

## **CENTRAL ARIZONA PROJECT FISH MONITORING**

SUMMARY OF FY 1999 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 fiscal year (FY) 1999 (October 1 1998 to September 30 1999). 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) North (Arizona) Canal (SRPn), (6) SRP South Canal (SRPs), and (7) Florence-Casa Grande (FCG) Canal (Table 1). Additional, non-standard sampling was performed opportunistically by AZGFD on SRPn and by ASU and BR on SRPn and SRP Consolidated and Tempe canals. All sampling was performed between 29 September 1998 and 28 January 1999 (Table 1).

Comparisons are not made herein with monitoring data acquired during FYs 1995 and 1996 as reported by Clarkson 1998, or to earlier years. The reader is referred to that document for comparisons with prior years.

## MONITORING OVERVIEW

A total of 27 taxa (including *Lepomis* hybrids) was captured during FY 1999 monitoring. Eight were taken in the FCG Canal, 12 in each of the San Pedro River and CAP Canal, 13 were in Salt River, 15 in Gila River and SRPs, and 17 were in SRPn (Table 2). Four native taxa (15% of total species) were collected: roundtail chub, longfin dace, Sonora sucker, and desert sucker, however, no stream or canal produced more than three: two were in the FCG Canal, and none in the CAP Canal. The remaining 23 taxa were non-native, which among stations numbered between 6 (FCG Canal) and 14 (SRPn). Natives comprised 18 to 25% of all species among stations, except in the CAP Canal where there were none.

Total number of fish varied widely among 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). Proportion that native fishes comprised of total catch ranged from 0 (CAP Canal) to 74.3% (San Pedro River). Gila and Salt rivers were 22.4 and 44.7% natives. SRPn, SRPs and FCG canal samples were 17.4, 24.8 and 1.7% natives above the electric fish barriers, respectively, and 14.3, 27.1 and 1.3% natives below those structures (Table 3).

Community structure differed substantially among stations (Table 3). Native longfin dace was the most abundant species in combined samples from the San Pedro River (followed by mosquitofish), and native desert sucker predominated the Salt River catch (followed by largemouth bass). Red shiner was the predominant species in samples from the Gila River (followed by native Sonora sucker) and FCG Canal (followed by mosquitofish). Bluegill was the

most abundant fish in the CAP Canal and undifferentiated *Tilapia* sp. (mostly young of year) predominated in SRPn and SRPs canals, where red shiner and the two native suckers also were abundant.

## SAN PEDRO RIVER

Sampling Notes and Deviations from Protocol – Sampling was performed between 26 and 29 October 1998 (Table 1). Names and locations of several stations are changed from Clarkson 1996 a and c; these are noted in the table. Eight of 9 stations were sampled: station 1-2-3 (Gage Station) was not sampled. Backpack electrofishing was the only gear type used, with seines employed only to acquire opportunistic, non-quantitative samples.

Area of sampling coverage (variable 20, rivers and streams form 2, Clarkson 1996 c) was highly variable among sites, and it was poorly estimated. There was no attempt to actually measure sampled area; instead it was assessed visually, typically by the individual using the backpack electrofisher. Thus, a number of persons, each with their own perceptions of areal coverage, were responsible for determination of this variable. Without verification, these data cannot be considered reliable. Electrofishing technique and efficiency were highly variable among users, resulting in data that may not be comparable among samples, reaches and stations. Minor protocol adjustments and consistent training of all participants (see “Recommendations,” below may remedy these problems.

Species Richness and Distribution -- Twelve species were captured in the San Pedro River (Tables 4 and 5A). Six were taken in the upper reach, five in the middle, and six in the lower. Three natives were encountered (longfin dace, desert sucker, and Sonora sucker), comprising a quarter of total species. Longfin dace was the only fish at all stations, desert sucker was at 6 of 8 stations, and Sonora sucker was only at the lower two stations in the lowermost reach.

Four non-natives were in the upper reach, three in the middle, and six in the lower. Black bullhead, largemouth bass, and fathead minnow were only in the upper or middle reaches, while yellow bullhead, carp, red shiner, and channel catfish were taken only from the lowermost reach. Green sunfish was found in all three reaches, and mosquitofish was only in upper and lower reaches.

Assemblage Structure – Natives outnumbered non-natives overall (74% of catch), and at upper (59%) and middle (96%) reaches (Tables 3 and 5A); they comprised 39.9% of numbers in the lower reach. Native longfin dace was the most abundant fish species overall (64% of total numbers), and at upper and middle reaches (Table 5A). Desert sucker comprised slightly less than 10% of the overall catch, and Sonora sucker was rare (less than 1% overall).

Mosquitofish was the most abundant non-native and the second-most abundant species overall, making up 13% of the catch. Red shiner comprised 4.3, black bullhead 4.1 and green sunfish 2.2% of total catch. Remaining non-natives each contributed less than 1% to the total.

## GILA RIVER

Sampling Notes and Deviations from Protocol – Sampling was performed between 26 October and 10 November 1998 (Table 1). Names and locations of several stations are changed from Clarkson 1996 a and c; these are noted in the table. Ten of 12 stations were sampled; stations 2-1-2 (Hawk Spring Canyon) and 2-4-1 (A-Diamond Ranch) were not sampled. Hawk Spring Canyon is inaccessible and has been deleted from the monitoring program, while the landowner or other responsible party could not be contacted to authorize access at A-Diamond Ranch. A variety of gears were used in reaches 1 and 2, but only backpack electrofishing was employed for quantitative sampling reaches 3 and 4. Qualitative samples were taken by seine at some sites, but these data are not incorporated into the tabulations in this report.

