

## Blue River Fish Barrier Monitoring



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## Summary

Lower Blue River in Greenlee Co., Arizona was visited on October 16 & 17, 2012 to monitor fishes down- (Reach 1 - San Francisco confluence to barrier) and upstream (Reach 2 - barrier to Pat Mesa) of a fish barrier constructed by Reclamation and completed in June 2012. Fishes were sampled by backpack electroshocker from two fixed sites (one, 100-m site below the barrier and one, 200-m site above the barrier), two random 200-m sites above the barrier, and opportunistically both above and below the barrier. A straight seine also was deployed below the barrier. Fourteen pools > 1m deep were inspected with mask and snorkel. Gaged stream discharge was near 3 cfs at the time of our visit, and water was clear to slightly turbid. Weather conditions were ideal for both collections and snorkel surveys. Fishes overall were uncommon and catch rates were low. Native longfin dace *Agosia chrysogaster*, and non-native fathead minnow *Pimephales promelas*, yellow bullhead *Ameiurus natalis* (all age 1+), western mosquitofish *Gambusia affinis* and green sunfish *Lepomis cyanellus* (all age-0) were captured below the barrier, and all but yellow bullhead and western mosquitofish, plus channel catfish *Ictalurus punctatus* (all age 1+), were encountered above the barrier. Non-native northern crayfish *Orconectes virilis* was occasionally observed throughout. Lowland leopard frog *Lithobates yavapaiensis* was common along the stream margin and one canyon treefrog *Hyla arenicolor* was seen in the riparian area.

## Introduction

Blue River is a tributary to San Francisco River (Gila River basin) that drains mountain terrains in Apache and Greenlee cos. Arizona, and Catron Co., New Mexico. Nearly the entire watershed is within lands administered by USDA Forest Service on Apache-Sitgreaves and Gila National Forests, but private inholdings are found along certain stream segments. The stream historically was occupied by longfin dace *Agosia chrysogaster*, speckled dace *Rhinichthys osculus*, loach minnow *Tiaroga cobitis*, Sonora sucker *Catostomus insignis*, and desert sucker *Pantosteus clarki* (Silvey et al. 1984), and a native trout (see Minckley 1973, Minckley & Marsh 2009). Razorback sucker *Xyrauchen texanus* historically may have accessed the stream, and tens of thousands were stocked in the late 1980s (Hendrickson 1993) but failed to establish.

Since 1950, non-native brown trout *Salmo trutta*, brook trout *Salvelinus fontinalis*, rainbow trout *Oncorhynchus mykiss*, Apache trout *Oncorhynchus apache*, fathead minnow *Pimephales promelas*, channel catfish *Ictalurus punctatus*, flathead catfish *Pylodictis olivaris*, red shiner *Cyprinella lutrensis*, common carp *Cyprinus carpio*, largemouth bass *Micropterus salmoides*, and western mosquitofish *Gambusia affinis* have been periodically detected within the drainage (Reclamation 2010). A single green sunfish *Lepomis cyanellus* was detected in lower Blue River in late 2011 by the Arizona Game and Fish Department (AZGFD). To protect native species from non-native fishes in the San Francisco River, Reclamation constructed a fish barrier (cover photo) on Blue River approximately 0.8 km upstream from its mouth. The barrier was completed in

June 2012. Immediately following closure of the barrier, roundtail chub *Gila robusta* and spikedace *Meda fulgida* were stocked in attempt to establish new populations of these two native fishes.

Reclamation commissioned Marsh & Associates to conduct annual, post-barrier construction fish monitoring of lower Blue River. The primary purpose of this activity is to assess the effectiveness of Reclamation's newly constructed barrier in preventing upstream invasions of non-native fishes. This is to be accomplished by general monitoring of fish assemblage structure above and below the barrier to document presence of non-native fishes upstream of the barrier, assess effectiveness of mechanical removal of non-native fishes, and determine success or failure of introductions of new native species. This report provides results of the first monitoring event, which was conducted in autumn 2012.

