CENTRAL ARIZONA PROJECT FISH MONITORING

FINAL

SUMMARY OF SAMPLE YEAR 2004 FISH SURVEYS IN BEHALF OF A LONG-TERM MONITORING PLAN FOR FISH POPULATIONS IN SELECTED WATERS OF THE GILA RIVER BASIN, ARIZONA

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This report summarizes fish sampling by Arizona Game and Fish Department (AZGFD), Arizona State University (ASU), and U.S. Bureau of Reclamation (USBR) in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year (SY) 2004 (period October 4, 2004 to January 26, 2005). 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) and Marsh (1999, 2004a), 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 24 taxa (excluding undetermined and hybrid *Lepomis*, but including undifferentiated cichlids) was captured during SY 2004 monitoring. Four species were taken in Gila River, five were in Salt River, 6 in FCG, 7 in San Pedro River, 13 in CAP, and 17 were in SRPs and SRPn (Table 2). Three native species (13% of total taxa) were collected: longfin dace, Sonora sucker, and desert sucker. Two were in San Pedro River, SRPs and SRPn, one in Salt River, and none was in Gila River, CAP or FCG canals. Natives comprised 12 to 29% of all species among stations, excepting sample streams where there were none. The remaining 21 taxa were non-native, which among streams numbered between four (Gila and Salt) and 15 (SRPs and SRPn) species.

Bigmouth buffalofish (Catostomidae: *Ictiobus cyprinellus*) is reported for the first time from a CAP monitoring program station.[1] A single specimen was taken from above the electrical fish barrier on the SRP North (Arizona) Canal during SY 2004. The fish was tentatively identified in the field, and photographed, but was not retained as a voucher. The species was introduced to the Salt River in 1918 along with black buffalofish *I. niger* and smallmouth buffalofish *I. bubalis* (Minckley 1973), and members of the genus still occur in reservoirs upstream from the Salt River Project canal system. A single black buffalofish was taken

[1]Clarkson (1996a: 26) reported occurrence of bigmouth buffalo in SRP canals and attributed the record to Marsh & Minckley (1982), however, those authors did not report the species there, and clearly stated (brackets ours) “Notably, a number of fishes known to be upstream … such as buffalofishes (*Ictiobus* spp.) and others … have not been recorded in the [Phoenix] Metropolitan Area and apparently do not move downstream.” We hereby correct and update this information.

from the same location (above the electrical fish barrier on SRPn) in 2000 (Marsh 2004b).

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. Species collected only in non-quantitative samples are noted in Table 2. 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 4.0% of 7,699 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% (Gila River, CAP and FCG canals) to 37.0% (Salt River). San Pedro was 21.2% native. SRPn, SRPs samples were 6.4 and 0% natives above the electric fish barriers, respectively, and 35.3 and 24.8% natives below those structures (Table 3).

Community structure differed substantially among streams, reaches, and stations (Table 3). Mosquitofish was the most abundant species in combined samples from the San Pedro River (followed by native desert sucker). Red shiner followed by mosquito fish was the most abundant species from samples in the Gila River. Native Sonora sucker predominated the Salt River catch (followed by non-native largemouth bass). Striped bass followed by grass carp were the most abundant fishes in the CAP Canal. Largemouth bass and channel catfish predominated in samples above the electrical fish barrier in SRPs and SRPn respectively (followed by bluegill and largemouth bass respectively), while red shiner was the most abundant species below the SRPs barrier and native Sonora sucker predominated below the barrier on SRPn. Red shiner and mosquitofish were the most abundant species in FCG (Table 3).

SAN PEDRO RIVER

Sampling Notes and Deviations from Protocol – Sampling was performed on October 5 and 6, 2004 (Table 1). Four of eight currently available stations were sampled. No samples were taken at station 2-1-1 (Coolidge Dam) or station 1-2-2 (Soza Ranch) because access was denied, or at the three stations of the downstream reach 1-3-1 (Aravaipa Creek), 1-3-2 (Swingle Wash), and 1-3-3 (Mouth) where the streambed was dry. A ninth station, 1-2-3 (Gage Station) has never been sampled and has been permanently deleted from the monitoring plan. Backpack electrofishing was conducted at all sites, and seines were also used to collect fishes at the three, upper reach stations.