Area of sampling coverage (variable 20, rivers and streams form 2, Clarkson 1996 c) was highly variable among sites, and poorly estimated. Electrofishing technique and efficiency were highly variable among users, resulting in data that may not be comparable among samples and among sites. See “San Pedro River,” above, and “Recommendations,” below for additional discussion on these observations.

Species Richness and Distribution – Fifteen species (including *Lepomis* hybrids) were captured in the Gila River (Tables 4 and 5B). Thirteen were taken in the upper reach, 12 and 13 in the two middle reaches, and nine in the lower. Three natives were encountered (longfin dace, desert sucker, and Sonora sucker), comprising a fifth of total species. Desert and Sonora suckers were found at 8 of 10 stations distributed among all four reaches, while longfin dace was only in the two middle reaches.

A dozen non-native species were in the upper reach, nine were in the upper-middle, 10 were taken from the lower-middle reach, and seven were found in the lowermost reach. Most non-native species were taken from all reaches, but threadfin shad was absent from reach 2, bluegill from 1, 2, and 4, hybrid *Lepomis* from 2 to 4, black crappie from 3 and 4, and flathead catfish was absent from reach 4. Carp, red shiner, and channel catfish were at all stations, yellow bullhead was at 9 of 10 stations, green sunfish at 8 of 10, and mosquitofish was at 7 of 10 stations; other non-natives each were found at 1 to 5 stations.

Assemblage Structure –The three native species comprised only 22.4 percent of total catch from the Gila River (Table 3), and among reaches 1 to 4 respectively were 13, 29, 27, and 11% of total numbers caught. Desert suckers were 14%, Sonora suckers were 9%, and longfin dace only 0.4% of total catch. Desert sucker was the most abundant fish reach 3, and Sonora sucker was the second most abundant species in reach 2.

Non-native red shiner was the most abundant species overall (36% of total catch) and predominated in reach 1 (followed by threadfin shad) and reach 2 (followed by native Sonora sucker). It was the second most abundant fish in reach 3. Channel catfish was the most abundant fish in the lower reach, followed closely by mosquitofish and then by yellow bullhead.

Other non-native fishes each contributed less than 5% to total catch and were considered uncommon or rare.

## SALT RIVER

Sampling Notes and Deviations from Protocol – Sampling was performed between 15 October and 04 November 1998 (Table 1). All three stations were sampled. A variety of gears were used to collect fishes.

Species Richness and Distribution – Thirteen fish species were taken from the Salt River; 9 were at the upper, 12 at the middle, and 8 at the lower station (Table 4). Three (23%) species were native (roundtail chub, desert sucker, and Sonora sucker) and ten were non-native. Most common species were at all stations, while uncommon and rare ones were at only one or two stations (Table 5C).

Assemblage Structure -- Native fishes comprised 44.7% of the total catch (Tables 3 and 5C). Desert sucker was the most abundant species overall (35%) and at the two upper stations. Sonora sucker contributed 10% of total numbers, while roundtail chub was rare (one individual).

Largemouth bass was the second most abundant species overall (17% of total catch) and the most abundant fish at the lower station. Mosquitofish was 15% of total fish and the second most abundant species at the middle station, and blue tilapia was 14% of total fish and the second most abundant species at the upper station. Other non-native fishes contributed 5% or less to total numbers. Channel catfish and flathead catfish both were rare and comprised < 1% of the catch.

## CENTRAL ARIZONA PROJECT CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed above Phoenix between 29 October and 01 October 1998 and below Phoenix between 25 and 28 January 1999. All stations were sampled. A variety of gears were consistently applied at the several stations, with exception of Station 4-4-1 (Bouse) where electrofishing was not used because of an equipment failure. Data quality and comparability otherwise are considered relatively high.

Species Richness and Distribution – Twelve taxa, all non-native, were captured from the CAP Canal. No new species were detected. Nine were in the upper, seven in the middle, and ten from the lower reach (Tables 4 and 5D). Grass carp, carp, channel catfish, bluegill, redear sunfish, largemouth bass, and striped bass were taken from all 3 reaches. No species was found at all stations, although bluegill and striped bass both were at 6 of 7 stations.

Assemblage Structure – Centrarchids were predominant among samples from the CAP Canal (Table 5D). Bluegill was the most abundant species overall (53% of total numbers), followed by carp (22%), hybrid *Lepomis* (8%), redear sunfish (5%) and largemouth bass (4%). Other

species each contributed less than 3% to total numbers.

Hybrid sunfish were predominant in the upper reach, a result of numbers taken at the upper station 4-1-1 (Table 5D), and carp was the most abundant species in the middle reach (one station) where other species were rare. Bluegill predominated in the lower reach, although it was the most abundant fish only at station 4-3-3. Carp predominated at station 4-3-1 and redear sunfish was the most abundant species at station 4-3-2.

## SRP NORTH (ARIZONA) CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed between 03 November and 22 December 1998. All stations were sampled during routine monitoring, and two opportunistic samples using a boat-mounted electrofisher were taken, also. Routine sampling was compromised by lapses in communication from Salt River Project regarding timing of changes in canal operations, which resulted in one instance in personnel arriving on site too late to obtain representative samples.

