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Fishes Inhabiting the Rio Grande, Texas and Mexico, Between El Paso and the Pecos Confluence[1]

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Abstract --The fishes of the middle part of the Rio Grande can be divided into three faunal assemblages: The saline Rio Grande fauna (made up of widely distributed and salt tolerant species) upstream from the Conchos confluence; the Rio Conchos-Rio Grande fauna (mostly south Texas and Mexican species) in the Rio Grande between the Conchos and Pecos; the tributary creek fauna (Chihuahuan species plus some derivatives) that depend on tributary creeks for all or part of their life history stages. Endangered species are found in the last assemblage but two presumed endangered species (Notropis simus and Scaphirhynchus platyrynchus) seem to have been eliminated already.

INTRODUCTION

The fishes of the Rio Grande (Belcher, 1975: fig. 3) have been intermittently studied for the past 130 years. Reasonably extensive reports exist for Colorado (Beckman, 1952), New Mexico (Koster, 1957), and the Rio Grande downstream from its confluence with the Pecos River (Trevino-Robinson, 1959). No comparable summarization exists for the intervening segment, although Miller (1977) treated the Mexican part of the middle Rio Grande basin. Proposals to channelize about 300 kilometers of the river and to designate another 200 kilometers as a wild river underscored the absence of a summarization of the fish fauna. The bulk of this paper is a report on fishes collected on two recent visits to the Rio Grande in the two project areas. We also include a summarization of a large number of collections made from the Rio Grande in Big Bend National Park between 1954 and 1976.

The Rio Grande "enters" Texas as a small stream most or all of which is diverted to irrigate fields south and east of El Paso. Commonly, the stream is dry over much of the distance between El Paso and Ft. Hancock. Southeast of this town the valley narrows and the ground water surfaces to form a salty stream. The river remains small for the next 300 km until it "receives" the Rio Conchos. Small volumes of water are added by small salt laden springs (such as Indian Hot Springs) and fresh tributary creeks (such as Capote Creek). These increases are commonly exceeded by losses from evaporation or irrigation diversions. Drastic increases in flow periodically follow intense desert rains. These torrents soon subside and the Rio Grande again becomes a small, sometimes intermittent stream. This pattern is of long duration as Emory (1859) reported periodic dry stream beds and occasional severe flooding and Thomas (1963) reported high salinities in the Rio Grande in 1936. This reach of the river has been extensively impacted by human activities. Much of the flow (and most of the low saline water) is diverted at or north of El Paso. The northwestern 150 kilometers have been leveed and channelized. A 16 kilometer segment around the Conchos confluence has also

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been leveed and channelized. The intervening 300 kilometers has been proposed for channel "rectification" and is extensively leveed already.

Much of the flow of the Rio Grande east of the Conchos is dependent upon that "tributary". Historically, the contribution of the Conchos has been considerably greater than that of the Rio Grande above the confluence and that difference has been magnified by the Rio Grande diversions upstream. Present flow rates depend chiefly on releases from Luis L. León Reservoir; at the time of our visit on 18 March, 1977, the Conchos flow was nearly 2 orders of magnitude greater than that of the Rio Grande. Strangely, the man-made conjunction has the Conchos entering at a right angle; in effect a forced right angle turn of the huge stream where it enters the small stream. Between the end of its rectified channel below Presidio and the upper part of Amistad Reservoir (just upstream from the Pecos confluence), the Rio Grande has not been substantially impacted by human activities. The major items are the stream measurement weirs just below Alamito Creek and just above Amistad Reservoir, river fords at Stillwater Crossing and Boquillas, and a bridge near Stillwater Crossing. Other impacts are indirect such as minor irrigation diversions, overgrazing, exotic plants and fishes, pesticides washed from nearby fields, leaching from mine tailings, etc. Much of this distance is little disturbed and one can see the diverse geology and magnificent land formations.

COLLECTION SITES

Most of the newly reported locality records are based on two collecting trips, 14-18 March and 3-7 April, 1977. Collections were concentrated in the channelization and wild river segments, respectively. Previously, only one sample had been obtained from each of those reaches. The 1977 and previous (1954) locations are plotted on figures 1 and 2. The bulk of the 1954 (and subsequent) Rio Grande collections were from the Big Bend National Park and have been reported in Hubbs (1958), Hubbs and Wauer (1973) and Hubbs and Williams (in press).

