CENTRAL ARIZONA PROJECT FISH MONITORING

ANNUAL REPORT

SUMMARY OF SAMPLE YEAR 2006 FISH SURVEYS IN BEHALF OF A LONG-TERM MONITORING PLAN FOR FISH POPULATIONS IN SELECTED WATERS OF THE GILA RIVER BASIN, ARIZONA

by

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This report summarizes fish sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year (SY) 2006 (period July 18, 2006 to January 15, 2007). Protocols implemented during this monitoring are detailed by Clarkson (1996 a-c).

Waters (stations) sampled during this monitoring were (1) San Pedro River (SanP) downstream from the U.S. and Mexico international boundary, (2) Gila River between Coolidge Dam and Ashurst-Hayden Diversion, (3) Salt River between Stewart Mountain Dam and Granite Reef Diversion, (4) Central Arizona Project (CAP) Canal at selected pump plants, (5) Salt River Project (SRP) South Canal (SRPs), (6) SRP Arizona (North) Canal (SRPn), and (7) Florence-Casa Grande (FCG) Canal (Table 1).

Comparisons are not made herein with monitoring data acquired during prior years as reported by Clarkson (1998) Marsh (1999, 2004a) and Marsh & Kesner (2006a, b), or to earlier years (e.g., Marsh and Minckley 1982, Mueller 1996). The reader is referred to those documents for comparisons with prior years.

MONITORING OVERVIEW

A total of 21 taxa (excluding undetermined and hybrid *Lepomis*) was captured during SY 2006 monitoring. Six species were taken in FCG and CAP, 9 in Salt and Gila rivers, 10 in SRPn, 13 in San Pedro River, and 15 were taken in SRPs (Table 2). Four native species (19% of total taxa) were collected: longfin dace, roundtail chub, Sonora sucker, and desert sucker. Three were in SRPs and Salt and San Pedro rivers, two in SRPn, one in Gila River, and none was in CAP or FCG canals. Natives comprised 11 to 23% of all species among streams, excepting sample streams where there were none. The remaining 17 taxa were non-native, which among streams numbered between six (Salt River, CAP and FCG) and 12 (SRPs) species.

Total number of fish varied widely among streams, reaches, and stations (Table 3), a reflection of differences in sampling effort and gear type as well as fish abundance. Canal samples were not strictly comparable since those from SRPn, SRPs, and FCG were opportunistic and qualitative (except for samples above the electrical fish barriers on the SRP canals, which represented near-complete censuses). Monitoring in streams and rivers, and in the CAP Canal, is mostly quantitative, supplemented by some non-quantitative sampling. Numbers presented in all tables include both quantitative and non-quantitative sampling data, and Appendix A provides non-quantitative fish data for samples from the three rivers and CAP canal, from which quantitative data typically is acquired.

Native fishes overall accounted for 9.8% of 2,559 individuals captured at all Gila River basin stations during the sample year (Table 3). Proportion that native fishes comprised of total catch ranged from 0% (CAP and FCG canals) to 42.9%

(Salt River). San Pedro was 36.4% native. SRPs, SRPn samples were 26.3 and 3.3% natives above the electric fish barriers, respectively, and 5.9 and 34.8% natives below those structures (Table 3).

Community structure differed substantially among streams, reaches, and stations (Table 3). Native longfin dace was the most abundant species in combined samples from the San Pedro River (followed by black bullhead). Red shiner followed by channel catfish was the most abundant species from samples in the Gila River. Largemouth bass was most abundant in the Salt River catch (followed by native desert sucker). Grass carp followed by common carp were the most abundant fishes in the CAP Canal. Channel catfish predominated in samples above the electrical fish barrier in SRPs and SRPn (followed by Sonora sucker and flathead catfish respectively). Red shiner and channel catfish predominated the catch below the barrier on SRPs, while largemouth bass followed by Sonora sucker predominated the catch below the barrier on the SRPn. Yellow bullhead catfish predominated the catch above the barrier in the FCG (followed by common carp), while red shiner was the most abundant species below the barrier (followed by channel catfish, Table 3).

SAN PEDRO RIVER

Sampling Notes and Deviations from Protocol – Sampling was performed by Marsh & Associates with assistance from Reclamation from October 10 through the 12, 2006 (Table 1). All eight currently available stations were sampled (station 1-2-2 was eliminated from the protocol in 2005). Backpack electrofishing was conducted at all sites. Seines were also used to collect fishes at three stations. Sampling generally was inefficient because of large water volume and flooding immediately prior to sampling (USGS 2006, Marsh et al. 2007).