Species Richness and Distribution – Seven species were captured in the San Pedro River (Tables 4 and 5A). No new species were detected. Seven were taken in the upper reach, and two in the middle. Two natives were encountered (longfin dace and desert sucker), comprising two-sevenths of total species. Longfin dace was found at all four stations and had the broadest representation among native species, and desert sucker was at one station in the upper reach.

Five non-natives were in the upper reach. Black bullhead was the only non-native capture in the middle reach station. Mosquitofish was at all three of the upper reach stations, while black bullhead, fathead minnow and common carp were contacted at two upper reach stations. Green sunfish was contacted at one upper reach station.

Assemblage Structure – Non-natives outnumbered natives overall (21.2% of a total catch of 645 individuals), at all reaches, and at half (two of four) of the stations (Tables 3 and 5A). Native desert sucker was the second most abundant fish species overall (12% of total numbers), and was the most abundant species at the upper station where it occurred (Table 5A). Longfin dace comprised about 9% of the overall catch.

Mosquitofish was the most abundant non-native and the most abundant species overall, making up 74% of the catch. Fathead minnow was 3%, while other species contributed less than 1% to the total catch.

GILA RIVER

Sampling Notes and Deviations from Protocol – Sampling was performed on November 18, 2004 (Table 1). Collections were made by AZGFD. Four of eleven currently available stations were sampled. No stations were sample in the upper reach because of access issues or in the upper-middle reach because AZGFD personnel were diverted to Fossil Creek and unavailable. Stations 2-3-1 (San Pedro River) and 2-3-2 (Kearny) were dry. Station 2-1-2 (Hawk Spring Canyon) is inaccessible and has been permanently deleted from the monitoring program. Backpack electrofishing was used at all sites.

Species Richness and Distribution – Four fish species were captured in the Gila River (Tables 4 and 5B). No new species were detected. Three were taken in the lower-middle reach, and four in the lower. No natives were encountered.

Red shiner and mosquitofish found at all sites and were the most widely distributed non-native species. Yellow bullhead was captured at two stations; one lower-middle and one lower. Black bullhead was captured at a single station in the lower reach.

Assemblage Structure –Non-native red shiner was by far the most abundant species overall (74% of total catch) and predominated at three of four stations.

Mosquitofish was second in overall abundance (23% of total numbers) and was predominant in one lower reach station. Yellow bullhead was 2.8%, and black bullhead was represented by a single specimen from a station in the lower reach.

SALT RIVER

Sampling Notes and Deviations from Protocol – Sampling was performed on 26 January 2005 (Table 1). One station was sampled using a boat-mounted electrofisher. Stations 3-1-2 (Blue Point RS) and 3-1-3 (Granite Reef Dam) were not sampled because of high flows.

Species Richness and Distribution – Five fish species were taken from the one station sample of the Salt River (Table 4). Sonora sucker was the only native species taken (20% of species).

Assemblage Structure -- Native Sonora sucker was the most abundant species captured (37% of the total Salt River catch of 108 individuals (Tables 3 and 5C). Non-native largemouth bass was second in abundance (27%), yellow bullhead and common carp were third (16% each), and bluegill made up less than 5% of the total catch.

CENTRAL ARIZONA PROJECT CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed upstream from Phoenix between 04 and 06 October 2004, and downstream from Phoenix between 01 and 04 November 2004 (Table 1). Six of seven stations were sampled; station 4-3-2 (Red Rock) in the lower reach was not sampled because of equipment failure. Boat-mounted electrofishing was conducted at all stations; trammel netting was conducted at all stations except 4-1-1 (Bouse) where electric seining was used, minnow traps were used at two upper stations, 4-1-2 (Little Harquahala) and 4-1-3 (Hassayampa), and trot lining was done at stations 4-1-3 (Hassayampa), 4-3-1 (Brady), and 4-3-3 (San Xavier).

Species Richness and Distribution – Thirteen taxa (exclusive of undetermined or hybrid *Lepomis*), all non-native, were captured from the CAP Canal. No new species were detected. Eight were in the upper, eight in the middle (one station), and twelve were in the lower reach (Tables 4 and 5D). Grass carp, carp, red shiner, channel catfish, largemouth bass, bluegill and striped bass were taken from all three reaches. No species was found at all stations, although bluegill, striped bass, channel catfish, grass carp and largemouth bass were at five of the six stations that were sampled.