Species Richness and Distribution – Seventeen species, including undetermined (primarily young of year) *Tilapia* and three natives, were captured from the SRPn Canal (Tables 2 and 4). The canal was subdivided for illustrative purposes into four reaches: “above barrier” and 3 downstream (Tables 4 and 5E) although these latter reaches were not designated in the monitoring protocol (Clarkson 1996a). Sixteen species were taken above the electric fish barrier and 13 were from collective downstream canal “reaches.” Goldfish was the only species encountered below but not above the barrier, while bigmouth buffalo, rainbow trout, undetermined *Tilapia* and blue tilapia were taken above but not below.

Below the fish barrier, three species (two native) were taken from the upper reach, 12 (three native) from the middle reach, and four (two native) from the lower reach (Table 4). Only native desert sucker and Sonora sucker were distributed among all three reaches, while native roundtail chub was restricted to a single station in the middle reach.

Non-native red shiner was taken from upper and middle reaches, while channel catfish, bluegill, and largemouth bass were encountered only in the middle and lower reaches. Other fishes were found only in the middle or lower reach.

Assemblage Structure – Native fishes collectively comprised 17.1% of total numbers taken from the SRPn Canal (Table 3). Desert sucker was 7, Sonora sucker was 6, and roundtail chub was 9% of the overall catch. Relative abundances of the two native suckers almost certainly were gross underestimates, 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 tilapia (redbelly [*T. zillii*] plus undetermined) and red shiner were the most abundant species overall (respectively 57 and 15% of total numbers), followed by desert sucker, channel

catfish (7%), Sonora sucker, roundtail chub, and flathead catfish (1%). Other species each contributed at less than 1% to the total numbers.

Tilapias, primarily young of year of undetermined species, were overwhelmingly predominant above the electric fish barrier but absent below (Table 5E). Next in close order came desert sucker, channel catfish, red shiner, Sonora sucker, and roundtail chub. All other species were uncommon-to-rare.

Below the fish barrier, red shiner was predominant in the upper reach, and Sonora sucker was the most abundant fish in the middle reach. Desert sucker was predominant in the lower reach; however, there was a general paucity of fish in that reach and results are not conclusive.

## SRP SOUTH CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed between 24 October and 05 November 1998. All stations were sampled during routine monitoring. However, routine sampling was compromised by lapses in communication from Salt River Project regarding timing of changes in canal operations, which resulted in one instance in personnel arriving too late to acquire representative samples at some sites. Locked gates across canal roadways caused additional delays and minor inconveniences.

Species Richness and Distribution – Sixteen species, including undetermined (primarily young of year) *Tilapia* and three natives, were captured from the SRP Canal (Tables 2 and 4). The canal was subdivided for illustrative purposes into two reaches: “above barrier” and a downstream 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 12 were from collective downstream canal stations. Grass carp, mosquitofish, and redbelly tilapia were the only species encountered below but not above the barrier, while carp, threadfin shad, yellow bass, and undetermined *Tilapia* were taken above but not below.

Below the fish barrier, nine species were at the upper, six at the middle, and eight at the lower station. Native desert sucker and Sonora sucker were at all 3 stations and roundtail chub was at the upper two. Only red shiner among non-native fishes was encountered at all stations.

Assemblage Structure – Native fishes comprised 25.8% of the total catch from SRPs Canal (Table 3). Sonora sucker was the second most abundant species (Table 5F), and contributed 11% to the total, while roundtail chub comprised 10% and desert sucker added 5%. As in the SRP canal (above), relative abundances of the two native suckers likely were underestimated.

Non-native tilapias (*T. zilli* plus undetermined) were the most abundant fishes overall (Table 5F), accounting for 56% of total catch, and followed among non-natives by red shiner (9%) and channel catfish (5%). Other non-native fishes contributed at most 1% to the total catch.

Tilapias, primarily young of year, were overwhelmingly predominant above the electric fish barrier but were uncommon below (Table 5E). Next in order came Sonora sucker, and roundtail chub, followed by channel catfish, desert sucker, carp and largemouth bass. All other species were uncommon-to-rare.

Below the fish barrier, native desert sucker was predominant at the upper station, and non-native red shiner was the most abundant fish at the middle and lower (Table 5F). These were the only fishes found at all three stations; others were uncommon-to-rare and at only one or two sites.

## FLORENCE-CASA GRANDE CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed on 17 October 1998. All routine monitoring stations were sampled. 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 compromise monitoring.

Species Richness and Distribution – Eight species including two natives were taken from the Florence-Casa Grande Canal (Tables 2 and 4). Native longfin dace was the only species that occurred below but not above the electric fish barrier at China Wash. Native Sonora sucker was found at five of six stations, including the Pima Lateral Feeder Canal, as were non-native red shiner and mosquitofish. The FCG Canal was the only artificial stream (canal) in which longfin dace was encountered.

Assemblage Structure – Native species comprised only 1.4% of total numbers from the FCG Canal (Table 3). A total of eight Sonora suckers was taken at five stations (Table 5G), and longfin dace was found only at one site (two individuals).

Red shiner was the predominant species overall (Table 5G, 75% of catch), followed by mosquitofish (10%), channel catfish (8%), and yellow bullhead (3%). Carp and threadfin shad each comprised 1% of the catch.