### **Methods**

The constructed fish barrier on lower Blue River (Figure 1) is located near UTM 668124E 367503E (NAD83) and is accessed most readily from downstream by vehicle via Martinez Ranch Road to a primitive road along the San Francisco River to Blue River, from upstream by 12 km hike down river from Juan Miller Crossing (Forest Service Road 475), or via helicopter. The portion of Blue River to be monitored included two segments: Reach 1 from San Francisco River to the fish barrier, and Reach 2 from the fish barrier upstream to Pat Mesa (Figure 1). Reach 2 was further subdivided into 23, 200-m long sub-reaches, consecutively numbered 1-23, upstream from the fish barrier. We visited the area on October 16 & 17, 2012 and followed most protocols and procedures described by Clarkson et al. (2011); we followed AZGFD (2012) with respect to site lengths (200-m) and fish measurements.

Two fixed sites, one below and one above the barrier were established during a preliminary reconnaissance and inspection on October 4 & 5, 2012; UTM coordinates are in Table 1. The below barrier site was 100-m long and its downstream boundary was approximately 550 m downstream from the barrier and 250 m upstream from the San Francisco confluence. The above barrier site was 200-m long and its downstream boundary was approximately 3000 m upstream from the barrier in sub-reach 15.

Two, randomly-selected 200-m monitoring sites were established in Reach 2 prior to departure for the field; these were located in sub-reaches 5 and 9, respectively beginning 1000 and 1800 m upstream from the barrier (Table 1).

All sites were measured along the thalweg using a standard hip chain, and up- and downstream boundaries plus transitions between mesohabitat types (pool, riffle, and run) were marked with colored flags. Photographs at the above barrier fixed site were taken with views up- and downstream from the up- and downstream boundaries (total of four photos). Fishes were captured from individual mesohabitats using a Smith-Root

type 24-A backpack electrofisher (nominal settings I-5, 200 VDC; approximately 0.4-0.5 output amps) and species identity and number plus effort (shocking seconds real-time) were recorded onto standard data forms. The following procedure for measuring and processing captured fishes (AZGFD 2012, and project Statement of Work) was in place and followed in-part: all spikedace, loach minnow, and roundtail chub captured at each processing point will be measured for total length (TL, mm) until the number measured exceeds 100; thereafter fishes will be enumerated only. All large-bodied fishes (e.g., suckers, roundtail chub, or non-native piscivores) captured will be enumerated and similarly measured for TL; those species observed by snorkeling (see below) but not captured will be categorized by general size category:  $\leq 50$ , 51-100 and  $>100$  mm. Fishes captured during snorkeling surveys on this trip were only categorized by size group. Native fishes will be released alive downstream from the processing site and non-native fishes will be killed and buried. Mortalities of threatened or endangered species, if any, will be fixed, preserved, labeled, and submitted for accession into the Arizona State University Collection of Fishes in accordance with State and Federal permits. On this trip, only green sunfish captured above the barrier were measured.

After each random- or fixed-site monitoring was concluded, the stream was further examined, concentrating on habitats that might harbor non-native or rare fishes, and sampled opportunistically by backpack electroshocker or straight seine (4.6 x 1.2 m x 6.35 mm-mesh). The entire area was examined during sampling for other aquatic and riparian species such as frogs.

All pools within Reach 2 greater than about a meter deep were inspected by a diver using mask and snorkel. Pool location (UTM), fishes encountered, size category, disposition of fishes, and general comments were recorded.

Field data forms were checked for completeness and any errors corrected prior to departing the site. Data were later entered into Reclamations' Access<sup>®</sup>-based electronic database, and all entries were verified.

## **Results**

We visited the lower Blue River on October 16 & 17, 2012. Discharge measured near 3 cfs at the Juan Miller gage upstream of our study area (Figure 2), but flows at the barrier appeared lower. The stream channel immediately above the barrier was shallow and relatively wide (cover photo), but there was no deep reservoir-pool, and immediately downstream of the barrier apron the stream was similar. Habitat down- and upstream was shallow riffles and relatively few deep pools, and substrates were covered by or mixed with ash derived from the Wallow Fire that burned portions of the upper watershed in summer 2011. Weather was clear and mild, and water clarity was high, so conditions were ideal for stream sampling and visual inspection of pools.

*Fixed sites.* The 100-m below barrier fixed site was comprised of seven mesohabitats: four pools alternating with three riffles. Pools were up to 2 m deep and bottoms were ashy-silt, imbricated cobble, coarse organic debris, and bedrock. Riffles were cemented cobble with sparse gravel or sand. Fish were uncommon and only two species, western mosquitofish and green sunfish were taken in 367 seconds of electrofishing (Table 2).

