	2	1			179	
Freshwater drum				3	5	14	11	29	11	20	17	7	7	3	4	4	8	6	3	11	17	9	3	5	196	
Rio Grande perch				3	1		1		1	2		1					1									26
Red drum																										1
Totals	119	99	87	45	120	77	118	145	189	148	160	114	66	83	87	76	96	52	61	80	33	32	45	26	2158	

stomachs, catfish remains - 3 stomachs, frogs - 2 stomachs and unidentifiable fish remains - 84 stomachs. Only one of the spotted gars examined appeared to be parasitized and this was with visceral round worms.

Since the spotted gar is a good predator species, its presence in the resaca is probably more beneficial than harmful.

Longnose gar - Only five specimens of longnose gars were collected in nets. None was caught in seines. Apparently this is the least abundant of the gars present in the resaca.

Of the five stomachs examined, three were empty, one held unidentifiable fish remains and the other contained shad remains.

Threadfin shad - This species is the most abundant forage fish present in the resaca. None were collected in nets but 3,545 specimens were taken in seines. These comprised nearly 30 per cent of the total fish in seining collections (Table 6). The threadfin shad were well distributed and were present at 22 of the 24 seining stations.

Gizzard shad - In all, 92 gizzard shad were taken in netting collections from the Resaca de la Guerra. An additional 232 specimens were collected with seines. They comprised 4.3 per cent of the fish taken in nets (Table 7) and less than 2 per cent of the fish taken in seines (Table 6). Due to overabundance, gizzard shad are often a problem species in waters where they occur. However, this is not the case in Resaca de la Guerra and this may, at least in part, be due to predation by other species.

Mexican tetra - The Mexican tetra is an excellent forage fish and is endemic to the lower Rio Grande basin. It does not appear, however, to be well established in Resaca de la Guerra. Only nine specimens were taken at Seining Stations Nos. 1 and 2 (Table 6).

Smallmouth buffalo - Based on netting results, the smallmouth buffalo is the dominant species present in the resaca (Tables 2 and 3). In addition, the species is well distributed throughout the study area, having been taken at all stations except Net Stations Nos. 23 and 24 in the lower end of the resaca. That no smallmouth buffalo were taken in seining collections is somewhat surprising in that the collections were taken in water ranging from one to five feet deep (Figure 4).

Gravid females were frequently collected during the course of the work, as were spent males and females. Though no smallmouth buffalo young were collected in seines, it is obvious that the species is successful in maintaining itself through spawning.

The smallmouth buffalo collected ranged from 102 to 571 millimeters, or from 4 to 22 inches in standard length.

River carpsucker - Only a single specimen of the river carpsucker was netted during the study of Resaca de la Guerra. The reason for the scarcity of this species is not understood, especially since it is generally abundant in waters of the Rio Grande watershed.

Carp - Most of the 61 carp collected were taken from the upper half of the study area (Table 7). By comparison with the smallmouth buffalo,