RESULTS

The 15 collections from the Rio Grande west of the influence of the irrigation water from the Rio Conchos that enters the Rio Grande between Stations 15 and 16 contain 11 fish species (Table 1). The redundant nature of these samples is reflected by the presence of 7 fishes (Dorosoma cepedianum, Cyprinus carpio, Notropis lutrensis, Carpiodes carpio, Ictalurus punctatus, Gambusia affinis, and Lepomis cyanellus) in 9 or more collections.

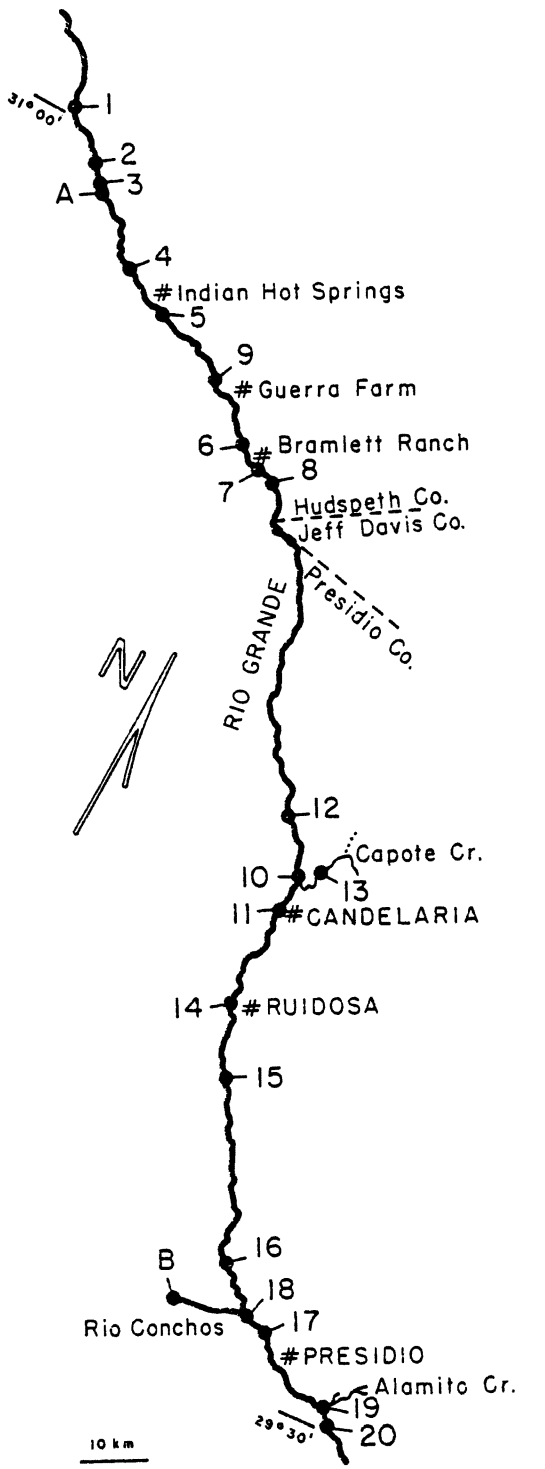

Figure 1.--Location of collection stations in the Rio Grande from and adjacent to the proposed channelization.