Pool and riffle habitat upstream from the below barrier fixed site was sampled opportunistically by electrofisher, which resulted in capture of 27 individuals representing five fish species (Table 3). Catch included two native longfin dace, but was predominated by non-native fathead minnow, yellow bullhead (all age-1+, 5-10 cm TL), western mosquitofish, and green sunfish (all age-0). Fathead minnow was the most abundant species in the sample. The large pool at the upstream end of the below barrier fixed site also was sampled by seine, where four hauls yielded 11 fathead minnow (Table 3). Our captures of yellow bullhead represent the first records of the species for the stream.

Non-native crayfish was present but uncommon throughout the area downstream of the fish barrier. Adult lowland leopard frog *Lithobates yavapaiensis* was common, and several were captured to confirm its identity (see Brennan & Holycross 2006).

The 200-m above barrier fixed site was comprised of five mesohabitats: three pools alternating with two riffles. Pools were of variable depth to 1 m, with bottoms of silt, silt-ash, cobble, and sand. Riffles were imbricated cobble with localized growths of filamentous green alga *Cladophora glomerata*. Fish were uncommon and only two species, fathead minnow and green sunfish, were taken in 406 sec of electrofishing (Table 2).

*Random sites.* The 200-m sub-reach 5 (lower) random site was comprised of seven mesohabitats: four pools alternating with three riffles. Pools were mostly less than a meter deep and had bottoms of ashy-silt and cobble, bedrock, and sparse sand. Riffles were cemented cobble and ashy-silt. Fishes were uncommon and six individuals representing three species, longfin dace, fathead minnow, and green sunfish were captured in 430 sec electrofishing (Table 4).

The 200-m sub-reach 9 (upper) random site was comprised of five mesohabitats: two pools alternating with three riffles. Pools were shallow and had bottoms of ashy-silt, cobble, and bedrock. Riffles were cemented gravel and large cobble, ashy-silt, and locally lush filamentous green algae. Fishes were uncommon and 33 individuals representing three species, longfin dace (just more than half the catch), fathead minnow (about a third of total numbers), and green sunfish (less than 10% of catch) were captured in 711 sec electrofishing (Table 4).

Opportunistic sampling above the barrier consisted of electrofishing a 132-m segment immediately upstream of the sub-reach 5 (lower) random site. Habitat was

unremarkable alternating pool-riffle with substrates similar to those described for other sites. Fish were uncommon and 18 individuals comprising two species, fathead minnow (two thirds of catch) and green sunfish (a third of catch) were captured in 569 sec of electroshocking (Table 5).

Eleven green sunfish captured by electrofishing above the barrier were measured: mean TL = 75 mm, SD = 35, and range 23-114 mm. All were considered age-0.

*Pool sampling.* There were 14 pools within Reach 2 that were greater than about a meter in depth and available for examination using mask and snorkel (Table 6). Water generally was clear and visibility good. Each pool was carefully searched visually from the bank for fishes prior to entering the water, but none was seen. One, age-1+ (ca. 35 cm long) channel catfish was encountered in each of two pools, and one of these was removed (Table 6); all other pools were fishless.

*Miscellaneous observations.* Adult lowland leopard frog was common along the stream margin throughout the segment above the barrier. One adult canyon tree frog *Hyla arenicolor* and three black-tailed rattlesnake *Crotalus mollosus* were encountered in the near-stream riparian.

### **Acknowledgements**

R.W. Clarkson (Reclamation, Glendale, Arizona) assisted with logistics and participated in monitoring. Collections were authorized by permits issued by Arizona Game and Fish Department and U.S. Fish and Wildlife Service (Region 2, Albuquerque, New Mexico).

### **Literature Cited**

AZGFD (Arizona Game and Fish Department), Bureau of Reclamation, US Forest Service, and US Fish and Wildlife Service. 2012. Blue River native fish restoration project: stocking, non-native removal, and monitoring plan. Arizona Game and Fish Department, Phoenix.

Brennan, T.C. and A. T. Holycross. 2006. A Field Guide to Amphibians and Reptiles in Arizona. Arizona Game and Fish Department, Phoenix. 150 pages.

Clarkson, R.W., B.R. Kesner and P.C. Marsh. 2011. Long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona: Revision no. 3. Report, U.S. Fish and Wildlife Service, Arizona Ecological Services Office, Phoenix. Bureau of Reclamation, Glendale and Marsh & Associates, LLC, Tempe, Arizona. 26 pages + appendices.