Species Richness and Distribution – Thirteen species were captured in the San Pedro River (Tables 4 and 5A). Eight species were taken in the upper reach, three in the middle, and seven in the lower. Three natives were encountered (longfin dace, Sonora sucker and desert sucker), comprising three-thirteenths of total species. Longfin dace was found at two stations, while Sonora sucker and desert sucker were collected at a single station each. Goldfish was collected for the second year in a row.

Six non-natives were in the upper reach, two in the middle, and six in the lower. Common carp, goldfish, mosquitofish, and fathead minnow were only found in the upper reach, yellow bullhead, channel catfish, flathead catfish and red shiner only in the lower and black bullhead and green sunfish were captured in all three reaches.

Assemblage Structure – Non-natives outnumbered natives overall (63.6% of a total catch of 107 individuals), and at upper and lower (but not middle) reaches (Tables 3 and 5A). Native longfin dace was the most abundant fish species

overall (35% of total numbers) and predominated the catch in the middle reach (95% of catch, Table 5A). Sonora sucker and desert sucker were represented by a single specimen each.

Black bullhead was the most abundant non-native and the second most abundant species overall, making up 23% of the catch. Channel catfish contributed 9% of the total catch, followed by mosquitofish (8%), green sunfish and fathead minnow (6% each), flathead catfish (5%), and yellow bullhead (4%). Other species each contributed less than 1% to the total catch.

GILA RIVER

Sampling Notes and Deviations from Protocol – Reaches were sampled between November 12 and 14, 2006 (Table 1). Collections were made by Marsh & Associates with assistance from Reclamation. Nine of eleven currently available stations were sampled. No stations were sampled in the upper reach because timely authorization to access these sites was unavailable from the land owner. Backpack electrofishing was used at all sites. Trammel nets were also used at three stations.

Species Richness and Distribution – Nine fish species were captured in the Gila River (Tables 4 and 5B). No new species were detected. Nine were taken in the upper-middle, six in the lower-middle, and four in the lower. One native desert sucker was encountered in the upper-middle reach. This is the first year in four that a native species was taken in the Gila River, and the first year since 1999 that desert sucker was encountered (Marsh 2004 b, c).

Red shiner, yellow bullhead, channel catfish and green sunfish were found at all reaches. Channel catfish was captured at 7 of the 9 stations making it the most widely distributed species sampled. Common carp and flathead catfish were captured at two reaches while largemouth bass, mosquitofish and desert sucker were only captured in the upper-middle reach.

Assemblage Structure –Non-native red shiner was by far the most abundant species overall (62% of total catch) mainly due to the catch in the upper middle reach where they predominated (304 individuals out of 425 total catch for the reach). Yellow bullhead was second in overall abundance (12% of total numbers) and predominated the catch in lower middle and lower reaches. Channel catfish was third closely followed by mosquitofish (each about 9% of total catch). Green sunfish occurred at six of nine stations among all three reaches and had an overall catch of 4%, and common carp was encountered in the two middle reaches accounting for 3% of total numbers. Other species each contributed less than 1% of the total catch.

SALT RIVER

Sampling Notes and Deviations from Protocol – Sampling was performed by Marsh & Associates with assistance from Reclamation on December 19, 2006 (Table 1). The upper and middle stations were sampled using a backpack electrofisher and trammel nets, while a boat-mounted electrofisher and trammel nets were used to sample the lower station. The generator used to power the boat electrofisher failed, so effort by this method was low.

Species Richness and Distribution – Nine fish species were taken from the Salt River; four from the upper, six from the middle and three from the lower station (Table 4 and 5C). Three native species (longfin dace, Sonora sucker and desert sucker) were taken (33% of species). Largemouth bass was the only species collected at all three stations. Native Sonora sucker, black bullhead and bluegill were collected from two stations. Native longfin dace and desert sucker, yellow bullhead and common carp were only encountered at the middle station, and rainbow trout was collected at the lower station.

Assemblage Structure – Total catch from the Salt River was 84 individuals. Native fishes comprised 43% of the total catch (Tables 3 and 5C). Desert sucker was the second most abundant species overall (23% of total numbers) and dominated the catch at the middle station, longfin dace was fourth overall (13%), and Sonora sucker was sixth (7%). This is the first year in three that native longfin dace and desert sucker were collected.

Largemouth bass was the most abundant species captured overall (30% of total catch). Bluegill was third (14%), black bullhead was fifth (8%) and yellow bullhead was seventh (2%). Other species each made up less than 2% of the total catch.

CENTRAL ARIZONA PROJECT CANAL

Sampling Notes and Deviations from Protocol – The three stations upstream from Phoenix were sampled by Reclamation with assistance from Marsh & Associates between July 18 and 20, 2006 (Table 1). No sampling was performed downstream of Phoenix because there was no low-flow period (no outage) during the sample year and sampling during normal operational flows is logistically impractical and dangerous. Boat-mounted electrofishing, minnow trapping, trammel netting, and trot lining were conducted at all stations sampled.