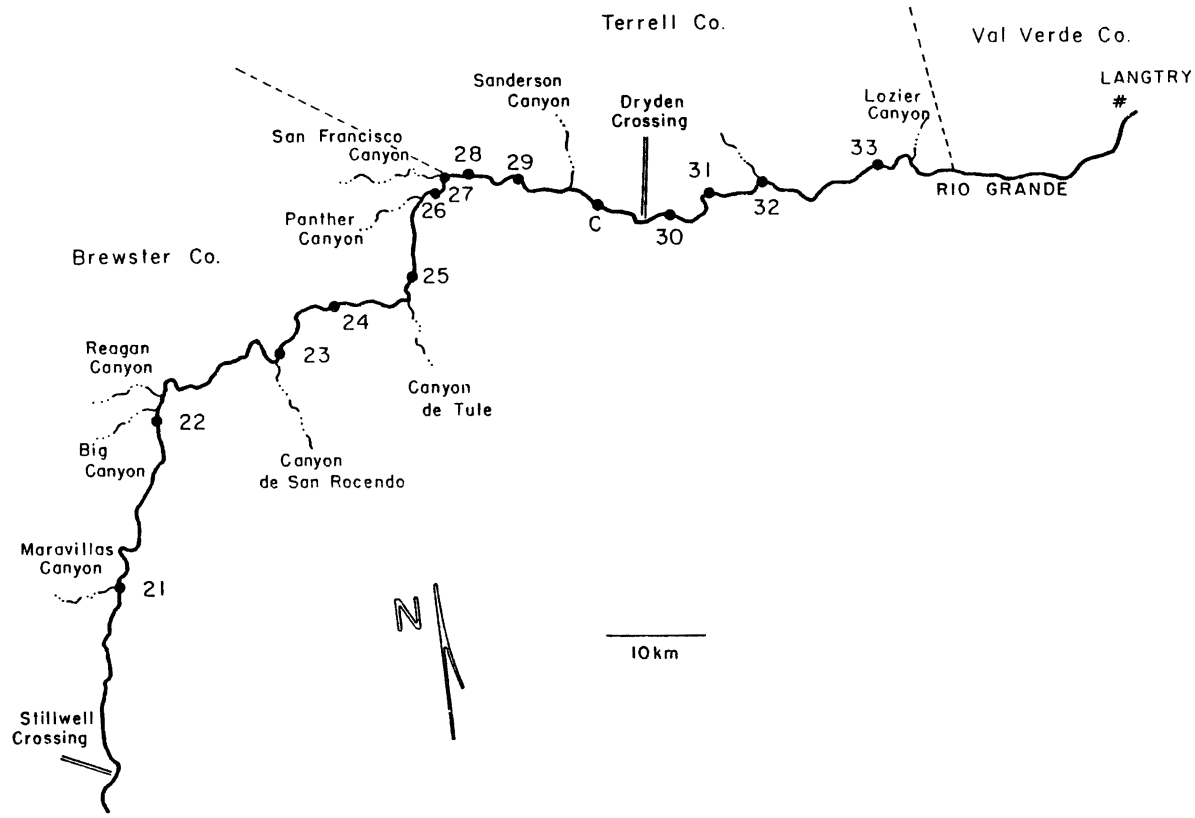

Figure 2.--Location of collection stations in the Lower Canyons of the Rio Grande.

Their widespread abundance suggests that they would be expected anywhere in this stream segment. The second listed species (Cyprinus carpio) is an exotic but the others are all widely distributed native fishes. Two of the other four species (Lepomis megalotis and Morone chrysops) were collected at widely separated sites. The former was found at very brushy sites. It is likely that this species can be obtained wherever those conditions prevail. The latter (undoubtedly, derived from fishes stocked near Del Rio) is an open-water top carnivore. This fish would be expected to be sparsely distributed because of dependence upon a complex food chain and consequently high primary productivity per fish. In a similar way, a large fish like Ictalurus furcatus would be expected to be rare in a small stream like the Rio Grande in this reach. The last species Pimephales vigilax, has not previously been taken east of Val Verde Co. As this fish is commonly used as a bait minnow, it is likely that the samples obtained are descendants from escaped bait.

The six collections from the vicinity of Presidio (16B on Table 1) contain 20 species; 11 were not taken upstream but 2 from there were absent. We expect that increased effort would have produced an Ictalurus punctatus, but that Pimephales vigilax is not present. Nine of the additional 11 species, Astyanax mexicanus (as A. fasciatus), Hybopsis aestivalis, Notropis chihuahua, Notropis braytoni, Notropis jemezanus, Pimephales promelas, Campostoma ornatum, Pylodictis olivaris, and Lepomis macrochirus, were reported from the Big Bend region by Hubbs (1958). One exception, Cyprinodon eximius has subsequently been reported from Terlingua creek by Miller (1977). The other, Menidia beryllina, is undoubtedly derived from descendants of bait-released stocks now abundant in Amistad Reservoir. We expect that Menidia (a euryhaline species) will soon spread and become abundant in the saline Rio Grande waters upstream from the Conchos confluence.

The distinct difference between the Rio Grande fishes on either side of the Conchos confluence is reflected by similar differences between the fishes inhabiting the tributary creeks, Capote and Alamito (stations 13 and 19, respectively).