- Hendrickson, D. A. 1993. Evaluation of the razorback sucker (*Xyrauchen texanus*) and Colorado squawfish (*Ptychocheilus lucius*) reintroduction programs in central Arizona based on surveys of fish populations in the Salt and Verde rivers from 1986 to 1990. Final report to Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix.
- Minckley, W.L. 1973. Fishes of Arizona. Arizona Game and Fish Department, Phoenix. 273 pages.
- Minckley, W.L. & P.C. Marsh. 2009. Inland fishes of the greater southwest: chronicle of a vanishing biota. University of Arizona Press, Tucson. 426 pages.
- Reclamation (Bureau of Reclamation). 2010. Final environmental assessment, Blue River native fish restoration project. Bureau of Reclamation, Phoenix Area Office, September 2010.
- Silvey, W., J.N. Rinne, and R. Sorenson. 1984. RUNWILD Wildlife/habitat relationships. Index to the natural drainage systems of Arizona – A computer compatible digital identification of perennial lotic waters. USDS Forest Service Southwestern Region Wildlife Unit Technical Report, Albuquerque, NM. 36 pages.

**Table 1.** Fish monitoring station boundaries (UTMs, NAD83, Zone 12 S), Blue River, Greenlee Co., Arizona, October 16 & 17, 2012. Sub-reach designations are m/200 upstream of the fish barrier; meters upstream from the fish barrier in parentheses.

Location	Type	Sub-reach (m)	Lower boundary	Upper boundary
Below barrier	Fixed	---	668272E 3676054N	668177E 3676076N
Above barrier	Random	5 (1000)	667869E 3677155N	667718E 3677277N
Above barrier	Random	9 (1800)	667501E 3677665N	667523E 3677852N
Above barrier	Fixed	15 (3000)	668392E 3678112N	668473E 3678234N

**Table 2.** Results of fish monitoring within two, fixed sites, one below and one above the constructed fish barrier on Blue River, Greenlee Co., Arizona, October 16 & 17, 2012. The below barrier site is 100-m in length and its downstream boundary is approximately 550 m downstream of the barrier; the above barrier site is 200-m long and its downstream boundary is approximately 3000 m upstream of the barrier (sub-reach 15). Effort is seconds real-time electrofishing, and CPE is number of fish per unit effort.

Downstream (below barrier) fixed site; effort = 367 sec

Species	Catch	Proportion	CPE
Western mosquitofish	6	0.75	0.016
Green sunfish	2	0.27	0.005
Totals	8	1.00	0.022

Upstream (above barrier) fixed site; effort = 406 sec

Species	Catch	Proportion	CPE
Fathead minnow	2	0.67	0.005
Green sunfish	1	0.33	0.002
Totals	3	1.00	0.007



**Table 3.** Results of opportunistic electrofishing and seine monitoring below the constructed fish barrier on Blue River, Greenlee Co., Arizona, October 16, 2012. Habitats sampled were two pools and a riffle beginning at the upstream boundary of the below-barrier fixed site (Table 1). Effort is seconds real-time electrofishing or number of seine hauls, and CPE is number of fish per unit effort. Native species are indicated by an asterisk (\*).

Opportunistic electrofishing downstream (below barrier); effort = 98 sec

Species	Catch	Proportion	CPE
Longfin dace*	2	0.07	0.020
Fathead minnow	13	0.48	0.133
Yellow bullhead	3	0.11	0.031
Western mosquitofish	6	0.22	0.061
Green sunfish	3	0.11	0.031
Totals	27	1.00	0.276

Opportunistic seining downstream (below barrier); effort = 4 hauls

Species	Catch	Proportion	CPE
Fathead minnow	11	1.00	2.75

**Table 4.** Results of fish monitoring within two, random sites above the constructed fish barrier on Blue River, Greenlee Co., Arizona, October 17, 2012. Downstream boundaries of sites were 1000 (sub-reach 5) and 1800 m (sub-reach 9) upstream of the barrier; each site was 200-m long. Effort is seconds real-time electrofishing, and CPE is number of fish per unit effort. Native species are indicated by an asterisk (\*).

