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Fishes in the lower San Pedro Mezquital River, Nayarit, Mexico

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Abstract: The San Pedro Mezquital River is the seventh largest river in Mexico, and flows through the Sierra Madre Occidental into the Marismas Nacionales Biosphere Reserve, on the coast of the state of Nayarit. The present study is to conform a systematic checklist of fishes in the lower basin of the San Pedro Mezquital River. In total, 52 species were collected from 24 families. Four native species were collected (*Atherinella crystallina*, *Poecilia butleri, Poeciliopsis latidens* and *Poeciliopsis prolifica*) that are federally protected. Five of the collected species were new records for the state of Nayarit. This checklist constitutes a first approximation of the fish fauna present in the San Pedro Mezquital River. However, the construction of the Las Cruces dam upstream, will modify the basin hydrology, worsen the introduction of exotic species and create habitat loss, which can have immediate negative impacts on the fish communities in this region.

Key words: Marismas Nacionales Biosphere Reserve, freshwater fishes, diversity, tropical river, introduced fishes

INTRODUCTION

Biological inventories have contributed to the knowledge of Mexican fish fauna, and have allowed scientists and natural resource managers to evaluate the ecological and biological attributes of aquatic communities in marine, estuarine and freshwater ecosystems. However, in many regions of Mexico, the ichthyofauna is not well documented. Therefore, additional evaluations of the biodiversity are needed to develop effective conservation strategies for freshwater biodiversity.

The San Pedro Mezquital basin is one of least studied freshwater ecosystem in the state of Nayarit, Mexico (González-Díaz and Soria-Barreto 2013). With a length of 540 km and a surface area of 2,767,406 ha, the river flows through the states of Durango, Zacatecas and Nayarit. The San Pedro Mezquital is the seventh largest river in Mexico. It flows through the Sierra Madre Occidental and links the desert of Chihuahua to the Gulf of California, effectively linking Nearctic and Neotropical regions. The watershed begins north of Durango City and includes the Tunal, Santiago Bayacora and Súchil and the Mezquital rivers. After the river crosses the Sierra Madre Occidental it flows into the Laguna Grande de Mexcaltitán, part of the Marismas Nacionales Biosphere Reserve in Nayarit. Near to the ocean, the morphology of the river is formed by lacustrine deltas in lakes and estuarine marshes (Tamayo 1999; INEGI 2000; WWF 2010; Blanco y Correa 2011).

Historically, human populations in the region have depended on the San Pedro Mezquital River for water and food (fishes) (WWF 2010). However, inadequate management of the basin has led to a decline in the quality and quantity of the ecosystem services provided by the river. Throughout the basin, freshwater fisheries are declining due to over-exploitation and pollution from sewage (INEGI 2000). Other land-use activities, such as livestock grazing, agricultural development and deforestation have also negatively affected the river. Moreover, the imminent construction of the hydroelectric dam Las Cruces upstream of San Pedro Ixcatán, planned for 2018 (SENER 2013), threatens freshwater communities of the river.

Although the basin has enormous cultural, economic and ecological value in western Mexico, research on the fish fauna is limited. Fish community structure