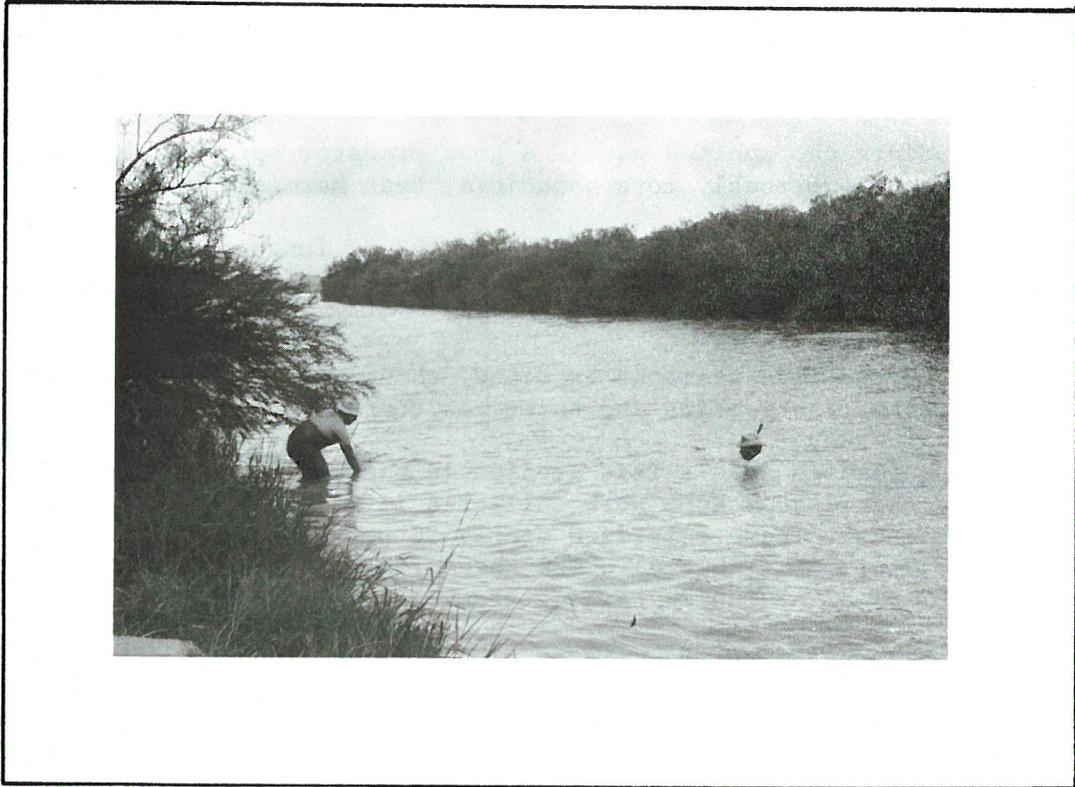


Fig. 4. Making seining collection near Station 11.



Fig. 5. Water hyacinths in the country club section of the resaca were sprayed by city authorities to keep them under control.

carp are not so well established in the resaca. Apparently the smallmouth buffalo is better adapted to the resaca type of habitat.

Tamaulipas shiner - The 48 specimens of this species taken in seining collections were obtained from the mid-portion of the study area. This indicates the species is not abundant nor well distributed in the Resaca de la Guerra and, therefore, cannot be considered of much value as a forage fish in these waters.

Channel catfish - A total of 294 channel catfish was taken in netting and seining collections. The species comprised 11.4 per cent of the fish collected with nets and is the most abundant of the game fishes present in the resaca (Table 2). Stomach analyses revealed that insects and fish are important in the diet of channel catfish.

Since channel catfish are well established and well distributed throughout the shallow, turbid resaca, they are the species most sought after by sport fishermen.

Blue catfish - Though not so abundant as the channel catfish (Table 2), the blue catfish is a valuable sport fish in Resaca de la Guerra.

Stomach analyses indicated their food to be similar to that of the channel catfish in that it consisted primarily of insects and fish. One stomach examined, however, contained partially digested mesquite beans.

Longnose killifish - Eight specimens of this species were taken in a seining collection near the lower end of the resaca (Table 6). It is not considered of great value as a forage species.

Gulf killifish - Only four specimens were collected in seines from the lower end of the resaca (Table 6). It is unimportant as a forage fish.

Sheepshead minnow - Seining collections from the lower reaches of the resaca contained 23 specimens of the sheepshead minnow (Table 6). It is not an important forage fish.

Mosquitofish - This species was collected from all 24 seining stations established on the resaca. A total of 2,095 specimens was taken (Table 6). It is an important species since it is valuable in mosquito control.

Sailfin molly - Sailfin mollies are relatively unimportant as a forage fish in the resaca. Only nine specimens were taken in seining collections. They were, for the most part, limited to the mid-portion of the study area (Table 6).

Amazon molly - In contrast to the scarcity of sailfin mollies, a total of 921 Amazon mollies was taken in collections from 20 of the 24 seining stations on Resaca de la Guerra (Table 6). Like the mosquitofish, the Amazon molly plays an important role in mosquito control.

Striped mullet - This species was collected in both nets and seines and it was found they were more abundant in the lower portions of the study area (Tables 6 and 7). Where it occurs in numbers, the striped

mullet is an important forage fish.

Tidewater silverside - Well distributed in the Resaca de la Guerra, a total of 840 tidewater silversides was taken at 23 of the 24 seining stations in the study area. It's value as a forage species, however, is undetermined.

White bass - A single specimen of the white bass was netted at Net Station No. 9 during the study of Resaca de la Guerra. More than likely this fish entered the resaca by way of the canal system from the Rio Grande River.

Because flowing water in volume is required for the spawning of white bass, it is not likely that this species will become important as a sport fish species through natural reproduction within the resaca.

Largemouth bass - Referred to as a "trout" by tourists to the Lower Rio Grande Valley, the largemouth bass is much sought after as the leading game fish species. In all, a total of 73 specimens was taken in netting and seining collections combined (Tables 2 and 6). None was in good physical condition. Their "K" factors (coefficient of physical condition) ranged from 1.82 to 2.93 with a mean of 2.37.