Assemblage Structure – Striped bass predominated overall (61% of total catch) in the sample of 2,119 individuals from the CAP Canal (Table 5D). Second most abundant was grass carp (24%), followed by common carp and channel catfish (about 5% each), red shiner (2%), and bluegill and redear sunfish (about 1%).

All other species contributed less than 1% of total catch.

Striped bass was predominant in the upper reach, but at only one station where 1,273 individuals were encountered (68% of the catch). Grass carp was second most abundant also due to a large catch (466 individuals or 25% of catch) at one station. Common carp was third for the entire upper reach (5%), and channel catfish was fourth (3%). Other species contributed less than 1% of the catch. (Table 5D). Grass carp (23 fish) was the most abundant species in the one-station middle reach, striped bass was second (7 fish), red shiner third (5 fish), and other species (common carp, channel catfish, redear sunfish, largemouth bass, and bluegill) were rare. Channel catfish was the most abundant species in the lower reach and at San Xavier (station 4-3-3), followed by red shiner and redear sunfish (18% each). Carp and striped bass (7 and 8 individuals respectively) were the most abundant at Brady (4-3-1) where only 22 fish were captured. Three striped bass, two channel catfish, and one each bluegill and flathead catfish were also captured.

SRP SOUTH CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed between 20 and 22 November 2004 (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 km below the barrier), River Road Siphon (2.5 km), "Demossing Station" (6.1 km), and Triple Junction (9.0 km) where the South Canal ends. The above and just below barrier sites were sampled with a bag seine after partial drainage, River Road Siphon was sampled by experimental gill net, and the other two samples were accomplished using dip nets. Locked gates across canal roadways caused delays and inconveniences, but these were minor.

Species Richness and Distribution – Seventeen species, including undetermined cichlids and two 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 5F) although these latter reaches were not designated in the monitoring protocol (Clarkson 1996a). Twelve species were taken above the electric fish barrier and 11 were from collective downstream canal stations. Green sunfish, bluegill, smallmouth bass, rainbow trout, black crappie, and tilapia were encountered above but not below, while yellow bullhead, Sonora sucker, mosquitofish, striped bass, and desert sucker were encountered below but not above the barrier.

Below the fish barrier, eight species were at the upper, one at the upper-middle, two at the lower-middle, and six at the lower station. Native desert sucker and Sonora sucker were contacted at the upper station only. Non-native flathead catfish had the widest distribution of all species having been contacted at 3 of 4

below barrier stations and at the one above barrier station.

Assemblage Structure – Native fishes comprised 11.5% of the total catch of 471 individuals from SRPs Canal (Table 3). Sonora sucker was the fifth most abundant species (Table 5F), and contributed 11.0% to the total, while desert sucker comprised 0.4%. Relative abundance of the native sucker almost certainly was a gross underestimate, 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 red shiner and largemouth bass were the two most abundant fishes overall (Tables 3 and 5F), accounting for 28 and 21% of total catch, respectively, and followed among non-natives by channel catfish (13%), bluegill (12%), undetermined cichlids (5%), flathead catfish (4%), grass carp and common carp (2% each). Other non-native fishes each contributed less than 1% to the total catch.

Predominant fishes above the electrical fish barrier were largemouth bass (38%), bluegill (22%), red shiner (11%), channel catfish (10%), undetermined cichlids (9%), flathead and common carp (3% each) and green sunfish (2%) (Table 5F). Next in order of abundance came Sonora sucker and bluegill. Grass carp, smallmouth bass, rainbow trout, and black crappie were represented by one individual.

Below the fish barrier, native Sonora sucker dominated the upper station (59% of catch), followed by channel catfish (24%). Other species were uncommon-to-rare at the upper station. One grass carp was captured at the upper middle station. At the lower middle station, the catch was predominated by 100 red shiner (Table 5F). The only other species capture was a single specimen of flathead catfish. At the lowermost station where only 28 fish were captured, non-native channel catfish and flathead catfish were the most abundant (46% and 25% respectively).

SRP NORTH (ARIZONA) CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed between 07 and 10 January 2005 (Table 1). Four stations were sampled during routine monitoring: one above the electrical fish barrier, one immediately (0.3 km) below the barrier, one at Evergreen Drain (8.0 km) and one in the reach extending from Indian Bend Wash (14.5 km) upstream to the 101-Pima freeway overpass. The above and below barrier sites were sampled with a bag seine after partial drainage, a straight seine was used at Evergreen Drain, and a boat-mounted electrofisher was used to collect fishes at Indian Bend Wash.