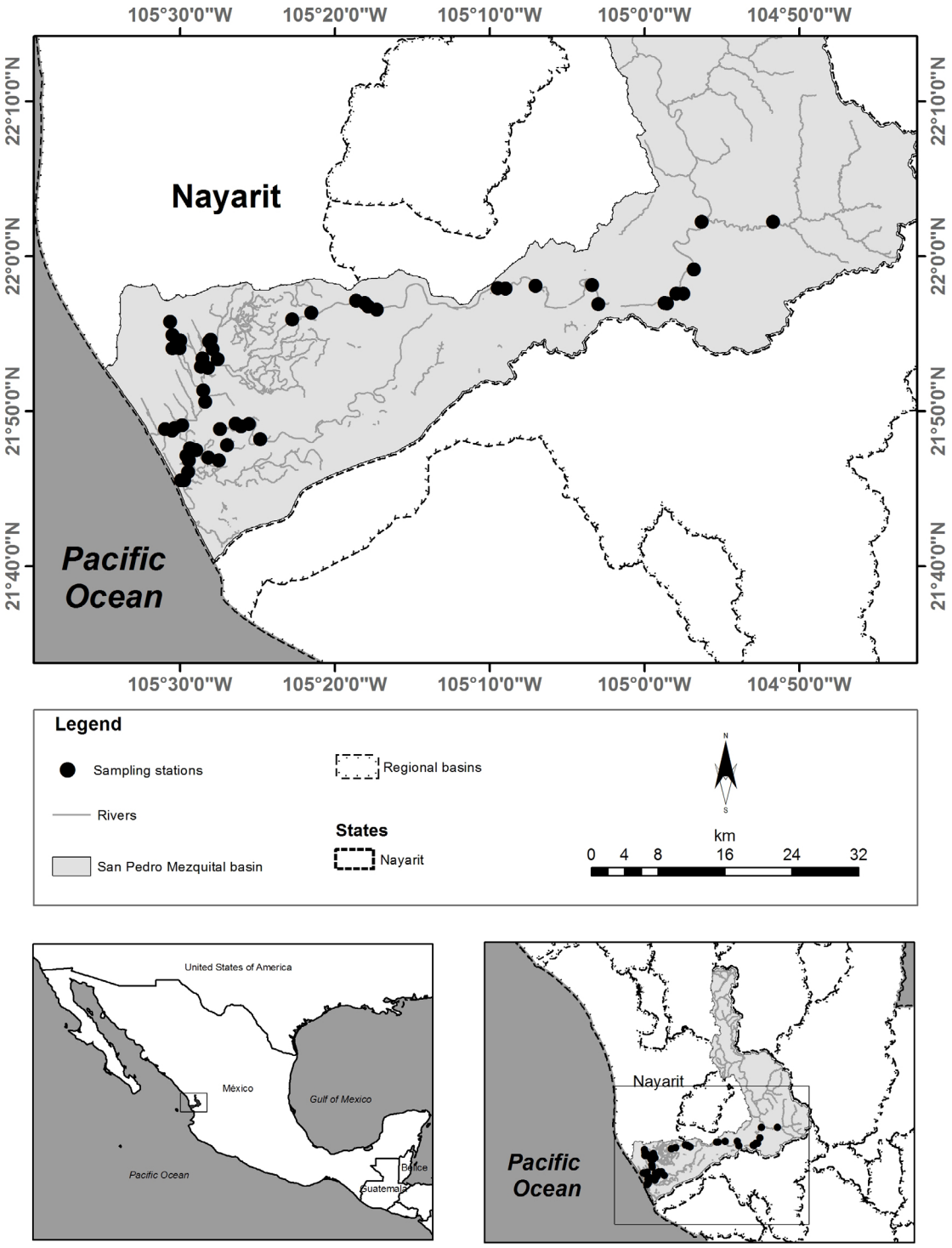

Figure 1. Location of San Pedro Mezquital River, Nayarit, Mexico and sampling sites.

in the upper basin has been documented in the state of Durango (Huidobro-Campos et al. 2009; Charre-Medellín et al. 2011; López-González 2012). There are limited and spatially scattered records of fishes in the middle and lower parts of the basin that only can be found in national fish collections (Miller 2009; González-Díaz and Soria-Barreto 2013); therefore the aim of this investigation was to describe the composition and distribution of fish species present in the lower part of the San Pedro Mezquital River.

MATERIALS AND METHODS

The study was conducted in the watershed of the San Pedro Mezquital River in the state of Nayarit, Mexico. There were only six historical records in this basin. We established 51 sites including these records to collect fishes (Figure 1; Table 1). All of the samples were collected between May 2010 to May 2012.

Sampling gear was selected to reflect habitat characteristics and environmental conditions. Sampling equipment employed included cast nets (4 m diameter

with 10 mm mesh), gill nets (10 m long, 2 m high and 40 mm mesh), scoop nets and baited hooks in an attempt to document all of the species at each of the 51 sites. Each site was georeferenced with a GPS receiver (Magellan explorist 200).

The fishes collected were preserved in a 10% formalin solution and were transported to the laboratory, where they were washed with running water and finally preserved in 70% ethanol. Collections were carried out with the permits of Fishing of Development SGPA/DGVS/01077/10 and DGOPA 02689.130410.1574 and were stored at the ichthyological collection at El Colegio de la Frontera Sur, San Cristóbal de Las Casas, Mexico (ECOSC).

All of the fishes collected were identified to species level. This identification was based in the published keys and species descriptions of Hubbs (1936), Hubbs

Table 1.Sampling sites in the San Pedro Mezquital River, Nayarit.