Above Barrier, lower Random Site – Sub-reach 5; effort = 430 sec

Species	Catch	Proportion	CPE
Longfin dace*	3	0.50	0.007
Fathead minnow	2	0.33	0.005
Green sunfish	1	0.17	0.002
Totals	6	1.00	0.014

Above Barrier, upper Random Site – Sub-reach 9; effort = 711 sec

Species	Catch	Proportion	CPE
Longfin dace*	18	0.55	0.025
Fathead minnow	12	0.36	0.017
Green sunfish	3	0.09	0.004
Totals	33	1.00	0.046

**Table 5.** Results of opportunistic electrofishing above the constructed fish barrier on Blue River, Greenlee Co., Arizona, October 16, 2012. Habitats sampled were three pools and two riffles extending 132 m upstream from the upstream boundary of the above barrier Random Site (sub-reach 5). Effort is seconds real-time electrofishing, and CPE is number of fish per unit effort.

Opportunistic electrofishing upstream of barrier; effort = 569 sec

Species	Catch	Proportion	CPE
Fathead minnow	12	0.67	0.211
Green sunfish	6	0.33	0.011
Totals	18	1.00	0.032

**Table 6.** Location (UTMs, NAD83, Zone 12 S) of 14 pools and results of snorkel surveys, Blue River, Greenlee Co., Arizona, October 16 & 17, 2012. Pools numbers are down- to upstream above the constructed fish barrier.

Pool No.	Location		Survey Result
1	668205 E	3676745 N	fishless
2	667782 E	3677243 N	fishless
3	667672 E	3677326 N	1, age-1+ channel catfish
4	667484 E	3677437 N	fishless
5	668102 E	3678439 N	fishless
6	668182 E	3678427 N	fishless
7	668166 E	3678276 N	fishless
8	668422 E	3678100 N	fishless
9	668450 E	3678210 N	fishless
10	668558 E	3678332 N	1, age-1+ channel catfish (removed)
11	668565 E	3678525 N	fishless
12	668310 E	3678641 N	fishless
13	668230 E	3678899 N	fishless
14	668207 E	3679103 N	fishless