Species Richness and Distribution – Seventeen species including undetermined cichlids 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” (three stations) the electrical fish barrier (Tables 5E), although these reaches were not designated in the monitoring protocol (Clarkson 1996a). Fifteen species were taken above the electric fish barrier and eleven were collected from downstream canal stations. Red shiner and mosquitofish were encountered below but not above the barrier, while yellow bullhead, threadfin shad, bigmouth buffalofish, green sunfish, desert sucker, and black crappie were taken above but not below.

Below the fish barrier, five species (one native) were taken from the upper station, seven (one native) from the middle, and eight (one native) were taken from the lower station (Table 4). Grass carp, Sonora sucker, and bluegill were distributed among all three stations while red shiner, mosquitofish, and flathead catfish were captured at two of three.

Assemblage Structure – Native fishes collectively comprised 21.4% of the total number of 355 individuals taken from the SRPn Canal (Table 3). Sonora sucker was the second most abundant fish species overall (21% of total catch), while only one desert sucker was encountered (0.3% of total numbers). As in the SRPs canal (above), relative abundances of the two native suckers likely were underestimated.

Non-native channel catfish was the most abundant species overall (24% of total numbers), followed among non-natives by red shiner (13%), largemouth bass (12%), mosquitofish (10%), grass carp (5%), flathead catfish (4%), and bluegill (3%). Other species each contributed 2% or less to the total numbers.

Channel catfish were predominant above the electric fish barrier (44% of total fishes), followed by largemouth bass (25%), flathead catfish (8%), native Sonora sucker (6%), and bluegill (4%). Other species were uncommon-to-rare (Table 5E).

Below the fish barrier, Sonora sucker was the predominant species overall (35% of catch), in the upper station (70%), and second most abundant in the lower and middle stations. Red shiner and mosquitofish were the most abundant species in the middle and lower stations respectively. Grass carp was common at the upper and lower stations, and channel catfish was common at the lower station, while other species were uncommon or rare at the respective station(s) where they occurred (Table 5E).

FLORENCE-CASA GRANDE CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed on 24 October 2004 (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 downstream

at below China Wash barrier (2.6 km downstream from the diversion dam), the first turnout at 11.4 km, and Pima Lateral Canal (15.2 km). All sights were sampled with a straight seine. In addition, dip nets were used at Pima Lateral. Lapses in communication between San Carlos Irrigation District (SCID) and ASU/BR resulted in confusion regarding timing of changes in canal operations, however, this did not significantly compromise monitoring.

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. Red shiner, mosquitofish, channel catfish, and green sunfish were above and below the electric fish barrier at China Wash, bluegill was above, while threadfin shad was only below.

Assemblage Structure – No native species were represented in the total sample of 3,644 individuals from the FCG Canal (Table 3). Among non-natives, red shiner was the predominant species above (63%) and below (82%) the electrical fish barrier, and overall (Table 5G, 78% of catch). Next in abundance was mosquitofish (22%). Nine channel catfish, two green sunfish, and one each bluegill and threadfin shad were also captured.

RECOMMENDATIONS

Relative to qualitative samples, field crews should enter either “1” or enter a nearest order of magnitude approximation (i.e., 1s, 10, 100s, 1000s) for the number of individuals of any species encountered but not enumerated. This will help avoid confusion about species presence and abundance at a station.

Continue to work toward improved communication between canal operators (CAWCD, SRP, SCID) and those performing fish monitoring activities so that sampling can coincide closely with scheduled outages.

Explore potential techniques to safely, reliably, and effectively sample fishes from the SRP canal system during periods of normal flow.

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TABLE 1. Station, date, gear type, and lead entity for sampling activities conducted in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, for sample year 2004 (period October 4, 2004 to January 10, 2005). 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 (04 or 05). 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.