Number	Site	Latitude (N)	Longitude (W)
1	El Naranjo Creek, San Pedro Mezquital River	22°02′12″	104°51′43″
2	San Pedro Mezquital River at San Pedro Ixcatán	22°02′12″	104°56′19″
3	Tributary of San Pedro Mezquital River	21°59′08″	104°56′49″
4	Tenamache Creek, San Pedro Mezquital River	21°57′34″	104°57′30″
5	Linares Creek, San Pedro Mezquital River	21°57′34″	104°57′57″
6	Malpaso Creek, San Pedro Mezquital River	21°56′57″	104°58′33″
7	San Pedro Mezquital River	21°56′58″	104°58′43″
8	Laguna del Mar, backwater San Pedro Mezquital River	21°56′54″	105°02′59″
9	Laguna del Mar 2, backwater San Pedro Mezquital River	21°58′08″	105°03′23″
10	El vado de San Pedro, branch San Pedro Mezquital River	21°58′04″	105°07′02″
11	San Pedro Mezquital River under the bridge at Ruíz	21°57′54″	105°08′59″
12	San Pedro Mezquital River in pump at Ruíz	21°57′55.65″	105°09′30.80″
13	San Pedro Mezquital River in open air theater at Ruíz	21°56′32″	105°17′17″
14	San Pedro Mezquital River under the bridge at Tuxpan	21°56′44″	105°17′51″
15	San Pedro Mezquital River in front of Tapanco at Tuxpan	21°56′59″	105°18′04.25″
16	San Pedro Mezquital River in pump at Tuxpan	21°57′08.30″	105°18′38.30″
17	San Pedro Mezquital River at Mezcal Tuxpan	21°56′20.45″	105°21′31″
18	San Pedro Mezquital River in the "Y" at Tuxpan	21°55′54″	105°22′46″
19	Las Grullas, lagoon system of Marismas Nacionales Biosphere Reserve	21°55′45″	105°30′39″
20	Laguna del Pochote, lagoon system of Marismas Nacionales Biosphere Reserve	21°54′54″	105°30′29″
21	La Grulla, lagoon system of Marismas Nacionales Biosphere Reserve	21°54′33″	105°30′00″
22	El Zanate 1, lagoon system of Marismas Nacionales Biosphere Reserve	21°54′03″	105°30′30″
23	Pesca del Pochote, lagoon system of Marismas Nacionales Biosphere Reserve	21°54′03″	105°30′02″
24	La Boca de Lazareto, lagoon system of Marismas Nacionales Biosphere Reserve	21°54′36″	105°28′02″
25	Laguna Agua Larga 2, lagoon system of Marismas Nacionales Biosphere Reserve	21°54′29″	105°28′07.50″
26	Laguna Agua Larga, lagoon system of Marismas Nacionales Biosphere Reserve	21°53′60″	105°27′54.50″
27	El Zanate, lagoon system of Marismas Nacionales Biosphere Reserve	21°53′24″	105°28′33″
28	La Boca del Mixtle, lagoon system of Marismas Nacionales Biosphere Reserve	21°53′20″	105°27′35″
29	Istlacuahui, lagoon system of Marismas Nacionales Biosphere Reserve	21°52′52″	105°28′39″
30	Zacatal, lagoon system of Marismas Nacionales Biosphere Reserve	21°52′48″	105°28′12″
31	Lagoon Toluca, of Marismas Nacionales Biosphere Reserve	21°51′19″	105°28′30″
32	Lagoon Toluca, of Marismas Nacionales Biosphere Reserve	21°50′36″	105°28′23″
33	Con Tepoten, lagoon system of Marismas Nacionales Biosphere Reserve	21°49′10″	105°25′34″
34	Con Camarada, lagoon system of Marismas Nacionales Biosphere Reserve	21°49′12″	105°26′25″
35	El Puyeque, lagoon system of Marismas Nacionales Biosphere Reserve	21°49′01″	105°26′03″
36	El Otate, lagoon system of Marismas Nacionales Biosphere Reserve	21°48′50″	105°27′25″
37	Playa Los Caimanes, lagoon system of Marismas Nacionales Biosphere Reserve	21°49′05″	105°29′52″
38	La Borrega, lagoon system of Marismas Nacionales Biosphere Reserve	21°48′55″	105°30′21″
39	La Borrega 1, lagoon system of Marismas Nacionales Biosphere Reserve	21°48′44″	105°30′31″
40	El Tesoro, lagoon system of Marismas Nacionales Biosphere Reserve	21°48′50″	105°30′59″
41	Pond Campo Los Limones, lagoon system of Marismas Nacionales Biosphere Reserve	21°48′11.24″	105°24′49.59″
42	Los Jiotes, lagoon system of Marismas Nacionales Biosphere Reserve	21°47′49″	105°26′57.45″
43	El Canal, lagoon system of Marismas Nacionales Biosphere Reserve	21°46′49″	105°27′30.30″
44	Las Conchitas lagoon system of Marismas Nacionales Biosphere Reserve	21°46′59″	105°28′11.60″
45	San Sebastián, lagoon system of Marismas Nacionales Biosphere Reserve	21°47′36″	105°29′22″
46	La Barra, lagoon system of Marismas Nacionales Biosphere Reserve	21°46′49″	105°29′27″
47	Zavala, lagoon system of Marismas Nacionales Biosphere Reserve	21°47′29.50″	105°28′58″
48	El Troncón, lagoon system of Marismas Nacionales Biosphere Reserve	21°47′07″	105°29′36″
49	Estuary Toromocho, lagoon system of Marismas Nacionales Biosphere Reserve	21°46′04.30″	105°29′29″
50	Los Pájaros, lagoon system of Marismas Nacionales Biosphere Reserve	21°45′32″	105°29′56″
51	El Espuelón, lagoon system of Marismas Nacionales Biosphere Reserve	21°45′32″	105°29′45″