## SRP CONSOLIDATED AND TEMPE CANALS

The SRP Consolidated Canal is an earthen distributary of the SRP South Canal. It is not a standard stream identified in the monitoring protocol (Clarkson 1996a), but it was sampled opportunistically to provide additional information. It was visited north of Williams Field Road in Chandler AZ on 24 October 1998 (Table 1) during a drawdown period. Collections were made along approximately 500 m of the canal.

Ten fish species including native desert sucker were taken from the Consolidated Canal (Table 5H). Mosquitofish was the most abundant species, followed by red shiner, redbelly tilapia, and



channel catfish; desert sucker was fourth in abundance (17 specimens). Other fishes (yellow bullhead, grass carp, carp, largemouth bass and blue tilapia) were rare, represented by only one to three individuals. This canal is the only stream or canal where two species of *Tilapia* (i.e., redbelly and blue) were found together.

The Tempe Canal is a concrete distributary of the South Canal. The reach below its origin downstream to "Chandler Falls" was visited on 24 October 1998. This is not a standard stream identified in the monitoring protocol (Clarkson 1996a), but it was sampled opportunistically (by visual inspection) to provide additional information. Data reported here are qualitative only.

Five fish species were observed, including native desert sucker and Sonora sucker; both were considered abundant. Numerous channel catfish were observed and the species was common. Several "Koi" variety of carp were seen, as were many stocked grass carp, which were considered common.

## RECOMMENDATIONS

Provide training specific to the goals and protocols of this program for all personnel. Such training should be intensive and include demonstrations and hands-on use of all equipment, review of all sampling procedures, and explanation of the standard data forms and their proper use. Training should enhance the overall quality of information acquired by this program, and remedy some sampling problems and deviations from protocols noted above, such as estimation of areal coverage and sampling efficiency differences.

A sketch map should be drawn for each station on each visit. In addition to station name and number, date, and artist, the map should clearly indicate the contour of the wetted stream margin, primary macrohabitat types to approximate scale and dominant substrate within each macrohabitat (per the standardized monitoring protocol), direction of flow, north arrow, any notable features or site characteristics, and a text-narrative as appropriate.

Obtain keys to locked gates along SRPn and SRPs canal roadways, and provide to authorized users on an as-needed basis.

Improve communication between canal operators (SRP, SCID) and those performing fish monitoring activities so that sampling can coincide with scheduled outages.

Examine the efficacy of boat-mounted electrofishing as a standard sampling technique for SRPn and SRP canals during normal flow conditions. There may a need for electrofishing to be adopted as primary collection technique if, as anticipated, future canal operations do not include periodic, scheduled drawdowns or outages.

## LITERATURE CITED

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the Gila River basin, Arizona. Revision 2. U.S. Bureau of Reclamation, Phoenix AZ. 26 pages + figures + appendices.

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Clarkson, R.W. 1996c. Standard operating procedures. Field Manual. Rivers and streams. Long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona. U.S. Bureau of Reclamation, Phoenix AZ. 19 pages.

Clarkson, R.W. 1998. Results of fish monitoring of selected waters of the Gila River basin, 1995-1996. U.S. Bureau of Reclamation, Phoenix AZ. 30 pages.

TABLE 1. Station, date, gear type, and lead agency for sampling activities conducted in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during fiscal year 1999 (October 1 1998 to September 30 1999). 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. An asterisk indicates stations that have been deleted from the protocol for the foreseeable future. Dates are given as month (1-12) day (1-31) and year (98 or 99). Abbreviations as follow: Stations: SRP = Salt River Project, FCG = Florence-Casa Grande Canal, and CAP = Central Arizona Project Canal; Gears: A = angling, Bp = backpack electrofisher, Ef = boat-mounted electrofisher, G = gill net, H = hoop net, M = minnow trap, S = seine, T = trammel net, and V = visual observation; and Lead: AZGFD = Arizona Game and Fish Department, ASU = Arizona State University, and BR = U.S. Bureau of Reclamation. 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. Non-standard stations, indicated by "na" in the station code position, are reported at the end of this compilation.

Station	Date	Gear	Lead	
San Pedro River				
1-1-1	Hereford	10 26 98	Bp	AZGFD
1-1-2	Lewis Springs	10 27 98	Bp	AZGFD
1-1-3	Charleston	10 27 98	Bp	AZGFD
1-2-1	Hughes Ranch	10 28 98	Bp	AZGFD
1-2-2	Soza Ranch	10 28 98	Bp	AZGFD
1-2-3	Gage Station*	not sampled – entry not authorized by landowner		
1-3-1	Aravaipa Creek	10 29 98	Bp, S	AZGFD
1-3-2	Swingle Wash	10 29 98	Bp	AZGFD
1-3-3	Mouth	10 29 98	Bp	AZGFD

TABLE 1, Continued.