Station		Date	Gear	Lead
San Pedro River				
1-1-1	Hereford	10 05 04	Bp, SS	AZGFD
1-1-2	Lewis Springs	10 05 04	Bp, SS	AZGFD
1-1-3	Charleston	10 05 04	Bp, SS	AZGFD
1-2-1	Hughes Ranch	10 06 04	Bp	AZGFD
1-2-2	Soza Ranch	No sample		
1-3-1	Aravaipa Creek	No sample		
1-3-2	Swingle Wash	No sample		
1-3-3	Mouth	No sample		
Gila River				
2-1-1	Coolidge Dam	No sample		
2-1-3	Hook & Line Ranch	No sample		
2-2-1	Dripping Springs Wash	No sample		
2-2-2	Christmas	No sample		
2-2-3	O'Carrol Canyon	No sample		
2-3-1	San Pedro River	No sample		
2-3-2	Kearny	No sample		
2-3-3	Kelvin	11 18 04	Bp	AZGFD
2-4-1	A-Diamond Ranch	11 18 04	Bp	AZGFD
2-4-2	Cochran	11 18 04	Bp	AZGFD
2-4-3	Box-O Wash	11 18 04	Bp	AZGFD
Salt River				

3-1-1	Stewart Mountain Dam	01 26 05	Ef	AZGFD
3-1-2	Blue Point RS	No sample		
3-1-3	Granite Reef Dam	No sample		

CAP Pumping Plants

4-1-1	Bouse	10 04 04	Ef, Es	USBR
4-1-2	Little Harquahala	10 05 04	M, T, Ef	USBR
4-1-3	Hassayampa	10 06 04	M, T, Tl, Ef	USBR
4-2-1	Salt-Gila	11 01 04	Ef, T	USBR
4-3-1	Brady	11 03 04	Ef, T, Tl	USBR
4-3-2	Red Rock	No sample		
4-3-3	San Xavier	11 04 04	Tl, T, Ef	USBR

SRP South Canal

5	0.0 Above fish barrier	11 22 04	BS	AZGFD
	0.1 Below fish barrier	11 20 04	BS	ASU
	2.5 River Road siphon	11 20 04	EXPG	ASU
	6.1 Demossing station	11 20 04	D	ASU
	9.0 Triple Junction	11 20 04	D	ASU

SRP North (Arizona) Canal

6	0.0 Above fish barrier	01 10 05	BS	AZGFD
	0.3 Below fish barrier	01 07 05	BS	ASU
	8.0 Evergreen Drain	01 07 05	SS	ASU
	14.5 Indian Bend Wash	01 07 05	Ef	ASU

FCG

7	0.0 Below diversion dam	10 24 04	SS	ASU
	2.6 Below China Wash	10 24 04	SS	ASU
	11.4 First turnout	10 24 04	SS	ASU
	15.2 Pima Lateral	10 24 04	SS, D	ASU

TABLE 2. Common names and four letter codes for fish species captured during sampling activities conducted in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2004 (period October 4, 2004 to January 10, 2005). Native fishes indicated by asterisks. Abbreviations as in Clarkson 1996a, but also see notes below.

Species		SanP	Gila	Salt	CAP	SRPs	SRPn	FCG	All sites
*Desert sucker	PACL	X	O	O	O	X	X	O	X
*Longfin dace	AGCH	X	O	O	O	O	O	O	X
*Sonora sucker	CAIN	O	O	X	O	X	X	O	X
Bigmouth buffalo	ICCY	O	O	O	O	O	X	O	X
Black bullhead	AMME	X	X	O	X	O	O	O	X
Black crappie	PONI	O	O	O	O	X	X	O	X
Bluegill	LEMA	O	O	X	X	X	X	X	X
Channel catfish	ICPU	O	O	O	X	X	X	X	X
Common carp	CYCA	X	O	X[1]	X	X	X	O	X
Fathead minnow	PIPR	X[1]	O	O	O	O	O	O	X
Flathead catfish	PYOL	O	O	O	X	X	X	O	X
Goldfish	CAAU	O	O	O	X	O	O	O	X
Grass carp	CTID	O	O	O	X	X	X	O	X
Green sunfish	LECY	X	O	O	O	X	X	X	X
Largemouth bass	MISA	O	O	X	X	X	X	O	X
Mosquitofish	GAAF	X	X	O	O	X	X	X	X
Rainbow trout	ONMY	O	O	O	O	X	X	O	X
Redear sunfish	LEMI	O	O	O	X	O	O	O	X
Red shiner	CYLU	O	X	O	X	X	X	X	X
Smallmouth bass	MIDO	O	O	O	X	X	O	O	X
Striped bass	MOSA	O	O	O	X	X	O	O	X
Threadfin shad	DOPE	O	O	O	O	O	X	X	X
Undetermined or hybrid sunfish[2]	LEPO	O	O	O	X	O	O	O	X
Undetermined Cichlid[3]	TILA	O	O	O	O	X	X	O	X
Yellow bullhead	AMNA	O	X	X	X	X	X	O	X

Stream	SanP	Gila	Salt	CAP	SRPs	SRPn	FCG	All sites
Total species (taxa)[4]	7	4	5	13	17	17	6	24
Native	2	0	1	0	2	2	0	3
Non-native	5	4	4	13	15	15	6	21
Percent native	29	0	20	0	12	12	0	13

[1] Species was collected or observed in a non-quantitative stream sample.