and Miller (1954), Miller (1960), Arredondo-Figueroa and Guzmán-Arroyo (1986), Marceniuk et al. (2009) and Miller (2009). For marine and estuarine fishes the work of Fischer et al. (1995), Allen and Robertson (1998), Castro-Aguirre et al. (1999, 2002) and Robertson and Allen (2015) were used.

A systematic checklist was made with taxonomic categories above the genus level following the classification of Nelson (2006). Genera and species within families were arranged in alphabetical order. Nomenclature, authorities and years of description of each species were obtained from the on-line work of Eschmeyer and Fricke (2015). The ecotonic classification was listed according to classification of Castro-Aguirre et al. (1999). The protection categories were obtained from American Fisheries Society list (Jelks et al. 2008), the Mexican Official Norm NOM-059 (2010) and the Red List (IUCN 2014). The frequencies of occurrence were calculated, using the percentage of occurrence of each species for all sampling sites.

RESULTS

The fish fauna in the San Pedro Mezquital River, Nayarit, consisted of 24 families, 40 genera, and 52 species (Table 1). Centropomidae (six species), Poeciliidae (five species) and Gerreidae (five species) were the most diverse fish families in the study region (Table 2). According to species descriptions (Castro-Aguirre et al. 1999), 11 species were classified as freshwater species, while 41 were marine species with some tolerance to freshwater. Five exotic species were collected: Grass Carp, *Ctenopharyngodon idella*; Common Carp, *Cyprinus carpio*; Yucatan Gambusia, *Gambusia yucatana*; and two Tilapia, *Oreochromis mossambicus* and *O. niloticus* (Table 2).

Moreover, four species were collected with some level of international and national protection: *Atherinella crystallina* (Near Threatened on the IUCN Red List, 2014); *Poecilia butleri* (protected by Mexican Official Norm NOM-059); *Poeciliopsis latidens* [Near Threatened species on the IUCN Red List (2014); Threatened on the NOM-059 and by the American Fisheries Society (Jelks et al. 2008)], and *Poeciliopsis prolifica* [Near Threatened on the IUCN Red List (2014)] (Table 2).

Eight species were broadly distributed (>30% of the sites), *Oreochromis niloticus* was the most widely distributed (60% of sites), followed by *Centropomus armatus* (45.1% of sites), *Cichlasoma beani* (43.1% of sites), *Atherinella crystallina* (39.2% of sites); *Lile stolifera, Mugil curema* and *Gobiomorus maculatus* (35.3% of sites), and *Poecilia butleri* (33.3% of sites; Table 2).