Though the largemouth bass is well distributed in the resaca, and despite sufficient forage, it is felt that the silt bottom and turbid water prevent the development of a large population. Largemouth bass are sight feeders and for this reason do not fare too well in the turbid waters of the resaca. Of the 16 stomachs examined, 10 were empty, 2 contained unidentified fish remains, 1 contained insects, 1 contained mucous and 2 contained detritus.

Warmouth - A total of 37 specimens was taken from 7 netting stations during the study of Resaca de la Guerra (Table 2). Of nine warmouth stomachs examined, five were empty, one contained insects, one contained mucous and two held only detritus.

Redear sunfish - Only one specimen of the redear sunfish was taken from the resaca. This fish was probably introduced by the local state fish hatchery.

Bluegill - Bluegills are numerous and well distributed throughout the resaca. A total of 3,433 was taken in netting and seining collections and the species comprised 28.2 per cent of the fish taken in seining collections (Table 6). Thus, the species ranks second in numbers only to the threadfin shad.

Food analyses for 32 bluegill stomachs revealed insect remains in 17 stomachs, fish remains in 1, mucous in 1, detritus in 12 stomachs and mesquite beans in another.

White crappie - The majority of the 29 specimens taken in netting and seining collections was taken from the lower portions of the resaca (Tables 6 and 7). Though white crappie are not abundant, there is a small, fishable population in the resaca. In the 14 white crappie stomachs examined, all contained the remains of unidentified fish.

Black crappie - A total of 221 black crappie was collected with nets and seines from Resaca de la Guerra. Of the two species of crappie present, the black crappie apparently is more abundant and better established. The average "K" factor for black crappies was 4.14 (Table 4), for white crappie the "K" factor was only 2.68.

Food analyses revealed the preferred foods of this species to consist of fish and insects and only one of the specimens examined was parasitized. The parasites involved were visceral round worms.

Freshwater drum - A total of 201 freshwater drum was taken in netting and seining collections. They were present in good numbers in most of the resaca but were not taken in the extreme upper or lower portions of the study area. The species does not contribute significantly to the sport fishery.

Red drum - The single red drum, or redfish, was captured at Netting Station No. 12 (Figure 1), near the mid-portion of the study area. The specimen weighed 15 pounds and 2 ounces, and its "K" factor was 1.71 (Table 4). It contained the remains of a smallmouth buffalo in its stomach.

The water in which this normally marine fish was captured contained some 200 p.p.m. of chlorides. The fish probably entered the resaca as a juvenile via the water pumped from the Rio Grande. It is believed that large numbers of this species, if they could be artificially stocked, would serve as a biological control on the undesirable "rough" fish.

Rio Grande perch - Uniformly distributed throughout the resaca, a total of 481 was taken in netting and seining collections. The species is often regarded as undesirable because of its high rate of spawning success and its tendency to overcrowd waters where it occurs.

Naked goby - Apparently evenly distributed throughout the resaca, 19 specimens of the naked goby were seined at 9 of the seining stations (Table 6). It is considered unimportant as a forage fish.

Chemical Analysis

Twelve water sampling stations were established at various locations along the resaca (Figure 1). Original plans called for monthly analyses to be made at each station to determine principal chemical factors, but because of old or insufficient quantities of reagents, they were not made as planned. However, it is felt that sufficient data were gathered to determine the water quality in Resaca de la Guerra. All samples were taken from the surface.

Dissolved oxygen values ranged from 2.2 to 8.4 p.p.m. in the summer (August) to 5.2 to 9.2 p.p.m. in the fall (November).

In June, free carbon dioxide values ranged from 0.0 to 10.0 p.p.m. and from a trace to 4.2 p.p.m. in the fall (December). No ph-th alkalinity was found, but methyl orange alkalinity values ranged from 177.0 p.p.m. to 90.0 p.p.m. There was no marked difference in methyl orange alkalinity from one section to the other in the resaca.

Chlorides ranged from 380.0 p.p.m. at Station No. 10 to 127.0 p.p.m. at Station No. 2. The average dissolved chloride content was 249.6 p.p.m.

The pH values ranged from 7.3 to 8.2 with the average reading of 7.8.

Within limits, water in the upper portions of the resaca was clearer than in lower portions. Secchi disc readings ranged from 12- to 17-inches at the four upper stations, and from 6- to 9-inches at the lower eight stations. Probably part of this difference lies in the fact that the upper portions are somewhat deeper and less affected by incoming water from the Rio Grande. Also, there is less irrigating done adjacent to the upper portions, which means less interchange of water and more time for silt to settle.