[2] 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.

[3] Undetermined Cichlids likely includes juvenile and adult Mozambique tilapia, *Tilapia* (*Oreochromis*) *mossambica*, and blue tilapia *Tilapia* (*Oreochromis*) *aurea* and their hybrids, plus juvenile redbelly (Zill's) *tilapia*, *Tilapia zilli*.

[4] Total species(taxa) includes undetermined Cichlids, but excludes undetermined or hybrid sunfishes, the latter of which are assumed to be subsumed into the individual parental species.

TABLE 3. Total numbers of fishes captured during sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2004 (period October 4, 2004 to January 10, 2005). Native fishes indicated by asterisks. Abbreviations as in Clarkson (1996a). Ab and Bb respectively indicate Above and Below electrical fish barriers on SRPn and SRPs canals.

Species	SanP	Gila	Salt	CAP	Ab	Bb	Ab	Bb	Ab	Bb	Total
*Desert sucker	75	0	0	0	0	2	1	0	0	0	78
*Longfin dace	62	0	0	0	0	0	0	0	0	0	62
*Sonora sucker	0	0	40	0	0	52	10	65	0	0	167
Bigmouth buffalo	0	0	0	0	0	0	1	0	0	0	1
Black bullhead	5	1	0	7	0	0	0	0	0	0	13
Black crappie	0	0	0	0	1	0	1	0	0	0	2
Bluegill	0	0	5	27	56	0	6	4	1	0	99
Channel catfish	0	0	0	95	26	34	75	10	6	3	249
Common carp	3	0	17	100	8	2	4	2	0	0	136
Fathead minnow	22	0	0	0	0	0	0	0	0	0	22
Flathead catfish	0	0	0	1	8	9	13	2	0	0	33
Goldfish	0	0	0	2	0	0	0	0	0	0	2
Grass carp	0	0	0	497	1	6	1	17	0	0	522
Green sunfish	1	0	0	0	4	0	5	0	1	1	12
Largemouth bass	0	0	29	18	96	3	43	1	0	0	190
Mosquitofish	477	83	0	0	0	3	0	34	269	516	1382
Rainbow trout	0	0	0	0	1	0	5	1	0	0	7
Redear sunfish	0	0	0	29	0	0	0	0	0	0	29
Red shiner	0	263	0	43	27	105	0	47	471	2375	3331
Smallmouth bass	0	0	0	6	1	0	0	0	0	0	7
Striped bass	0	0	0	1290	0	1	0	0	0	0	1291
Threadfin shad	0	0	0	0	0	0	1	0	0	1	2
Undetermined or hybrid sunfish	0	0	0	2	0	0	0	0	0	0	2
Undetermined Cichlid	0	0	0	0	24	0	3	1	0	0	28
Yellow bullhead	0	10	17	2	0	1	2	0	0	0	32
Total	645	357	108	2119	253	218	171	184	748	2896	7699
Total native	137	0	40	0	0	54	11	65	0	0	307
Total nonnative	508	357	68	2119	253	164	159	119	748	2896	7391
Percent native	21.2	0.0	37.0	0.0	0.0	24.8	6.4	35.3	0.0	0.0	4.0