Species Richness and Distribution – Six taxa (exclusive of undetermined or hybrid *Lepomis*), all non-native, were captured from the CAP Canal. No new species were detected. For the one reach sampled, four species were collected in the upper station, while five species were encountered in the middle and lower stations (Tables 4 and 5D). Channel catfish, largemouth bass and striped bass were taken from all three stations. Grass carp, common carp, and sunfishes

(bluegill and undetermined and/or hybrid *Lepomis*) were collected from two stations.

Assemblage Structure – Grass carp was the most abundant species overall (30% of total catch), followed by common carp (20%), largemouth bass (18%), striped bass (16%), channel catfish (10%) and sunfishes (7%) in the sample of 114 individuals from the CAP Canal (Table 5D).

SRP SOUTH CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed by Marsh & Associates with assistance from Reclamation on November 25 and 27, 2006 (Table 1). Five stations were sampled during routine monitoring; one above the electrical fish barrier and four downstream at just below fish barrier (0.1 miles below the barrier), River Road Siphon (2.5 miles), RWCD turnout (4.0 miles), and Triple Junction (9.0 miles) where the South Canal ends. The above and just below barrier sites were sampled with a bag seine, the RWCD turnout was sampled with a straight seine, River Road Siphon was sampled by trammel net, and Triple Junction was sampled using dip nets. Locked gates across canal roadways continue to cause short delays and inconveniences, but these were minor.

Species Richness and Distribution – Fifteen species, including three natives, were captured from the SRPs Canal (Tables 2 and 4). No new species were detected. The canal was subdivided into two reaches: "above barrier" (one station), and a downstream, below barrier reach with four stations (Tables 4 and 5E) although these latter stations were not designated in the monitoring protocol (Clarkson 1996a). Thirteen species were taken above the electric fish barrier and eight were from collective downstream canal stations. Native Sonora sucker and desert sucker, plus non-native red shiner, channel catfish, largemouth bass, and flathead catfish were encountered above and below the electrical fish barrier. Native roundtail chub, plus non-native yellow bullhead, common carp, threadfin shad, rainbow trout, bluegill, and redbelly tilapia[1] were encountered above but not below, while grass carp and mosquitofish were encountered below but not above the barrier.

Below the fish barrier, two species were at the upper, two at the upper-middle, four at the lower-middle, and four at the lower station. Non-native channel catfish had the widest distribution of all species having been contacted at four of five stations.

[1] Tilapias (members of the family Cichlidae) can be difficult to identify, especially when small, and several species, all non-native, are known to occur in the Gila River basin. Redbelly tilapia *Tilapia zilli* and blue tilapia *Oreochromis aurea* are most frequently encountered; others are sporadic in occurrence and generally rare (Marsh & Minckley 1982, Minckley & Marsh, in press). We name only specimens that are reliably assigned to a species; individuals of questionable identity are reported as undetermined.

Assemblage Structure – Native fishes comprised 21% of the total catch of 568 individuals from SRPs Canal (Table 3). Sonora sucker was the third most abundant species (Table 5E), and contributed 17% to the total, while desert sucker comprised 3%. Relative abundance of native suckers is almost certainly underestimated, as collectors tend to capture sub-samples of up to a few hundred individuals rather than all of the obviously large aggregations that are encountered throughout the canal.

Non-native channel catfish was the most abundant fish overall (Tables 3 and 5F), accounting for 38% of total catch, and followed among non-natives by red shiner (18%), flathead catfish and common carp (each about 8%), and rainbow trout (5%). Other non-native fishes each contributed less than 1% to the total catch.

Predominant fishes above the electrical fish barrier were channel catfish (43%), native Sonora sucker (22%), common carp (11%), flathead catfish (10%), rainbow trout (6%), native desert sucker (4%), and redbelly tilapia (1%, Table 5E). Other species each contributed less than 1% to the total catch above the barrier.

Below the fish barrier, red shiner was the most abundant species captured in combined catch (65%), followed by channel catfish (24%), native Sonora sucker (5%), flathead catfish (3%), and mosquitofish (1%). Other species each contributed less than 1% to the total catch below the barrier (Table 5E).

SRP NORTH (ARIZONA) CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed by Marsh & Associates with assistance from Reclamation on January 13 and 15, 2007 (Table 1). Two stations were sampled during routine monitoring: one above the electrical fish barrier and one below the fish barrier. The above barrier site was sampled with a bag seine and a boat-mounted electrofisher was used to collect fishes below the barrier in the reach between the 101 (Pima) freeway and Indian Bend Wash, 14.5 miles downstream from Granite Reef Diversion Dam. Other stations were not sampled because there was no reach-wide outage that would have provided an opportunity to safely and effectively make collections.