Station	Date	Gear	Lead	
<b>Gila River</b>				
2-1-1	Coolidge Dam	11 10 98	Ef, S	AZGFD
2-1-2	Hawk Spring Canyon*	not sampled -- inaccessible		
2-1-3	Hook & Line Ranch	11 10,11 98	A, Bp, Ef, G, S, T	AZGFD
2-2-1	Dripping Spring Wash	10 26 98	A, Bp, Ef, S	AZGFD
2-2-2	Christmas	10 26 98	"0," Ef, S	AZGFD
2-2-3	O'Carrol Canyon	10 27 98	Ef, S	AZGFD
2-3-1	San Pedro River	11 02 98	Bp	AZGFD
2-3-2	Kearny (Indian Camp Wash)	11 02 98	Bp	AZGFD
2-3-3	Kelvin (Riverside)	11 03 98	Bp	AZGFD
2-4-1	A-Diamond Ranch	not sampled – landowner not available to authorize entry		
2-4-2	Cochran	11 03 98	Bp	AZGFD
2-4-3	Box-O Wash	11 04 98	Bp	AZGFD
<b>Salt River</b>				
3-1-1	Stewart Mountain Dam	11 04 98	Bp, G, Ef	AZGFD
3-1-2	Blue Point RS	10 15 98	Bp, Ef, S, T	AZGFD
3-1-3	Granite Reef Dam	10 16 98	Ef, T	AZGFD
<b>CAP Pumping Plants</b>				
4-1-1	Bouse	09 29 98	A, Ef, G, H, M, T	BR
4-1-2	Little Harquahala	09 30 98	A, Ef, G, H, M, T	BR
4-1-3	Hassayampa	10 01 98	A, Ef, G, H, M, T	BR
4-2-1	Salt-Gila	01 25 99	A, Ef, G, H, M, T	BR
4-3-1	Brady	01 26 99	A, Ef, G, H, M, T	BR
4-3-2	Red Rock	01 27 99	A, Ef, G, H, M, T	BR

4-3-3 San Xavier

01 28 99

A, Ef, G, H, M, T

BR

TABLE 1, Continued.

Station	Date	Gear	Lead	
SRP South Canal				
5	above fish barrier	11 09 98	S	AZGFD
	at below fish barrier	11 05 98	S	ASU
	2.8 @ River Road siphon	11 05 98	S, T	ASU
	4.0 @ RWCD turnout	11 05 98	S	ASU
	9.0 @ below demossing plant	10 24 98	V	ASU
SRP North (Arizona) Canal				
6	above fish barrier	12-07-98	S	AZGFD
	38 @ 67 Ave to Thunderbird	11 03 98	Ef, V	AZGFD
	31 @ 19 Ave to I-17	11 03 98	Ef	AZGFD
	14 @ Hayden to Pima	11 04 98	Ef	AZGFD
	14 @ Indian Bend to Dobson	12 22 98	Ef	BR
	at below fish barrier	12 04 98	V	ASU
	0.25 above Beeline Hwy	12 04 98	S	ASU
	6.6 mi below barrier	12 04 98	V	ASU
	7.8 @ Evergreen Drain	12 04 98	S	ASU
	11 @ Mesa Drive	12 04 98	V	ASU
	14.2 @ Indian Bend Wash	12 05 98	V	ASU
Florence Casa-Grande Canal				
7	0.5 below diversion dam	10 17 98	Bp, S	ASU
	1.5	10 17 98	Bp, S	ASU
	2.6 @ China Wash	10 17 98	S	ASU
	10.5	10 17 98	S	ASU
	15.2 @ Pima Lateral	10 17 98	Ef	ASU
	Pima Lateral Feeder	10 17 98	Bp, S	ASU

TABLE 1, Concluded.

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Station	Date	Gear	Lead
SRP Consolidated Canal na above Williams Field Road	10 24 98	S	ASU
SRP Tempe Canal na S Canal to Chandler Falls	10 24 98	V	ASU

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TABLE 2. Common names and four letter code 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 fiscal year 1999 (October 1 1998 to September 30 1999). Native fishes indicated by asterisks. Abbreviations as in Clarkson 1996 a.

Species	SanP	Gila	Salt	CAP	SRPn	SRPs	FCG
*Roundtail chub Giro	0	0	X	0	X	X	0
Fathead minnow Pipr	X	0	0	0	0	0	0
Goldfish Caau	0	0	0	X	X	0	0
*Longfin dace agch	X	X	0	0	0	0	X
Grass carp Ctid	0	0	0	X	X	X	0
Carp cyca	X	X	X	X	X	X	X
Red shiner cylu	X	X	0	X	X	X	X
*Sonora sucker Cain	X	X	X	0	X	X	X
*Desert sucker pacl	X	X	X	0	X	X	0
Bigmouth buffalo iccy	0	0	0	0	X	0	0
Largemouth bass Misa	X	X	X	X	X	X	0
Bluegill Lema	0	X	0	X	X	X	0
Green sunfish Lecy	X	X	X	X	X	X	0
Bluegill x green hybrid Lepo/hybr	0	X	0	X	0	0	0
Redear sunfish Lemi	0	0	X	X	0	0	0
Black crappie Poni	0	X	0	0	0	0	0
Black bullhead Amme	X	0	0	0	0	0	0
Yellow bullhead Amna	X	X	X	0	0	0	X
Channel catfish lcpu	X	X	X	X	X	X	X
Flathead catfish Pyol	0	X	X	0	X	X	0
Mosquitofish Gaaf	X	X	X	0	0	X	X
Rainbow trout Onmy	0	0	0	0	X	0	0
Threadfin shad Dope	0	X	0	X	X	X	X
Redbelly tilapia Tizi	0	0	0	0	X	X	0
Blue tilapia Tiau	0	0	X	0	0	0	0
Yellow bass Momi	0	0	X	0	X	X	0
Striped bass Mosa	0	0	0	X	0	0	0
Total species	12	15	13	12	17	15	8
Native	3	3	3	0	3	3	2
Non-native	9	12	10	12	14	12	6
Percent native	25	20	23	0	18	20	25





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 fiscal year 1999 (October 1 1998 to September 30 1999). Native fishes indicated by asterisks. Abbreviations as in Clarkson (1996 a). Ab and Bb respectively indicate Above and Below electrical fish barriers on SRPn, SRPs and FGC canals.