DISCUSSION

The fish fauna present in the lower San Pedro Mezquital River in the state of Nayarit reflects the hydrological and geological history of the region and the strong links between freshwater and marine-estuarine ecosystems. For example, freshwater species such as *A. crystallina, C. beani, P. butleri* and *P. latidens* are also found in nearby watersheds of the Santiago, Ameca and Baluarte rivers, among others (Miller 1986, 2009). These fauna are similar as a result of connections and isolations events between the upper part of San Pedro Mezquital River and its basins, during the Pleistocene (Domínguez-Domínguez et al. 2006).

The fish fauna is dominated by marine-estuarine species, suggesting there is a strong influence marine from tidal, waves, saline intrusion and storm surges in the Pacific Coastal Plain (Blanco y Correa 2011).

Fish diversity in the lower San Pedro Mezquital River is high, and 52 species were documented that correspond to 73% of the entire basin. These species live in a relatively small area compared with other nearby aquatic systems. For instance, the Agua Brava-Teacapán lagoon, a much larger and more environmentally complex system located near the river basin, has 76 species of fishes (Álvarez-Rubio et al. 1986). The recorded data suggest that the San Pedro Mezquital River also has greater species richness than both the Ameca River (50 species; Guzmán and Lyons 2003) and the Santiago River (up to 44 species; Gómez-Balandra et al. 2012).

Notably, the present study reported four species that had not been previously documented in the state of Nayarit (González-Díaz and Soria-Barreto 2013): *Ctenopharyngodon idella, Gambusia yucatana, Oreochromis niloticus* and *Aboma etheostoma*.

Additionally, four of the native species we collected are classified as protected. It is necessary to do more research to provide biological and ecological information of these species, and to determine their real conservation status and the possible threats they face in the basin.

The San Pedro Mezquital River is under anthropogenic activities such as waste water discharges (INEGI 2000), presence of exotic species and overfishing. In addition the construction of the hydroelectric Las Cruces dam, will strongly affect the aquatic habitats and fish communities. Dams alters the flow regime, temperature and nutrients in rivers, and also act as a barriers for species dispersal, resulting in fragmentation of habitat, migration interruption and changes of habitat and structure of aquatic communities (Marmulla 2001, Guzmán et al. 2010). Damming limits and reduces the distribution of fishes and diminishes population of native and endemic species (Terra et al. 2010; Gómez-Balandra et al. 2012).

The present work is the first attempt to enumerate the fish fauna of the lower San Pedro Mezquital River. Further seasonal sampling is required in order to document changes on the physicochemical conditions of water and fish communities. The results of this research serve as a baseline of the fish diversity and

Table 2. Checklist of fish fauna of the San Pedro Mezquital River, Nayarit. Mexico. M= marine origin, F= freshwater origin, E= exotic. Ecotonic classification 1= stenohaline, 2= euryhaline, 3= primary, 4= secondary, 5=vicarious, 6= estuarine, 7= catadromous. Protection category (A)= threatened NOM-059, (Pr)= in special protection NOM-059, (NT) = near threatened Red List, (Am) = Threatened (Jelks et al. 2008).