Species Richness and Distribution – Ten species (exclusive of undetermined or hybrid *Lepomis*) were captured from the SRPn Canal (Tables 2 and 4). No new species were detected. Two native species were encountered. The canal was subdivided for into two reaches: “above” (one station) and “below” (one station) the electrical fish barrier (Tables 5F), although these reaches were not designated in the monitoring protocol (Clarkson 1996a). Eight species were taken above the electric fish barrier and seven were collected from below. Native Sonora sucker, channel catfish, bluegill, largemouth bass, and rainbow trout were collected above and below the barrier. Common carp, desert sucker, and

flathead catfish were encountered above but not below the barrier, while green sunfish and mosquitofish were taken below but not above.

Assemblage Structure – Native fishes collectively comprised 5% of the total number of 1,029 individuals taken from the SRPn Canal (Table 3). Sonora sucker was the third most abundant fish species overall (5% of total catch), while only five desert suckers were encountered (0.5% of total numbers). As in the SRPs canal (above), relative abundances of the two native suckers likely were underestimated.

Non-native channel catfish dominated the overall catch (79% of total numbers), followed among non-natives by flathead catfish (5%), largemouth bass (4%), rainbow trout (3%) and common carp (2%). Other species each contributed 1% or less to the total numbers.

Above the fish barrier the catch was dominated by the catch of 815 channel catfish (85% of catch), followed by flathead catfish (6%), Sonora sucker and rainbow trout (each about 3%), common carp (2%) and largemouth bass (1%). Other species each contributed less than 1% to the total catch above the barrier (Table 5F).

Below the fish barrier, largemouth bass was the dominant species (46%), followed by Sonora sucker (35%), mosquitofish (4%) and four other species of which 2 specimens of each were collected (3% each); channel catfish, green sunfish, bluegill, and rainbow trout (Table 5F).

FLORENCE-CASA GRANDE CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed by Marsh & Associates on October 29, 2006 (Table 1). Four stations were sampled during routine monitoring: one immediately below the canal headworks at Ashurst-Hayden Diversion Dam (above the electrical fish barrier located at China Wash), and three below China Wash barrier located 2.6 miles downstream from the diversion dam. Stations immediately below the barrier were at China Wash, at the first turnout 11.4 miles downstream from Ashurst-Hayden, and at the Pima Lateral Canal (15.2 miles downstream). All four sites were sampled with a straight seine and backpack electrofisher. In addition dip nets were used at Pima Lateral.

Species Richness and Distribution – Six species were taken from the Florence-Casa Grande Canal (Tables 2 and 4); none was native. No new species were detected. All species were above and below the electric fish barrier at China Wash. Yellow bullhead and channel catfish were captured at all stations and had the widest distribution.

Assemblage Structure – No native species were represented in the total sample of 126 individuals from the FCG Canal (Table 3). Above the electrical fish barrier, the catch was predominated by yellow bullhead (44%) and common carp (31%), while channel catfish was common (15%). Below the electrical fish barrier, red shiner was most abundant (30%), followed by yellow bullhead (26%), channel catfish (23%), and common carp (14%). Other species were uncommon-to-rare above or below the barrier (Table 5G).

RECOMMENDATIONS

The process of acquiring permission required to authorize access to established stations will be initiated early in the sample year in attempt to ensure that all authorizations are in hand when the field season begins.

Greater effort will be directed toward qualitative sampling in habitats adjacent to fixed sample reaches in attempt to encounter additional species.

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TABLE 1. Station, date, gear type, and lead entity for sampling activities conducted in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, for sample year 2006 (period July 18, 2006 to January 15, 2007). Stations are identified by 3-digit numeric codes that respectively indicate stream name, reach name, (1-up to 4-down-stream), and station name (1-3 for upper, middle, and lower) (see Clarkson 1996 a-c). Where station location and name have changed from Clarkson 1996 a-c, the corrected (new) name is given. Dates are given as month (01-12) day (01-31) and year (06 or 07). Abbreviations as follow: Stations: SRP = Salt River Project, FCG = Florence-Casa Grande Canal, and CAP = Central Arizona Project Canal. Gear codes, names, and acronyms by category are Entrapment/Entanglement: 1=gill net (G), 2=trammel net (T), 3=hoop net (H), 4=fyke net (F), 5=trap net (TR), 6=minnow trap (M), 7=shock/gill net (SGN), 8=shock/trammel net (STN), 9=experimental gill net (EXPG); Seining: 10=straight seine (SS), 11=bag seine (BS), 12=kick seine (KS), 13=dip net (D); Angling: 14=spin-cast (SC), 15=fly rod (FR), 16=drop line (DL), 17=trotline (TL); Electrofishing: 18=backpack shocker (Bp), 19=boat shocker (Ef), 20=bank shocker (BKS); 21 = tote barge shocker (TB); and Miscellaneous: 25=trammel net/drifted (TND), 26=gill net/drifted (GND), and 27=electric seine (ES). CAP stations all are associated with pumping plants, which are named for each station, while FCG and SRP stations are given as approximate miles downstream from canal origin and/or a verbal location description. Lead entity was either Marsh & Associates (M&A) or U.S. Bureau of Reclamation, Phoenix (Reclamation)