Species	SanP	Gila	Salt	CAP	SRPn		SRPs		FCG	
					Ab	Bb	Ab	Bb	Ab	Bb
*Roundtail chub giro	0	0	1	0	244	5	498	47	0	0
Fathead minnow pipr	6	0	0	0	0	0	0	0	0	0
Goldfish caau	0	0	0	1	0	1	0	0	0	0
*Longfin dace agch	879	11	0	0	0	0	0	0	0	2
Grass carp ctid	0	0	0	9	2	1	0	4	0	0
Carp cyca	6	127	39	102	38	7	75	0	8	1
Red shiner cylu	60	921	0	11	392	512	4	511	118	412
*Sonora sucker cain	9	334	76	0	302	62	527	71	4	4
*Desert sucker pacl	134	220	275	0	418	28	129	154	0	0
Bigmouth buffalo iccy	0	0	0	0	2	0	0	0	0	0
Largemouth bass misa	1	51	133	17	41	29	67	11	0	0
Bluegill lema	0	16	0	246	4	6	17	10	0	0
Green sunfish lecy	30	41	13	1	2	2	0	10	0	0
Bluegill x green hybrid lepo/hybr	0	2	0	38	0	0	0	0	0	0
Redear sunfish lemi	0	0	3	21	0	0	0	0	0	0
Black crappie poni	0	2	0	0	0	0	0	0	0	0
Black bullhead amme	56	0	0	0	0	0	0	0	0	0
Yellow bullhead amna	10	201	7	0	0	0	0	0	23	1
Channel catfish icpu	10	232	6	6	398	8	223	23	53	6
Flathead catfish pyol	0	16	1	0	110	0	10	3	0	0
Mosquitofish gaaf	175	268	118	0	0	0	0	11	19	48
Rainbow trout onmy	0	0	0	0	51	0	0	0	0	0
Threadfin shad dope	0	82	0	1	2	4	20	0	7	2
Redbelly tilapia tizi	0	0	0	0	231	0	0	13	0	0
Blue tilapia tiau	0	0	112	0	0	0	0	0	0	0
Undetermined <i>Tilapia</i> tila	0	0	0	0	3297	0	3079	0	0	0
Yellow bass momi	0	0	3	0	2	1	2	0	0	0
Striped bass mosa	0	0	0	13	0	0	0	0	0	0
Native	1022	565	352	0	964	95	1154	222	4	10

Non-native	354	1959	435	466	4572	571	3497	596	228	470
Percent native	74.3	22.4	44.7	0	17.4	14.3	24.8	27.1	1.7	1.3

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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 fiscal year 1999 (October 1 1998 to September 30 1999). Stations are identified by 2-digit numeric codes that respectively indicate reach name, (1-up to 4-down-stream), and station name (1-3 for upper, middle, and lower) (see 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 station not sampled during FY 99; dash (--) indicates the designated reach or station does not exist on that stream/canal. Reaches along SRP and FGC canals are artificial; canal reaches 1 are above respective electrical fish barriers, 2-4 are below. FGC Reach 3 is in the Pima Lateral Feeder Canal. Abbreviations as in text; see also Clarkson (1996 a-c).

Reach/ Station	SanP	Gila	Salt	CAP	SRPn	SRPs	FCG
1-1	5	8	9	3	16	12	7
1-2	5	ns	12	7	--	--	5
1-3	6	12	8	5	--	--	--
total	6	13	13	9	16	14	7
n/nn	2/4	2/12	3/10	0/9	3/13	3/11	1/7
2-1	5	10	--	7	2	9	6
2-2	4	10	--	--	1	6	7
2-3	ns	8	--	--	3	8	1
total	5	12	--	7	3	12	8
n/nn	2/3	3/9	--	0/7	2/1	3/9	2/6
3-1	3	11	--	3	7	--	3
3-2	9	9	--	6	10	--	--
3-3	8	6	--	5	--	--	--
total	9	13	--	10	12	--	3
n/nn	3/6	3/10	--	0/10	3/9	--	1/2
4-1	--	ns	--	--	3	--	--
4-2	--	7	--	--	4	--	--
4-3	--	9	--	--	--	--	--
total	--	9	--	--	6	--	--
n-nn	--	2/7	--	--	2/4	--	--
all reaches	12	15	13	12	17	16	8
n/nn	3/9	3/12	3/10	0/12	3/14	3/13	2/6
percent native	25	20	23	0	18	20	25

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 fiscal year 1999 (October 1 1998 to September 30 1999). Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are total fish or number of young-of-year (age-0) followed by number of older age classes (age  $\geq 1$ ), if specified; subtotals and total number are for combined age classes.