Table 1.--Numbers of fishes collected from the Rio Grande from and adjacent to the proposed channelization between Presidio and El Paso

Species	Stations A	1	2	3	4	5	9	6	7	8	12	10	13	11	14	15	16	18	17	19	20	B
Dorosoma cepedianum		14	108	133	1	23	3		6		3	43		1	21	14	159	18	4		4	10
Astyanax mexicanus																				1		8
Cyprinus carpio	2	58	26	28	1	29	5	50	16	1	14	125	6	65	86	28	57	2		1	1	7
Hybopsis aestivalis																			17		13	4
Notropis chihuahua																			1	3		
Notropis braytoni																				1	1	44
Notropis lutrensis	74	11	13	83	130	242	66		49	85	55	335	118	40	11	65	54	50	354	166	63	36
Notropis jemezanus																						22
Pimephales vigilax			2	1		1																
Pimephales promelas																				1		3
Campostoma ornatum																				262	16	
Carpiodes carpio	x	1	2			26			2	2		74		2			2	1				3
Ictalurus punctatus		1	1		1		1		1	5	3	1		4								
Ictalurus furcatus							1												1		2	5
Pylodictis olivaris																					1	1
Cyprinodon eximius																				13	1	
Gambusia affinis	18	1		1		9		7	1	61		1		7	5	122	57			78	28	14
Menidia beryllina																	2	4	4	10	1	
Morone chrysops		1		2	1							1		1								
Lepomis cyanellus	2	4		2	4	8	2	11	7	2	4	23		29	38	105	168	2		11	4	3
Lepomis megalotis	2								1	2				2			1					
Lepomis macrochirus																		1				
H'		1.7	1.3	1.5	0.4	1.5	0.9	1.1	1.8	1.4	1.4	1.7	0.3	2.1	1.8	2.0	2.2	1.6	0.5	1.6	2.3	
% Introduced		65	18	12	1	9	6	74	19	1	18	26	5	44	53	8	12	8	1	2	2	
Fish/seine hour		46	101	119	92	193	156	136	166	351	79	316	248	151	161	445	500	78	381	527	133	

Table 2--List of fishes collected from the Lower Canyons of the Rio Grande.

Species	Stations 21	22	23	24	25	26	27	28	29	30	31	32	33	C
Lepisosteus osseus			1			1			2	1		1		1
Dorosoma cepedianum	15				3	21	1	2	7	11	3	5	1	
Cycleptus elongatus	108	2	15	1	6	7	2			5	4	19	1	
Carpiodes carpio	5	1		1	1		1	2		1	2	8		31
Ictiobus bubalus	1											1		1
Astyanax mexicanus						1						33		1
Cyprinus carpio	3						1							1
Rhynichthys cataractae	188	182	209	92	87	77	47	184	141	191	168	850	167	
Hybopsis aestivalis	4	13	36	8	6	7	4	6	3	3	11	9	9	2
Pimephales promelas			1							1				
Notropis chihuahua	1													
Notropis jemezanus	3	5	7	4	20	19	3	3	48	5	16	6	12	11
Notropis lutrensis	6	1	19	1	5	112	4	6	2	12	29	37		1
Notropis braytoni		2	11	3	15	9	4	19	6		6	10	3	25
Ictalurus punctatus		1	7	2	2		3		2		2	1	7	2
Ictalurus furcatus		5	13	10	6		4	3	8	1	4		2	69
Pylodictus olivaris		1	4		2						3	1	2	6
Fundulus kansae	2													
Gambusia affinis	3		4			4	4					1		
Menidia beryllina				2		1			1			2		
Micropterus salmoides				1	1							4		
Lepomis cyanellus	1													
Lepomis macrochirus	1		1											

Chemical and physical conditions in the two creeks are reasonably similar - Capote is slightly smaller and has been reported dry near the mouth. We attribute the fish faunal differences to the impact of seasonal migrations into the Rio Grande as reported for Terlingua Creek by Hubbs and Wauer (1973). Those salty Rio Grande waters at the mouth of Capote Creek may exclude the typical Rio Grande tributary creek fauna from any upstream tributary. Regardless of the cause, these fishes were not found in Capote Creek. We looked carefully for fishes in the waters of Indian Hot Springs to determine if an endemic fauna were there. These warm, salt-laden springs were fishless. We did note Gambusia affinis was concentrated in the warm outflow waters emptying into the colder Rio Grande waters during our March visit.

The faunistic difference between the fishes of the two segments is of long duration. The 1954 samples (A and B) are well representative of the faunal units found in 1977 samples.