ORDER / Family Species	Category	Relative frequency (%)	Voucher ECOSC
MYLIOBATIFORMES / Urotrygonidae			
Urobatis cf. *halleri* Cooper, 1863	M, 1	3.9	8362, 8385
ELOPIFORMES / Elopidae			
Elops affinis Regan, 1909	M, 2	7.8	8291, 8308, 8313, 8365, 8378
ANGUILLIFORMES / Ophichthidae			
Myrophis vafer Jordan & Gilbert, 1883	M, 2	2	8130
CLUPEIFORMES / Engraulidae			
Anchoa analis (Miller, 1945)	M, 2	11.8	8122, 8127, 8136, 8140, 8158, 8171
Anchoa lucida (Jordan & Gilbert 1882)	M, 2	5.9	8159, 8207, 8210
Clupeidae			
Dorosoma smithi Hubbs & Miller, 1941	M, 5	13.7	7907, 7941, 7947, 7983, 8011, 8072, 8170, 8237
Lile stolifera (Jordan & Gilbert 1882)	M, 2, 6	35.3	7918, 8003, 8060, 8067, 8073, 8076, 8081, 8092, 8100, 8107, 8112, 8156, 8206, 8223, 8230, 8289, 8312, 8321, 8359, 8364
GONORYNCHIFORMES / Chanidae			
Chanos chanos (Forsskål, 1775)	M, 1	3.9	8287, 8320
CYPRINIFORMES / Cyprinidae			
Ctenopharyngodon idella (Valenciennes, 1844)	F, E, 3	2	8113
Cyprinus carpio Linnaeus, 1758	F, E, 3	2	8290
SILURIFORMES / Ictaluridae			
Ictalurus cf. *dugesii* (Bean, 1880)	F, 3	3.9	7943, 7949, 7956, 7970, 8014, 8020
Ariidae			
Sciades guatemalensis (Günther, 1864)	M, 2	21.6	8028, 8108, 8116, 8147, 8178, 8200, 8204, 8208, 8219, 8284, 8356
Sciades seemanni (Günther, 1864)	M, 2	15.7	8166, 8190, 8201, 8264, 8304, 8317, 8372, 8386, 8392, 8402
Cathorops liropus (Bristol 1897)	M, 2	15.7	8117, 8131, 8167, 8179, 8189, 8191, 8226, 8272, 8285
MUGILIFORMES / Mugilidae			
Agonostomus monticola (Bancroft, 1836)	M, 7	5.9	7909, 8005, 8032
Mugil cephalus Linnaeus, 1758	M, 2	2	8296
Mugil curema Valenciennes, 1836	M, 2	35.3	8139, 8141, 8163, 8188, 8198, 8235, 8249, 8262, 8280, 8283, 8297, 8311, 8315, 8326, 8348, 8368, 8371, 8375, 8384, 8391, 8394, 8398, 8399, 8404, 8409
ATHERINOFORMES / Atherinopsidae			
Atherinella crystallina (Jordan & Culver, 1895)	M, 5, (NT)	39.2	7892, 7896, 7903, 7911, 7915, 7921, 7923, 7927, 7932, 7944, 7957, 7965, 7974, 7985, 7988, 7994, 8000, 8022, 8041, 8047, 8057, 8064, 8078, 8089, 8098, 8118, 8132, 8148, 8176, 8180, 8336, 8340
CYPRINODONTIFORMES / Poeciliidae			
Gambusia yucatana Regan, 1914	F, E, 4	3.9	8085, 8102
Poecilia butleri Jordan, 1889	F, 4, (Pr)	33.3	7894, 7900, 7913, 7919, 7922, 7926, 7930, 7934, , 7950, 7961, 7971, 7977, 7992, 8006, 8015, 8021, 8025, 8033, 8037, 8044, 8052, 8061, 8086, 8095, 8103, 8242, 8335, 8339, 8355
Poeciliopsis latidens (Garman, 1895)	F, 4, (A), (NT), (Am)	25.5	7895, 7901, 7910, 7914, 7920, 7931, 7935, 7951, 7962, 7972, 7978, 7987, 7993, 7998, 8007, 8026, 8034, 8038, 8045, 8053, 8062, 8087, 8096, 8104
Poeciliopsis prolifica Miller, 1960	F, 4, (NT)	15.7	7902, 7952, 7963, 7973, 7979, 8027, 8039, 8054, 8063, 8088, 8331
Poeciliopsis viriosa Miller, 1960	F, 4	11.8	7936, 7964, 8040, 8046, 8055, 8105
PERCIFORMES / Centropomidae			
Centropomus armatus Gill, 1863	M, 2	45.1	8119, 8125, 8133, 8143, 8149, 8168, 8172, 8181, 8184, 8192, 8202, 8220, 8228, 8239, 8244, 8250, 8253, 8265, 8274, 299, 8319, 8328, 8342, 8349, 8358, 8363, 8406
Centropomus medius Günther, 1864	M, 1	2	8286
Centropomus nigrescens Günther, 1864	M, 2	15.7	7937, 7953, 8008, 8109, 8173, 8193, 8255, 8300, 8343
Centropomus robalito Jordan & Gilbert, 1882	M, 2	5.9	8154, 8205, 8212
Centropomus unionensis Bocourt, 1868	M, 1	2	8120
Centropomus viridis Lockington, 1877	M, 2	3.9	8216, 8266
Carangidae			
Caranx caninus Günther, 1867	M, 2	13.7	8227, 8273, 8318, 8370, 8373, 8379, 8387, 8393, 8405
Oligoplites altus (Günter, 1868)	M, 2	7.8	8298, 8307, 8357, 8388
Lutjanidae			
Lutjanus colorado Jordan & Gilbert, 1882	M, 1	7.8	8197, 8217, 8279, 8295
Gerreidae			
Diapterus brevirostris (Sauvage, 1879)	M, 2	27.5	8128, 8137, 8144, 8152, 8160, 8214, 8224, 8231, 8238, 8275, 8281, 8292, 8301, 8305, 8360, 8366, 8381, 8389, 8403