Station	Date	agch	amme	amna	cain	cyca	cylu	gaaf	icpu	lecy	misa	pacl	pipr	
San Pedro River														
1-1-1	Hereford	10 26 98	0-20	7-20	0	0	0	0	0-1	0	9-0	0	1-49	0
1-1-2	Lewis Springs	10 27 98	0-4	0-8	0	0	0	0	0-87	0	0-1	0	0-1	0
1-1-3	Charleston	10 27 98	167	7	0	0	0	0	62	0	11	1	20-50	0
	subtotal		191	42	0	0	0	0	150	0	21	1	121	0
1-2-1	Hughes Ranch	10 28 98	247	11	0	0	0	0	0	0	1-1	0	1-4	2
1-2-2	Soza Ranch	10 28 98	383	1-2	0	0	0	0	0	0	2-3	0	0	4
	subtotal		630	14	0	0	0	0	0	0	7	0	5	6
1-3-1	Aravaipa Creek	10 29 98	24-7	0	0	0	2	1-11	0	0	0	0	0	0
1-3-2	Swingle Wash	10 29 98	15	0	5-0	4-2	4-1	28	4	5-0	2-0	0	2-4	0
1-3-3	Mouth	10 29 98	12	0	5-0	2-1	0-1	30	9	5-0	0	0	2-0	0
	subtotal		58	0	10	9	6	60	25	10	2	0	8	0
Total number			879	56	10	9	6	60	175	10	30	1	134	6

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 fiscal year 1999 (October 1 1998 to September 30 1999). Fish species listed alphabetically using standard abbreviations per Clarkson (1996); data are total fish or number of young-of-year (age-0) followed by number of older age classes (age  $\geq 1$ ), if specified; subtotals and total number are for combined age classes.

Station	Date	Fish species														
		agch	amna	cain	cyca	cylu	dope	gaaf	icpu	lecy	lema	hybr	misa	pacl	poni	pyol
Gila River																
2-1-1	11 10 98	0	0	0	0-18	17	65	0	0-15	0-1	0	0-2	1-2	0	0	0-8
2-1-3	11 10,11 98	0	25-2	0-33	0-3	65	2	14	2-1	12-6	0	0	4-17	1-9	1-0	3-0
	subtotal	0	27	33	21	82	67	14	18	19	0	2	24	10	1	11
2-2-1	10 26 98	0	1-8	1-123	2-13	85	0	81	2-2	1-6	0	0	4-7	0-17	0-1	0
2-2-2	10 26 98	1	1-2	96	2-26	560	0	0	11-10	1-1	0	0	6-2	14	0	1-2
2-2-3	10 27 98	0	8-9	10-26	12-12	37	0	0	4-0	2-4	0	0	0	5-44	0	1-0
	subtotal	1	29	256	67	682	0	81	29	15	0	0	19	80	1	4
2-3-1	11 02 98	10	23-3	15-8	14-2	104	9-0	50	2-2	0	14-2	0	5-3	94-11	0	0
2-3-2	11 02 98	0	29-9	1-0	1-13	1	0	13	35	0-2	0	0	0	2-0	0	1-0
2-3-3	11 03 98	0	9-9	0	1-1	1	0	1	14-0	2-2	0	0	0	0	0	0
	subtotal	10	82	24	32	106	9	64	53	6	16	0	8	107	0	1
2-4-1	not sampled															
2-4-2	11 03 98	0	20-4	3-1	2-0	13	0	6	129-1	0	0	0	0	4-5	0	0
2-4-3	11 04 98	0	38-1	16-1	5	38	6-0	103	1-1	1-0	0	0	0	4-10	0	0
	subtotal	0	63	21	7	51	6	109	132	1	0	0	0	23	0	0
Total number		11	201	334	127	921	82	268	232	41	16	2	51	220	2	16



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 fiscal year 1999 (October 1 1998 to September 30 1999). Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are total fish or number of young-of-year (age-0) followed by number of older age classes (age  $\geq 1$ ), if specified; total number is for combined age classes.

Station	Date	amna	cain	cyca	gaaf	giro	icpu	lecy	lemi	misa	momi	pacl	pyol	tiau
Salt River														
3-1-1	11 04 98	0-3	0-23	10	1	0	0	0-4	0-1	19-18	0	13-122	0	103-0
3-1-2	10 15 98	3-1	0-36	1-14	117	1-0	0-6	4-1	0	49-7	0-2	2-137	0-1	4-0
3-1-3	10 16 98	0	0-17	14-0	0	0	0	2-2	0-2	27-13	0-1	1-0	0	1-4
	Total number	7	76	39	118	1	6	13	3	133	3	275	1	112

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 fiscal year 1999 (October 1 1998 to September 30 1999). Fish species listed alphabetically using standard abbreviations per Clarkson (1996); data are total fish or number of young-of-year (age-0) followed by number of older age classes (age  $\geq 1$ ), if specified; subtotals and total number are for combined age classes.

Station	Date	Fish species											
		caau	ctid	cyca	cylu	dope	icpu	lecy	lepo	lema	lemi	misa	mosa
CAP Pumping Plants													
4-1-1	09 29 98	0	0	0	0	0	0	0	38-0	0-1	0	0	0-3
4-1-2	09 30 98	0	0-1	0	0	0	0-3	1-0	0	2-0	0-1	0-1	0-2
4-1-3	10 01 98	0	0-1	0-10	0	0	0	0	0	1-0	0	0-5	0-1
	subtotal	0	2	10	0	0	3	1	38	4	1	6	6
4-2-1	01 25 99	0	0-1	0-56	1	0	0-2	0	0	1-0	0	0-2	0-5
4-3-1	01 29 99	0	0	0-33	10	0	0	0	0	0	0	0	0-1
4-3-2	01 27 99	0	0	0-3	0	0	0-1	0	0	0-3	0-19	0-9	0-1
4-3-3	01 28 99	0-1	0-6	0	0	0-1	0	0	0	0-238	0-1	0	0
	subtotal	1	6	36	10	1	1	0	0	241	20	9	2
	Total number	1	9	102	11	1	6	1	38	246	21	17	13



TABLE 5E. 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 fiscal year 1999 (October 1 1998 to September 30 1999). Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are total fish or number of young-of-year (age-0) followed by number of older age classes (age  $\geq 1$ ), if specified; total number is for age classes combined. See Table 1 for sampling dates. A single goldfish (caau) that was captured below the barrier at station 38 is not shown.