The 13 collections from the Lower Rio Grande Canyons contained 23 species (Table 2). Thirteen (Dorosoma cepedianum, Carpiodes carpio, Astyanax mexicanus, Hybopsis aestivalis, Pimephales promelas, Notropis chihuahua, Notropis jemezanus, Notropis lutrensis, Notropis braytoni, Ictalurus furcatus, Pylodicitis olivaris, Gambusia affinis, and Lepomis macrochirus) were found in the collections near Presidio and reported from the Rio Grande in Big Bend National Park (Hubbs, 1958). The absence of Cycleptus elongatus and Rhinichthys cataractae from the upstream stations is likely to be a seasonal artifact because both have been reported from the Rio Conchos. Both species are also absent in the August 1954 collection (C). All of the Cycleptus collected downstream were young of the year. Similarly, the bulk of the Rhinichthys were young. It is unlikely that adult Cycleptus would be collected with the seines used in such high water (and none were). Samples taken near the mouth of Tornillo Creek in April commonly have many young Cycleptus but no adults are in collections from that spot. Similarly, Rhinichthys are likely to be most abundant just after the breeding season. Our station 20 (Rio Grande just east of the mouth of Alamito Creek) included one fish tentatively identified as a Rhinichthys that escaped prior to being preserved. Rhinichthys abundance in the area is supported by its presence in a collection from the Rio Grande just upstream from Mariscal Canyon in Big Bend National Park. Specimens have also been taken from the Conchos system in Chihuahua. The absence of Lepisosteus osseus, Ictiobus bubalus and Micropterus salmoides in the collections near Presidio is likely to be a sampling artifact. The high-water flows made it very difficult to sample deep-water environments commonly occupied by these (especially Ictiobus and Micropterus) and our downstream samples were sufficiently infrequent that chance occurrence in the Presidio samples is likely. Two species (Menidia beryllina and Lepomis cyanellus) were collected near Presidio but not reported from Big Bend National Park by Hubbs (1958). It is unlikely that the former existed in the region before 1960 as Tilton and White (1964) showed that this fish was then just being distributed across Texas. Hubbs and Echelle (1972), documented a similar and recent spread of this fish in the Pecos Basin. Lepomis cyanellus is now known from Big Bend National Park (Hubbs and Williams, in press), supporting Hubbs' (1958) prediction that it existed within the park. Similar to Menidia audens, Fundulus kansae has recently been introduced into the region. Its introduction and subsequent spread was reported by Hubbs and Wauer (1973). The fish from the Rio Grande at the mouth of Maravillas Cr. surely reflects an additional spread. We herein also report the presence of Fundulus kansae in McKinney Spring in Big Bend National Park. It is likely that the specimens of Micropterus salmoides reflect a modest population of indigenous fishes that can serve as a recreational resource. We expect that largemouth bass occur throughout the Rio Grande east of the Conchos confluence (and also in much of the Conchos system).

The 23 species extensively overlap those reported from the Big Bend by Hubbs (1958) who recorded 7 additional fishes. Four of them, [Dionda episcopa, Gambusia gaigei, Lepomis (=Chaenobryttus) gulosus, and Lepomis microlophus] were recorded as inhabiting small clear tributaries and would be rare or absent in the river proper. Moxostoma congestum was subsequently reported from Tornillo Cr. by Hubbs and Wauer (1973). Three fishes, Anguilla rostrata, Hybognathus placitus, and Aplodinotus grunniens) were reported from Big Bend by Hubbs (1958), but not obtained in the 1977 samples. The first is catadromous and upstream migrants would be unlikely to pass Falcon Dam (much less Amistad); samples have not been obtained since Falcon was filled. The other two would be expected to occur in the area. Aplodinotus could easily have been overlooked but the absence of Hybognathus is inexplicable.

DISCUSSION

The fishes inhabiting the Rio Grande in west Texas can be placed in three faunal assemblages: Saline Rio Grande fauna, Rio Conchos-Rio Grande fauna, Tributary Creek fauna.

The Saline Rio Grande Faunal assemblage is dominated by four wide spread species, Dorosoma cepedianum, Cyprinus carpio, Notropis

lutrensis, and Lepomis cyanellus. The limited diversity (Shannon H' values are generally well below 2) seems to be due to harsh conditions - salinity and periodic interrupted stream flows. The latter may be most critical as the fish present are ones expected in pools in west Texas streams. Our repeated efforts in riffles were generally unproductive. This assemblage has been impacted by human activities. Certainly the three exotics (Cyprinus, Morone, Pimephales) must have some impact. It is likely that Cyprinus has depressed Carpiodes abundance but the impact of Morone and Pimephales is difficult to assess, and the absence of prior studies makes any conclusions conjectural.