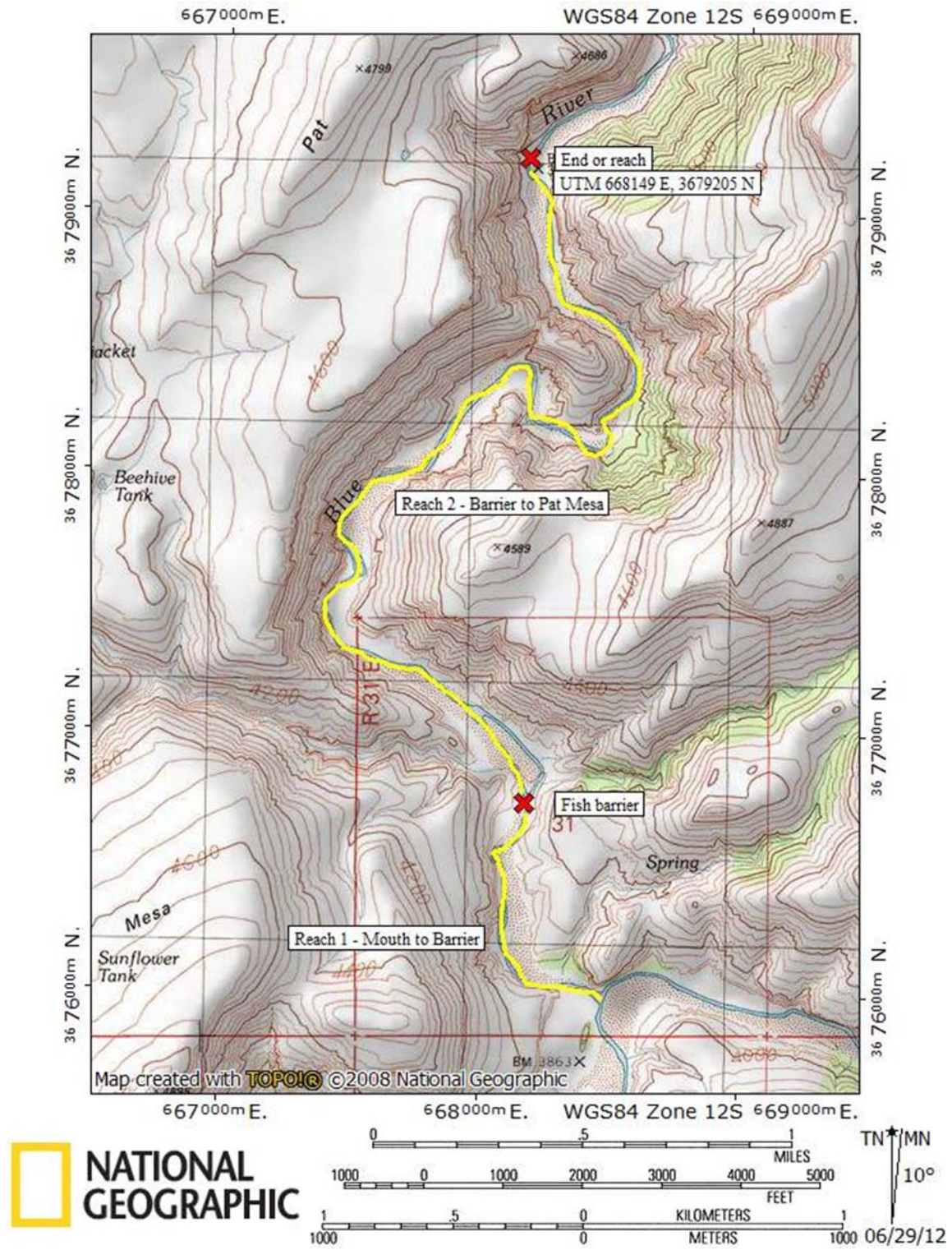


Figure 1. Map of lower Blue River, Greenlee County, Arizona, showing location of fish barrier and sampling Reaches 1 & 2. Map locations provided by Reclamation.

### USGS 09444200 BLUE RIVER NEAR CLIFTON, AZ.

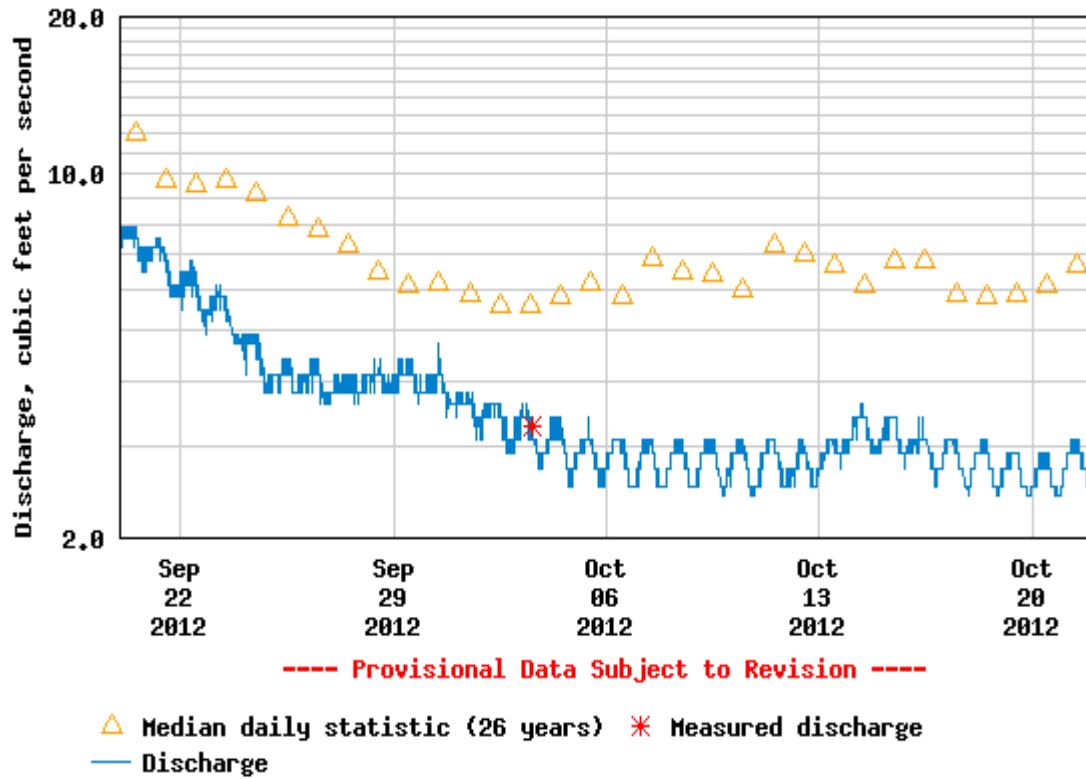


Figure 2. Discharge in Blue River, Greenlee Co., Arizona during and prior to the period of fish monitoring October 16 & 17, 2012. The gage site at Juan Miller Crossing is about 12 km upstream of the barrier.