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) 2004 (period October 4, 2004 to January 10, 2005). Species counts include undetermined Cichlids but exclude undetermined plus hybrid *Lepomis* (see notes accompanying Table 2). 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 2004; 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	5	6	12	15	5
1-2	5	--	NS	4	--	--	--
1-3	4	NS	NS	7	--	--	--
total	7		5	8	12	15	5
n/nn	2/5		1/4	0/8	0/12	2/13	0/5
2-1	2	NS	--	8	8	5	5
2-2	NS	NS	--	--	1	7	3
2-3	--	NS	--	--	2	8	2
2-4	--	--	--	--	6	--	--
total	2			8	11	11	5
n/nn	1/1			0/8	2/9	1/10	0/5
3-1	NS	NS	--	6	--	--	--
3-2	NS	NS	--	NS	--	--	--
3-3	NS	3	--	9	--	--	--
total		3		12			
n/nn		0/3		0/12			
4-1 --	--	4	--	--	--	--	--
4-2 --	--	2	--	--	--	--	--
4-3 --	--	2	--	--	--	--	--
total		4					
n/nn		0/4					
all reaches	7	4	5	13	17	17	6
n/nn	2/5	0/4	1/4	0/13	2/15	2/15	0/6
percent native	29	0	20	0	12	12	0

TABLE 5A. Fish catch at San Pedro River stations (see TABLE 1) during sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2004 (period October 4, 2004 to January 10, 2005). Fish species listed alphabetically using standard abbreviations per Clarkson (1996a), 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		CYCA			LECY		PACL				
station code	AGCH	0	1	0	1	GAAF	0	1	0	1	PIPR	sum	No Spp
1-1-1	1		3	1		3	1					9	5
1-1-2	16		1	1	1	470					21	510	5
1-1-3	36					4			49	26	1	116	4
subtotal	53	0	4	2	1	477	1	0	49	26	22	635	7
1-2-1	9		1									10	2
1-2-2												no sample	
subtotal	9	0	1	0	0	0	0	0	0	0	0	10	2
Total	62	0	5	2	1	477	1	0	49	26	22	645	7

TABLE 5B. Fish catch at Gila River stations (see TABLE 1) during sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2004 (period October 4, 2004 to January 10, 2005). Fish species listed alphabetically using standard abbreviations per Clarkson (1996a); 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				sum	No Spp
station code	0	1	0	1	CYLU	GAAF		
2-3-1							no sample	
2-3-2							no sample	
2-3-3			1		33	8	42	3
subtotal	0	0	1	0	33	8	42	3
4-1		1	7	2	212	56	278	4
4-2					13	17	30	2
4-3					5	2	7	2
subtotal	0	1	7	2	230	75	315	4
Total	0	1	8	2	263	83	357	4

TABLE 5C. Fish catch at Salt River stations (see TABLE 1) during sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2004 (period October 4, 2004 to January 10, 2005). Fish species listed alphabetically using standard abbreviations per Clarkson (1996a), 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.

	AMNA		CAIN		CYCA		LEMA		MISA		sum	No Spp
station code	0	1	0	1	0	1	0	1	0	1		
3-1-1		17		40		17		5	7	22	108	5
Total	0	17	0	40	0	17	0	5	7	22	108	5

TABLE 5D. Fish catch at Central Arizona Project (CAP) canal stations (see TABLE 1) during sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2004 (period October 4, 2004 to January 10, 2005). Fish species listed alphabetically using standard abbreviations per Clarkson (1996a); 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		CTID		CYCA			ICPU		LEMA		LEMI		LEPO		MIDO		MISA		MOSA		PYOL		sum	No Spp
station code	0	1	0	1	0	1	0	1	0	1	CYLU	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1		
4-1-1								466		79		15	37								2		1	1001	272			1873	6
4-1-2								1						3							4				1			9	4
4-1-3								5		13	10		2	1	1								2		1			35	7
subtotal	0	0	0	0	0	0	0	472	0	92	10	15	39	4	1	0	0	0	0	0	6	0	3	1002	273	0	0	1917	8
4-2-1								23		1	5		1		2		1						2	2	5			42	8
subtotal	0	0	0	0	0	0	0	23	0	1	5	0	1	0	2	0	1	0	0	0	0	0	2	2	5	0	0	42	8
4-3-1										7			2		1							1	2	8			1	22	6
4-3-3		7		2		2		2			28		38		19	1	27		2			1	9					138	9
subtotal	0	7	0	2	0	2	0	2	0	7	28	0	40	0	20	1	27	0	2	0	0	2	11	8	0	0	1	160	12
Total	0	7	0	2	0	2	0	497	0	100	43	15	80	4	23	1	28	0	2	0	6	2	16	1012	278		1	2119	13