Continued

Table 1. *Continued.*

ORDER / Family Species	Category	Relative frequency (%)	Voucher ECOSC
Eucinostomus currani Zahuranec, 1980	M, 2	7.8	8232, 8309, 8322, 8407
Eucinostomus entomelas Zahuranec, 1980	M, 2	5.9	8233, 8276, 8367
Eugerres axillaris (Günther, 1864)	M, 2	21.6	8123, 8145, 8194, 8211, 8215, 8234, 8268, 8277, 8282, 8302, 8306, 8323, 8361, 8382
Gerres simillimus Regan, 1907	M, 2	17.6	8195, 8269, 8278, 8293, 8303, 8310, 8314, 8324, 8353, 8374, 8383, 8408
Haemulidae			
Pomadasys macracanthus (Günther, 1864)	M, 2	7.8	8162, 8271, 8294, 8325
Sciaenidae			
Micropogonias ectenes (Jordan & Gilbert, 1882)	M, 1	3.9	8142, 8164
Cichlidae			
Cichlasoma beani (Jordan, 1889)	F, 4	43.1	7893, 7897, 7904, 7916, 7925, 7928, 7938, 7945, 7954, 7958, 7966, 7975, 7981, 7989, 7995, 7997, 8001, 8009, 8016, 8023, 8029, 8035, 8042, 8048, 8058, 8065, 8079, 8090, 8110, 8134, 8174, 8185, 8245, 8260, 8329, 8332, 8337, 8344
Oreochromis mossambicus (Peters, 1852)	F, E, 4	27.5	7905, 7912, 7939, 8121, 8150, 8155, 8175, 8186, 8209, 8221, 8240, 8257, 8263, 8288, 8345, 8377, 8380
Oreochromis niloticus (Linneaus, 1758)	F, E, 4	60.8	7898, 7906, 7917, 7929, 7940, 7946, 7959, 7967, 7976, 7982, 7990, 7996, 8002, 8010, 8017, 8024, 8030, 8036, 8043, 8049, 8059, 8066, 8071, 8075, 8080, 8091, 8099, 8106, 8111, 8169, 8177, 8182, 8187, 8203, 8213, 8222, 8229, 8241, 8243, 8246, 8251, 8252, 8256, 8258, 8261, 8330, 8333, 8338, 8346, 8350
Eleotridae			
Dormitator latifrons (Richardson, 1844)	M, 2, 6	7.8	8012, 8018, 8082, 8347, 8351
Eleotris picta Kner, 1863	M, 2, 6	17.6	7968, 8031, 8050, 8068, 8083, 8093, 8101, 8114, 8157, 8267
Gobiomorus maculatus (Günther, 1859)	M, 2, 6	35.3	7899, 7924, 7942, 7948, 7955, 7960, 7969, 7986, 7991, 8004, 8013, 8019, 8051, 8069, 8074, 8084, 8094, 8115, 8126, 8135, 8151, 8183, 8247, 8254, 8352
Gobiidae			
Aboma etheostoma (Jordan & Starks, 1895)	M, 2	3.9	8390, 8397
Awaous transandeanus (Günther, 1861)	M, 2, 6	3.9	7908, 7933
Gobionellus microdon (Gilbert, 1892)	M, 2, 6	21.6	8124, 8129, 8138, 8146, 8161, 8196, 8248, 8259, 8270, 8334, 8354
PLEURONECTIFORMES / Paralichthyidae			
Citharichthys gilberti Jenkins & Evermann, 1889	M, 2	9.8	8236, 8327, 8369, 8376, 8395, 8400
Achiridae			
Achirus mazatlanus (Steindachneri, 1869)	M, 2	13.7	8165, 8199, 8218, 8225, 8316, 8341, 8396
Trinectes fonsecensis (Günther, 1862)	M, 2	11.8	7980, 7984, 7999, 8056, 8070, 8077, 8097
TETRAODONTIFORMES / Tetraodontidae			
Sphoeroides annulatus (Jenyns, 1842)	M, 2	2	8401

fish community structure before the operation and construction of the Las Cruces dam. Consequently, it will be necessary to evaluate the impacts that this alteration will have downstream on the habitats and aquatic fauna.

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