Station		Date	Gear	Lead
San Pedro River				
1-1-1	Hereford	10 10 06	Bp	M&A
1-1-2	Lewis Springs	10 10 06	Bp	M&A
1-1-3	Charleston	10 10 06	Bp	M&A
1-2-1	Hughes Ranch	10 11 06	Bp	M&A
1-2-3	Three Links Farm	10 11 06	Bp, SS	M&A
1-3-1	Aravaipa Creek	10 11 06	Bp, SS	M&A
1-3-2	Swingle Wash	10 12 06	Bp	M&A
1-3-3	Mouth	10 12 06	Bp, SS	M&A
Gila River				
2-1-1	Coolidge Dam	No sample		
2-1-3	Hook & Line Ranch	No sample		
2-2-1	Dripping Springs Wash	11 12 06	Bp, T	M&A
2-2-2	Christmas	11 12 06	Bp	M&A
2-2-3	O'Carroll Canyon	11 12 06	Bp, T	M&A
2-3-1	San Pedro River	11 12 06	Bp	M&A
2-3-2	Kearny	11 13 06	Bp	M&A
2-3-3	Kelvin	11 13 06	Bp	M&A
2-4-1	A-Diamond Ranch	11 13 06	Bp, T	M&A
2-4-2	Cochran	11 13 06	Bp	M&A
2-4-3	Box-O Wash	11 14 06	Bp	M&A

Salt River

3-1-1	Stewart Mountain Dam	12 19 06	Bp, T	M&A
3-1-2	Blue Point RS	12 19 06	Bp, T	M&A
3-1-3	Granite Reef Dam	12 19 06	Ef, T	M&A

CAP Pumping Plants

4-1-1	Bouse	07 18 06	Ef, M, T, TL	Reclamation
4-1-2	Little Harquahala	07 19 06	Ef, M, T, TL	Reclamation
4-1-3	Hassayampa	07 20 06	Ef, M, T, TL	Reclamation
4-2-1	Salt-Gila	No Sample		
4-3-1	Brady	No Sample		
4-3-2	Red Rock	No Sample		
4-3-3	San Xavier	No Sample		

SRP South Canal

5	0.0 Above fish barrier	11 27 06	BS	M&A
	0.1 Below fish barrier	11 25 06	BS	M&A
	2.5 River Road siphon	11 25 06	T	M&A
	4.0 RWCD turnout	11 25 06	SS	M&A
	9.0 Triple Junction	11 25 06	D	M&A

SRP North (Arizona) Canal

6	0.0 Above fish barrier	01 15 07	BS	M&A
	0.2 Below fish barrier	01 13 07	Ef	M&A
	8.0 Evergreen Drain	No sample		
	14.5 Indian Bend Wash	No Sample		

FCG

7	0.0 Below diversion dam	10 29 06	Bp, SS	M&A
	2.6 Below China Wash	10 29 06	Bp, SS	M&A
	11.4 First turnout	10 29 06	Bp, SS	M&A
	15.2 Pima Lateral	10 29 06	Bp, SS, D	M&A

TABLE 2. Common names and four letter codes for fish species captured during sampling activities conducted in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2006 (period July 18, 2006 to January 15, 2007). Native fishes indicated by asterisks. Abbreviations as in Clarkson 1996 a, but also see notes below.