The Rio Conchos - Rio Grande faunal assemblage is made up of those species living in the Rio Grande and not dependent upon tributary creeks for a part of their life history. The abundance of these fishes is not correlated with the presence of tributary flows. Typical fishes of this assemblage are Notropis jemezanus, N. lutrensis, N. braytoni, Rhinichthys cataractae, Hybopsis aestivalis, Ictalurus punctatus, Ictalurus furcatus, Pylodictis olivaris, Dorosoma cepedianum, Cycleptus elongatus, and Carpiodes carpio. Seven other fishes (Lepisosteus osseus, Ictiobus bubalus, Pimephales promelas, Menidia beryllina, Micropterus salmoides, Aplodinotus grunniens, and Hybognathus nuchalis) are reasonably abundant in the Rio Conchos-Rio Grande faunal assemblage.

Only one (Menidia beryllina) of those 18 species is introduced. Its impact is not yet fully assessed as its entry into the region is so recent that its abundance may be in a growth phase. It is not likely that this quiet water euryhaline form will become excessively abundant in the fresh-flowing waters of the Rio Grande. Rhinichthys cataractae is not only a prominent member of this faunal assemblage, it also seems to be absent or very scarce in adjacent areas. This population is isolated from other stocks by the saline and frequently dry Rio Grande upstream from Presidio. It is likely that it represents a race adapted to deep canyons with relatively warm water. Essentially, a collection from Texas with numerous Rhinichthys and/or Cycleptus is likely to be from the Rio Grande between Presidio and Amistad Reservoir. The Rio Conchos - Rio Grande faunal assemblage will often be supplemented by representatives from the tributary creek faunal assemblage.

Two fishes (Scaphirhynchus platyrynchus and Notropis simus) may once have inhabited the Rio Conchos - Rio Grande faunal assemblage. Scaphirhynchus was reported from the Rio Grande near Albuquerque by Cope and Yarrow (1875). We have obtained hearsay reports of a sturgeon from near Dryden Crossing (and also from Mexican tributaries in Coahuila) that support the former occurrence of shovelnose sturgeon in the river. Notropis simus has been recorded from the Rio Grande in New Mexico and downstream from Del Rio but the collections preceded or were at a similar time interval as the first collections from our study area. We doubt that Notropis simus now lives in the Lower Canyons of the Rio Grande and suggest that work to ascertain if it still exists concentrate on the lower Rio Conchos. We have no suggestions as to the conditions that may have led to the extinction or substantial decline of these two fishes that once were part of this faunal assemblage. Both species are commonly found on listings of endangered species and N. simus may be extinct in U.S. waters. Its absence in Trevino-Robinson's collections is particularly alarming as most Texas records are from that stream segment. The New Mexico records are from the Rio Grande in areas that now have reduced flow or are dry.

The tributary creek faunal assemblage is made up of a group of fishes that spends all or a substantial fraction of their time in the small tributaries. Three species (Notropis lutrensis, Pimephales promelas, Notropis braytoni) may occur in the creeks or Rio Grande. Except for the first, they are seldom found far from the creek mouth. Three (Moxostoma congestum Carpiodes carpio, Cycleptus elongatus) are creek inhabitants only as young and the adults may be found with equal abundance elsewhere in the Rio Grande. Eleven species (Cyprinodon eximius, Campostoma ornatum, Notropis chihuahua, Fundulus kansae, Astyanax mexicanus, Gambusia affinis and the sunfishes, Lepomis gulosus, cyanellus, microlophus, macrochirus, and megalotis) are most commonly collected in creeks but have been found in the Rio Grande. The first six are listed by relative frequency of creek vs. river abundance. Hubbs and Wauer (1973) had reported that this assemblage moved out of the creeks seasonally but our 1977 samples of the first two are the first demonstration of fish that must have moved into the river. Samples of the five sunfishes are sufficiently infrequent that definite patterns are difficult to ascertain. Two species (Gambusia gaigei, Dionda episcopa) are limited to the tributary waters. The former is on all lists of endangered fishes; its status has been discussed recently by Hubbs and Williams (in press). The fishes in the tributary creek assemblage often present special problems. Three of them (Cyprinodon eximius, Campostoma ornatum, Notropis chihuahua) are commonly found on endangered species listings as their U.S. distribution is restricted to the creek mouths. These areas should be watched with care to reduce the possibility of extermination of this fragile assemblage. The spread of the introduced Fundulus kansae is of primary concern (Hubbs and Wauer, 1973). Future intro-

ductions of bait minnows should be avoided.

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