Discussion:

Catfishes and crappies apparently are well established in Resaca de la Guerra and are the species most sought after by sport fishermen. Both types of fishes successfully reproduce and the crappie population does not appear to be stunted. Many fishermen using the resaca, however, are unaware that crappies are present.

Catfishes are taken on trotlines or with hook and line baited with "stink" bait. The crappies are caught on hook and line, using live minnows as bait.

Despite numerous reports, accepted as valid, describing excellent bass fishing in years past, it is apparent that largemouth bass are not well suited to the murky, resaca-type habitat now present. Since bass are sight-feeders, the murky water now present in the resaca prevents the development of a large population in that their feeding is restricted, growth is slower and the silt bottom is not conducive to successful spawning.

It is believed that Resaca de la Guerra is approaching the latter stages of a ~~hydrarch~~ succession, i.e. a change from an aquatic to a terrestrial habitat. Over the years the decaying of plants and the deposit of silt, brought in with water from the Rio Grande, has caused the resaca to become shallower. Furthermore, rough fishes which are not harvested have become the dominant species present and these fish tend to keep the water murky by roiling the bottom in their feeding activities.

Past experience has revealed the futility of chemical eradication of fish in the shallow, resaca-type waters of the lower Rio Grande valley. Such chemical eradication results in the rapid clearing of the water, allowing sunlight to penetrate the water to the bottom and the development of aquatic vegetation in great abundance. Under shallow water conditions, the resultant vegetation growth is a far worse problem than the rough fish. Furthermore, since there is no really effective device for screening fish from the water pumped into the resaca, it would only be a matter of time before rough fishes became re-established.

Presently, aquatic vegetation is not a general problem in the Resaca

de la Guerra. A dense stand of water hyacinths was found in the country club section of the resaca but the plants were sprayed by city authorities to keep them under control (Figure 5).

Large beds of Chara, or muskgrass, were found along the shoreline of the resaca but turbid water prevents its development. If the water should become clear, this plant would certainly become a major problem. Scattered small beds of pond weed, or Potamogeton, were also found.

Of the emergent vegetation present, occasional clumps of cattails and bulrushes were found along the resaca shoreline, however, they are not presently a vegetation problem.

Recommendations:

1. To promote clearing of the water, provide additional storage and greater depth, it is recommended that the possibility of deepening Resaca de la Guerra to 10 or 12 feet by dredging be investigated by the concerned authorities.

2. Under present conditions, further stocking of largemouth bass fry or fingerlings is not recommended. Large numbers of channel catfish, however, should be stocked approximately every two years.

3. So long as local and state laws are complied with, it is recommended that commercial fishermen be allowed to harvest unlimited numbers of gars, smallmouth buffalo and carp in an effort to control these populations.

4. An effort should be made by the Texas Game and Fish Commission to secure a suitable predator sport fish, such as the red drum. If large numbers of these fish could be located, they should be stocked to provide added sport, as well as serve as a partial control of rough fishes.

5. Sports fishermen should be notified through news media that there is a good population of catfish and crappie in the resaca.

6. Every effort should be made to prevent pollution of the resaca. Crop dusters, especially, have accidentally let insecticides drift into the resacas, which have caused fish kills.

7. It is recommended that more public access be provided by the City of Brownsville to enable anglers to make better use of the fishery resources in the resaca. Public fishing piers, for example, would be helpful in harvesting more fish.

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Date March 16, 1963

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The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

Furthermore, it is noted that regular audits are essential to identify any discrepancies or errors in the accounting system. By conducting these audits frequently, potential issues can be resolved before they become significant problems.

In addition, the document highlights the need for clear communication between all parties involved in the financial process. This includes providing timely updates to stakeholders and ensuring that everyone has access to the necessary information.

Finally, it is stressed that adherence to all applicable laws and regulations is a top priority. This not only protects the organization from legal risks but also builds trust with external partners and investors.

The second section of the document focuses on the implementation of a robust internal control system. This system should be designed to prevent fraud and minimize the risk of errors. Key components include segregation of duties, which ensures that no single individual has control over all aspects of a transaction.

Another critical element is the use of standardized procedures for all financial activities. This helps to reduce variability and ensures that everyone is following the same rules. Regular training and updates are also necessary to keep the system effective.

Moreover, the document discusses the importance of maintaining a strong relationship with external auditors. These professionals provide an objective assessment of the organization's financial health and can offer valuable insights into areas for improvement.

In conclusion, the document serves as a comprehensive guide for anyone responsible for managing the financial affairs of an organization. It provides practical advice and best practices that can help ensure long-term success and stability.