Species		SanP	Gila	Salt	CAP	SRPs	SRPn	FCG	All sites
*Desert sucker	PACL	X	X	X	O	X	X	O	X
*Longfin dace	AGCH	X	O	X	O	O	O	O	X
*Roundtail chub	GIRO	O	O	O	O	X	O	O	X
*Sonora sucker	CAIN	X	O	X	O	X	X	O	X
Black bullhead	AMME	X	O	X	O	O	O	O	X
Bluegill	LEMA	O	O	X	X	X	X	O	X
Channel catfish	ICPU	X	X	O	X	X	X	X	X
Common carp	CYCA	X	X	X	X	X	X	X	X
Fathead minnow	PIPR	X	O	O	O	O	O	O	X
Flathead catfish	PYOL	X	X	O	O	X	X	X	X
Goldfish	CAAU	X	O	O	O	O	O	O	X
Grass carp	CTID	O	O	O	X	X	O	O	X
Green sunfish	LECY	X	X	O	O	O	X	X	X
Largemouth bass	MISA	O	X	X	X	X	X	O	X
Mosquitofish	GAAF	X	X	O	O	X	X	O	X
Rainbow trout	ONMY	O	O	X	O	X	X	O	X
Red shiner	CYLU	X	X	O	O	X	O	X	X
Redbelly tilapia	TIZI	O	O	O	O	X	O	O	X
Striped bass	MOSA	O	O	O	X	O	O	O	X
Threadfin shad	DOPE	O	O	O	O	X	O	O	X
Undetermined or hybrid sunfish[1]	LEPO	O	O	O	X	O	X	O	X
Yellow bullhead	AMNA	X	X	X	O	X	O	X	X

Stream	SanP	Gila	Salt	CAP	SRPs	SRPn	FCG	All sites
Total species (taxa)[2]	13	9	9	6	15	10	6	21
Native	3	1	3	0	3	2	0	4
Non-native	10	8	6	6	12	8	6	17
Percent native	23	11	33	0	20	20	0	19

[1] Undetermined or hybrid sunfish may include juveniles of all species of *Lepomis* plus juvenile and adult individuals that represent crosses among the several species of *Lepomis* , which are known to hybridize freely.

[2] Total species(taxa) excludes undetermined or hybrid sunfishes, which are assumed to be subsumed into the individual parental species.

TABLE 3. Total numbers of fishes captured during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2006 (period July 18, 2006 to January 15, 2007). Native fishes indicated by asterisks. Abbreviations as in Table 2. Ab and Bb respectively indicate Above and Below electrical fish barriers on SRPn, SRPs, and FCG canals.

					SRPs		SRPn		FCG		
Species	SanP	Gila	Salt	CAP	Ab	Bb	Ab	Bb	Ab	Bb	Total
*Desert sucker	1	1	19	0	18	1	5	0	0	0	45
*Longfin dace	37	0	11	0	0	0	0	0	0	0	48
*Roundtail chub	0	0	0	0	1	0	0	0	0	0	1
*Sonora sucker	1	0	6	0	90	8	27	24	0	0	156
Black bullhead	25	0	7	0	0	0	0	0	0	0	32
Bluegill	0	0	12	1	2	0	5	2	0	0	22
Channel catfish	10	47	0	11	180	36	815	2	7	22	1130
Common carp	1	17	1	23	45	0	17	0	15	3	122
Fathead minnow	6	0	0	0	0	0	0	0	0	0	6
Flathead catfish	5	4	0	0	41	5	55	0	1	2	113
Goldfish	1	0	0	0	0	0	0	0	0	0	1
Grass carp	0	0	0	34	0	1	0	0	0	0	35
Green sunfish	6	23	0	0	0	0	0	2	1	1	33
Largemouth bass	0	1	25	20	3	1	12	32	0	0	94
Mosquitofish	9	46	0	0	0	2	0	3	0	0	60
Rainbow trout	0	0	1	0	26	0	24	2	0	0	53
Red shiner	1	328	0	0	2	99	0	0	3	38	471
Redbelly tilapia	0	0	0	0	5	0	0	0	0	0	5
Striped bass	0	0	0	18	0	0	0	0	0	0	18
Threadfin shad	0	0	0	0	1	0	0	0	0	0	1
Undetermined or hybrid sunfish	0	0	0	7	0	0	0	2	0	0	9
Yellow bullhead	4	64	2	0	1	0	0	0	21	12	104
Total	107	531	84	114	415	153	960	69	48	78	2559
Total native	39	1	36	0	109	9	32	24	0	0	250
Total nonnative	68	530	48	114	306	144	928	45	48	78	2309
Percent native	36.4	0.2	42.9	0.0	26.3	5.9	3.3	34.8	0.0	0.0	9.8

TABLE 4. Fish species richness determined by sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year (SY) 2006 (period July 18, 2006 to January 15, 2007). Species counts excludes undetermined plus hybrid *Lepomis* (see notes accompanying Table 1). See table 1 for reach and station names (see also Clarkson 1996 a-c). Distances between stations and reaches are relative. Totals for each reach (and for all reaches) followed by number of native and non-native (n/nn) species; NS indicates no sample during SY 2006; dash (--) indicates designated reach or station does not exist on that stream/canal. Reaches along SRPn, SRPs, and FCG canals are artificial; canal reaches 1 are above respective electrical fish barriers and reaches 2, 3, and 4 are below; see also Clarkson (1996 a-c).