Station	Fish species																
	cain	ctid	cyca	cylu	dope	giro	iccy	icpu	lecy	lema	misa	momi	onmy	pacl	pylol	tila	tizi
SRP North (Arizona) Canal																	
Above barrier	270-32	0-2	0-38	82-310	0-2	244-0	0-2	282-116	0-2	0-4	6-35	0-2	2-49	254-164	4-106	2770-527	226-5
subtotal	302	2	38	392	2	244	2	398	2	4	41	2	51	418	110	3297	231
Below barrier	0-6	0	0	0	0	0	0	0	0	0	0	0	0	0-6	0	0	0
0.25 blw dam	0	0	0	0-200	0	0	0	0	0	0	0	0	0	0	0	0	0
6.6	no quantitative data																
7.8	0-20	0	0	0-300	0	0	0	0	0	0	0	0	0	0-5	0	0	0
subtotal	26	0	0	500	0	0	0	0	0	0	0	0	0	11	0	0	0
11	no quantitative data																
14	0-15	0	0-6	0	0	0	0	0-3	0	0-2	0-5	0-1	0	0-2	0	0	0
14	2-18	0-1	0-1	0-12	0-4	5-0	0	0	1-1	1-0	10-8	0	0	1-7	0	0	0
14.2	no quantitative data																
subtotal	35	1	7	12	4	5	0	3	2	3	23	1	0	10	0	0	0
31	0-1	0	0	0	0	0	0	0	0	0	0-2	0	0	0-7	0	0	0
38	0	0	0	0	0	0	0	0-5	0	0-3	0-4	0	0	0	0	0	0
subtotal	1	0	0	0	0	0	0	5	2	3	6	0	0	7	0	0	0

Total number 364 3 45 904 6 249 2 406 4 10 70 3 51 446 110 3297 231

TABLE 5F. 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 fiscal year 1999 (October 1 1998 to September 30 1999). Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are total fish or number of young-of-year (age-0) followed by number of older age classes (age  $\geq$ 1), if specified; total number is for age classes combined. See Table 1 for sampling dates.

Station	Fish species															
	cain	ctid	cyca	cylu	dope	gaaf	giro	icpu	lecy	lema	misa	momi	pacl	pyol	tila	tizi
SRP South Canal																
Above barrier	527	0	1-74	4	17-3	0	428-70	78-145	0	6-11	4-63	2-0	83-46	4-6	2595-484	0
subtotal	527	0	75	4	20	0	498	223	0	17	67	2	129	10	3079	0
Below barrier	0-44	0	0	0-104	0	0-11	1-0	22-0	0	1-0	0	0	1-105	0-1	0	11-2
2.8 mi blw dam	0-26	0-4	0	0-207	0	0	46-0	0	0	0	0-2	0	0-31	0	0	0
4.0	0-1	0	0	0-200	0	0	0	1-0	10-0	9-0	9-0	0	0-17	2-0	0	0
9.0	no quantitative data															
subtotal	71	4	0	511	0	11	47	23	10	10	11	0	154	3	0	13
Total number	598	4	75	515	20	11	545	246	10	27	78	2	283	13	3079	13

TABLE 5G. Fish catch at Florence-Casa Grande 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 fiscal year 1999 (October 1 1998 to September 30 1999). Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are total number of fish or number of young-of-year (age-0) followed by number of older age classes (age  $\geq 1$ ), if specified.

Station	Date	Fish species							
		agch	amna	cain	cyca	cylu	dope	gaaf	icpu
Florence-Casa Grande Canal									
Above fish barrier									
0.5 mi below dam	10 17 98	0	18-2	3-1	0-5	0-85	0-7	0-8	17-0
1.5	10 17 98	0	3-0	0-0	0-3	0-33	0	0-11	36-0
subtotal		0	23	4	8	118	7	19	53
Below Fish Barrier									
2.6	10 17 98	0-2	0	0-1	0	0-122	0-1	0-1	4-0
10.5	10 17 98	0	1-0	0-1	0-1	0-27	0-1	0-40	2-0
15.2	10 17 98	0	0	0-1	0	0	0	0	0
subtotal		2	1	3	1	149	2	41	6
Pima Lateral Feeder	10 17 98	0	0	1-0	0	0-263	0	0-7	0
Total number		2	24	8	9	530	9	67	59

TABLE 5H. Fish catch at non-standard 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 fiscal year 1999 (October 1 1998 to September 30 1999. Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are number of young-of-year (age-0) followed by number of older age classes (age  $\geq$ 1).

Station	Date	Fish species									
		amna	ctid	cyca	cylu	gaaf	icpu	misa	pacl	tiau	tizi
SRP Consolidated Canal	10 24 98	3-0	0-2	0-1	0-250	0-340	27-0	2-0	0-17	0-1	0-101
SRP Tempe Canal	10 24 98	no quantitative data									