TABLE 5E. Fish catch at Salt River Project (SRP) South Canal stations (see TABLE 1) during sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2004 (period October 4, 2004 to January 10, 2005). Fish species listed alphabetically using standard abbreviations per Clarkson (1996a), 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				ICPU				MIDO		MISA		MOSA		ONMY		PACL		PONI		PYOL				
	0	1	0	1	0	1	0	1	CYLU	GAAF	0	1	LECY*	LEMA*	0	1	0	1	0	1	0	1	0	1	0	1	0	1	TILA*	sum	No Spp
above barrier						1		8	27		15	11	4	56		1	69	27				1				1	2	6	24	253	12
subtotal	0	0	0	0	0	1	0	8	27	0	15	11	4	56	0	1	69	27	0	0	0	1	0	0	0	1	2	6	24	253	12
0.1 below dam				52		5			5	1	2	19								1				2			1			88	8
2.5 below dam						1																								1	1
6.1 below dam									100																		1			101	2
9.0 below dam	1							2		2	13							3									7			28	6
subtotal	1	0	0	52	0	6	0	2	105	3	15	19	0	0	0	0	0	3	0	1	0	0	0	2	0	0	9	0	0	218	11
Total	1	0	0	52	0	7	0	10	132	3	30	30	4	56	0	1	69	30	0	1	0	1	0	2	0	1	11	6	24	471	17

* No age information is given

TABLE 5F. Fish catch at Salt River Project (SRP) North (Arizona) Canal stations (see TABLE 1) during sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2004 (period October 4, 2004 to January 10, 2005). Fish species listed alphabetically using standard abbreviations per Clarkson (1996a), 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					ICCY		ICPU		LECY		LEMA		MISA		ONMY		PACL		PONI		PYOL		TILA		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	0	1	0	1		
above barrier	2		3	7	1		4			1		1		30	45	2	3	3	3	5	38	5		1		1		5	8	3		171	15
subtotal	2		3	7	1		4		0	1	0	1		30	45	2	3	3	3	5	38	5		1		1		5	8	3		171	15
0.3 below dam				26	8				1										1			1									37	5
8.0 below dam				12	2				46		2							2										1		1	66	7
14.5 below dam				27	7		2				32				10				1		1								1		81	8
subtotal	0		0	65	17		2		47	0	34	0		0	10	0	0	2	2	0	1	1	0		0		1	1	1		184	11
Total	2		3	72	18		6		47	1	34	1		30	55	2	3	5	5	5	39	6	1		1		6	9	4		355	17

TABLE 5G. Fish catch at Florence Casa Grande (FCG) Canal stations (see TABLE 1) during sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2004 (period October 4, 2004 to January 10, 2005). Fish species listed alphabetically using standard abbreviations per Clarkson (1996a), 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.

				ICPU		LECY		LEMA			
	CYLU	DOPE	GAAF	0	1	0	1	0	1	sum	No Spp
above barrier	471		269	6		1			1	748	5
subtotal	471	0	269	6	0	1	0	0	1	748	5
2.6 below dam	471	1	346	2		1				821	5
11.4 below dam	1750		150	1						1901	3
15.2 below dam	154		20							174	2
subtotal	2375	1	516	3	0	1	0	0	0	2896	5
Total	2846	1	785	9		2			1	3644	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 2004 (period October 4, 2004 to January 10, 2005). Abbreviations as in Clarkson (1996a).

	Gear	Species code	Count	Comment
CAP canal				
	boat shocker	CTID	100	COMMON
	boat shocker	CYCA	10	UNCOMMON
	boat shocker	MIDO	2	NEW RECORD?
	boat shocker	MOSA	1000	ABUNDANT
	boat shocker	MOSA	10	UNCOMMON
	electric seine	CTID	182	
	electric seine	CTID	184	REACH 2
	electric seine	CYCA	11	REACH 2
	electric seine	CYCA	58	VISUAL CENSUS
	electric seine	ICPU	22	
	electric seine	ICPU	30	REACH 2
	electric seine	MISA	1	REACH 2
	electric seine	MOSA	31	
	electric seine	MOSA	232	REACH 2
Salt River				
	boat shocker	AMNA	4	
	boat shocker	CAIN	24	
	boat shocker	CYCA	17	
	boat shocker	MISA	7	
San Pedro River				
	backpack shocker	AGCH	9	
	straight seine	AGCH	15	
	straight seine	CYCA	2	
	straight seine	GAAF	457	
	straight seine	PIPR	22	