Reach/Station		SanP	Gila	Salt	CAP	SRPs	SRPn	FCG
1-1		5	NS	4	4	13	8	6
1-2		4	--	6	5	--	--	--
1-3		3	NS	3	5	--	--	--
total		8		9	6	13	8	6
n/nn		2/6		2/7	0/6	3/10	2/6	0/6
2-1		0	5	--	NS	2	7	3
2-2		--	8	--	--	2	NS	4
2-3		3	6	--	--	4	NS	5
2-4		--	--	--	--	4	--	--
total		3	9			8	7	6
n/nn		1/2	1/8			2/6	1/6	0/6
3-1		3	4	--	NS	--	--	--
3-2		5	4	--	NS	--	--	--
3-3		3	3	--	NS	--	--	--
total		7	6					
n/nn		1/6	0/6					
4-1	--	--	0	--	--	--	--	--
4-2	--	--	4	--	--	--	--	--
4-3	--	--	2	--	--	--	--	--
total			4					
n/nn			0/4					
all reaches		13	9	9	6	15	10	6
n/nn		3/10	1/8	3/6	0/6	3/12	2/8	0/6
percent native		23	11	33	0	20	20	0

TABLE 5A. Fish catch at San Pedro River stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2006 (period July 18, 2006 to January 15, 2007). Fish species listed alphabetically using standard abbreviations as in Table 2; data are total fish or number of young-of-year (age-0) followed by number of older age classes (age >1), if specified; subtotals and total number are for each age class.

		AMME		AMNA		CAAU		CAIN		CYCA				ICPU		LECY		PACL			PYOL			
station code	AGCH	0	1	0	1	0	1	0	1	0	1	CYLU	GAAF	0	1	0	1	0	1	PIPR	0	1	sum	No Spp
1-1-1		6	12				1				1					2	1			2			25	5
1-1-2		1	2										9						1	1			14	4
1-1-3	1		1																	3			5	3
subtotal	1	7	15	0	0	0	1	0	0	0	1	0	9	0	0	2	1	0	1	6	0	0	44	8
1-2-1																							0	0
1-2-3	36		1													1							38	3
subtotal	36	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	38	3
1-3-1								1				1									1		3	3
1-3-2		1	1	3										5		1	1				2		14	5
1-3-3				1										5							2		8	3
subtotal	0	1	1	4	0	0	0	1	0	0	0	1	0	10	0	1	1	0	0	0	5	0	25	7
Total	37	8	17	4	0	0	1	1	0	0	1	1	9	10	0	4	2	0	1	6	5	0	107	13

TABLE 5B. Fish catch at Gila River stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2006 (period July 18, 2006 to January 15, 2007). Fish species listed alphabetically using standard abbreviations as in Table 2; data are total fish or number of young-of-year (age-0) followed by number of older age classes (age >1), if specified; subtotals and total number are for each age class.

	AMNA		CYCA				ICPU		LECY		MISA		PACL		PYOL		sum	No Spp
station code	0	1	0	1	CYLU	GAAF	0	1	0	1	0	1	0	1	0	1		
2-2-1					132	19	11		13	2	1						178	5
2-2-2		1		11	158	10	12		3					1		1	197	8
2-2-3				4	14	17	12	1	1						1		50	6
subtotal	0	1	0	15	304	46	35	1	17	2	1	0	0	1	1	1	425	9
2-3-1	6	5			1		3	1		2							18	4
2-3-2	3	8	1	1			3	2		1							19	4
2-3-3	5	6					1								2		14	3
subtotal	14	19	1	1	1	0	7	3	0	3	0	0	0	0	2	0	51	
2-4-1																	0	0
2-4-2	14	8			23		1			1							47	4
2-4-3	3	5															8	2
subtotal	17	13	0	0	23	0	1	0	0	1	0	0	0	0	0	0	55	4
Total	31	33	1	16	328	46	43	4	17	6	1	0	0	1	3	1	531	9

TABLE 5C. Fish catch at Salt River stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2006 (period July 18, 2006 to January 15, 2007). Fish species listed alphabetically using standard abbreviations as in Table 2; data are total fish or number of young-of-year (age-0) followed by number of older age classes (age ≥1), if specified; total number is for each age class.

		AMME		AMNA		CAIN		CYCA		LEMA		MISA		ONMY		PACL		Sum	No Spp
station code	AGCH	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1		
3-1-1			6				1			1		2						10	4
3-1-2	11		1	2		3	2		1			16				8	11	55	6
3-1-3										3	8	4	3		1			19	3
Total	11	0	7	2	0	3	3	0	1	4	8	22	3	0	1	8	11	84	9

TABLE 5D. Fish catch at Central Arizona Project (CAP) canal stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2006 (period July 18, 2006 to January 15, 2007). Fish species listed alphabetically using standard abbreviations as in Table 2; data are total fish or number of young-of-year (age-0) followed by number of older age classes (age ≥1), if specified; subtotals and total number are for each age class.

	CTID		CYCA		ICPU		LEMA		LEPO		MISA		MOSA		Sum	No Spp
station code	0	1	0	1	0	1	0	1	0	1	0	1	0	1		
4-1-1						2		1	2			7		10	22	4
4-1-2		4		1		2			5			6		1	19	5
4-1-3		30		22		7						7		7	73	5
Total	0	34	0	23	0	11	0	1	7	0		20		18	114	6

TABLE 5E. Fish catch at Salt River Project (SRP) South Canal stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2006 (period July 18, 2006 to January 15, 2007). Fish species listed alphabetically using standard abbreviations as in Table 2: data are total fish or number of young-of-year (age-0) followed by number of older age classes (age ≥1), if specified; total number is for each age class. See Table 1 for sampling dates.

	AMNA		CAIN		CTID		CYCA					GIRO		ICPU		LEMA		MISA		ONMY		PACL		PYOL		TIZI		Sum	No Spp
	0	1	0	1	0	1	0	1	CYLU	DOPE	GAAF	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1		
above barrier	1		16	74				45	2	1			1	27	153	2		3			26	2	16	3	38		5	415	13
subtotal	1	0	16	74	0	0	0	45	2	1	0	0	1	27	153	2	0	3	0	0	26	2	16	3	38	0	5	415	13
0.1 below dam				8											33													41	2
2.5 below dam																			1				1					2	2
4.0 below dam									85		2			1										2	1			91	4
9.0 below dam						1			14					2										1	1			19	4
subtotal	0	0	0	8	0	1	0	0	99	0	2	0	0	3	33	0	0	0	1	0	0	0	1	3	2	0	0	153	8
Total	1	0	16	82	0	1	0	45	101	1	2	0	1	30	186	2	0	3	1	0	26	2	17	6	40	0	5	568	15

TABLE 5F. Fish catch at Salt River Project (SRP) North (Arizona) Canal stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2006 (period July 18, 2006 to January 15, 2007). Fish species listed alphabetically using standard abbreviations as in Table 2: data are total fish or number of young-of-year (age-0) followed by number of older age classes (age ≥1), if specified; total number is for each age class. See Table 1 for sampling dates.

	CAIN		CYCA			ICPU		LECY		LEMA		LEPO		MISA		ONMY		PACL		PYOL		sum	No Spp
	0	1	0	1	GAAF	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1		
above barrier	10	17		17		572	243			1	4			1	11		24		5	3	52	960	8
subtotal	10	17		17	0	572	243	0	0	1	4	0	0	1	11	0	24	0	5	3	52	960	8
0.2 below dam		24			3		2		2	1	1	2		28	4		2					69	7
subtotal	0	24		0	3	0	2	0	2	1	1	2	0	28	4	0	2	0	0	0	0	69	7
Total	10	41		17	3	572	245		2	2	5	2		29	15		26		5	3	52	1029	10

TABLE 5G. Fish catch at Florence Casa Grande (FCG) Canal stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2006 (period July 18, 2006 to January 15, 2007). Fish species listed alphabetically using standard abbreviations as in Table 2; data are total fish or number of young-of-year (age-0) followed by number of older age classes (age ≥1), if specified; total number is for each age class. See Table 1 for sampling dates.

	AMNA		CYCA			ICPU		LECY		PYOL		Sum	No Spp
	0	1	0	1	CYLU	0	1	0	1	0	1		
above barrier	8	13		15	3	7		1			1	48	6
subtotal	8	13	0	15	3	7	0	1	0	0	1	48	6
2.6 below dam		1		2			4					7	3
11.4 below dam	7	2			20	2				2		33	4
15.2 below dam	1	1		1	18	14	2		1			38	5
subtotal	8	4	0	3	38	16	6	0	1	2	0	78	6
Total	16	17		18	38	23	6	1	1	2	1	126	6

Appendix A. Numbers of fishes captured in non-quantitative stream and CAP canal samples in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2006 (period July 18, 2006 to January 15, 2007). Abbreviations as in Clarkson (1996a).

	Gear	Species code	Count
San Pedro River			
	backpack shocker	AGCH	2
	straight seine	AGCH	1
	backpack shocker	CAIN	1
	backpack shocker	PIPR	1
Gila River			
	backpack shocker	LECY	1