

I. Project Title: **Monitoring the Colorado pikeminnow population estimate in the mainstem Colorado River via periodic population estimates**

II. Bureau of Reclamation Agreement Number(s): R10PG40070 & R13PG40018

Project/Grant Period: Start date (Mo/Day/Yr): 6/3/2013
End date: (Mo/Day/Yr): 9/30/2017
Reporting period end date: 9/30/2013
Is this the final report? Yes _____ No X

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IV. Abstract:

The Interagency Standardized Monitoring Program (ISMP) was developed in 1986 to monitor population trends of Colorado pikeminnow and humpback chub in the Colorado River Basin using catch per effort (CPE) indices. ISMP was expanded in 1998 to include mark-recapture population estimates of the major Colorado pikeminnow and humpback chub populations. For Colorado pikeminnow in the upper Colorado River, population estimates were conducted annually during 1991–1994, 1998–2000, 2003–2005, and 2008–2010. The current three-year field sampling effort began in 2013 and is scheduled to continue in 2014 and 2015.

A draft report that presents the results of this three-year effort and puts these findings into context with those from previous efforts is scheduled to be ready for peer review on 30 August 2016, with a draft final report scheduled to be ready for approval consideration by 31 October 2016. This report is scheduled to be finalized by 31 December 2016.

V. Study Schedule: 2013-2017

VI. Relationship to RIPRAP:

Colorado River Action Plan:

Colorado River Mainstem

V. Monitor populations and habitat and conduct research to support recovery actions.

V.A. Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

VII. Accomplishment of FY 2013 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Sampling occurred from 1 April to 14 June 2013. We completed four passes in the upper Colorado River (Price-Stubb diversion dam to Westwater Wash) and three passes in the lower Colorado River (Cisco boat launch to the confluence of the Green River). Pass 1 sampling took place from 1 April to 15 May, Pass 2 from 19 April to 23 May, Pass 3 from 20 May to 14 June, and Pass 4 from 3-14 June. Pass 4 sampled only the upper river. The lower river was not sampled for a fourth pass due to the inability of heavily-laden, motorized electrofishing boats to return upstream during low water conditions.

Sampling data from 2013 has been entered into Excel spreadsheets. However, the fish capture-recapture matrix for Colorado pikeminnow collections in 2013 has not yet been developed. Therefore an estimator model hasn't yet been chosen. Likewise, the point estimate ($N\text{-hat}$), confidence interval, probability of capture ($p\text{-hat}$), and coefficient of variation (C.V.) values have not yet been generated for 2013 sampling.

There were a total of 256 capture events with Colorado pikeminnow during 2013 sampling. The Colorado pikeminnow collected ranged from 95-930 mm TL (with weights up to 7,734 g) and were collected from RM 183.0 (2.5 miles downstream of Riverbend Park in Palisade, CO) downstream to RM 0.0 (the confluence of the Colorado and Green rivers). Of these 256 capture events, 159 occurred with Colorado pikeminnow that were large enough to have PIT tags. PIT tag numbers were recorded for 156 of those 159 events. Pit tag numbers weren't recorded for the other three capture events, due to PIT reader failure.

These 256 capture events translated to collecting 144 unique Colorado pikeminnow individuals during 2013 sampling that were large enough to have a PIT tag (range = 152-930 mm TL). Of these 144 individuals, 38 were collected during Pass 1 (15 in the upper river, 23 in the lower), 42 were collected during Pass 2 (10 in upper river, 32 in the lower), 49 were collected during Pass 3 (11 in the upper river, 38 in lower), and 15 were collected in Pass 4 (all in upper river). Twelve PIT-tagged fish were collected multiple times during 2013 sampling, with 10 individuals being collected twice and 1 fish being collected three times (i.e., a total of 12 recapture events).

Of the 144 unique, PIT-tagged Colorado pikeminnow collected in 2013, 42 (29.2%) were juvenile fish (i.e., ≤ 399 mm TL). Broken down further, 20 of the juvenile fish were ≤ 200 mm TL (size range of our captures = 152–183 mm TL), 3 were 200–299 mm TL (size range of our captures = 251–291 mm TL), and 19 were 300–399 mm TL (size range of our captures = 343–397 mm TL). Thirty-two (22.2%) of the 144 unique Colorado pikeminnow collected were recruiting sub-adult fish (i.e., 400–449 mm TL), with the size range of our captures being from 401–448 mm TL. The majority of unique, PIT-tagged Colorado pikeminnow encountered during 2013 sampling ($n = 70$; 48.6%) were adult fish (i.e., ≥ 450 mm TL), with the size range of our captures being from 450–930 mm TL.

There were also 97 collections of Colorado pikeminnow that were too small to be PIT-tagged (size range of our captures = 95–166 mm TL). Since these fish weren't PIT-tagged, it's unknown whether these were all unique individuals, or whether later collections represented a recapture of a previously-handled fish. All 97 collections of these smaller fish occurred in the lower river, with 45 being collected during in Pass 1 (from RM 35.9–5.0; May 12–15), 8 being collected during Pass 2 (from RM 72.7–0.0; May 20–23), 44 being collected during Pass 3 (from 63.9–15.2; June 3–14).

Table 1. Total number of Colorado pikeminnow > 250 mm TL captured in each sampling pass and year in the Colorado River study area, Colorado and Utah, 1991-2013. Totals include recaptures of the same fish caught in previous passes of the same year (in parentheses). Captures are partitioned by upper and lower reach.

Year	Lower reach sampling passes					Upper reach sampling passes				
	1	2	3	4	5	1	2	3	4	5
1991	37	---	---	---	---	23	17 (4)	25 (2)	---	---
1992	18	15 (1)	---	---	---	21	24 (2)	23 (2)	---	---
1993	51	41 (4)	---	---	---	31	31 (6)	33 (11)	---	---
1994	47	22 (3)	---	---	---	28	37 (3)	38 (6)	---	---
1998	31	56 (6)	---	---	---	47	73 (8)	55 (16)	---	---
1999	38	24 (2)	---	---	---	52	65 (8)	54 (18)	---	---
2000	31	19 (1)	---	---	---	51	52 (8)	28 (6)	---	---
2003	11	16 (0)	44 (0)	40 (2)	---	11	15 (0)	16 (2)	11 (1)	---
2004	28	36 (1)	27 (0)	---	---	19	16 (2)	48 (8)	---	---
2005	26	50 (3)	46 (7)	36 (6)	34 (5)	22	30 (4)	26 (4)	46 (5)	38 (9)
2008	13	29 (0)	35 (3)	23 (7)	---	17	15 (0)	17 (1)	20 (2)	16 (2)
2009	11	35 (0)	28 (3)	21 (4)	---	10	13 (0)	32 (0)	15 (2)	23 (9)
2010	19	14 (1)	35 (5)	37 (6)	---	14	19 (1)	15 (1)	22 (3)	17 (2)
2013	17	31 (0)	25 (4)	---	---	15	10 (1)	12 (1)	14 (5)	---

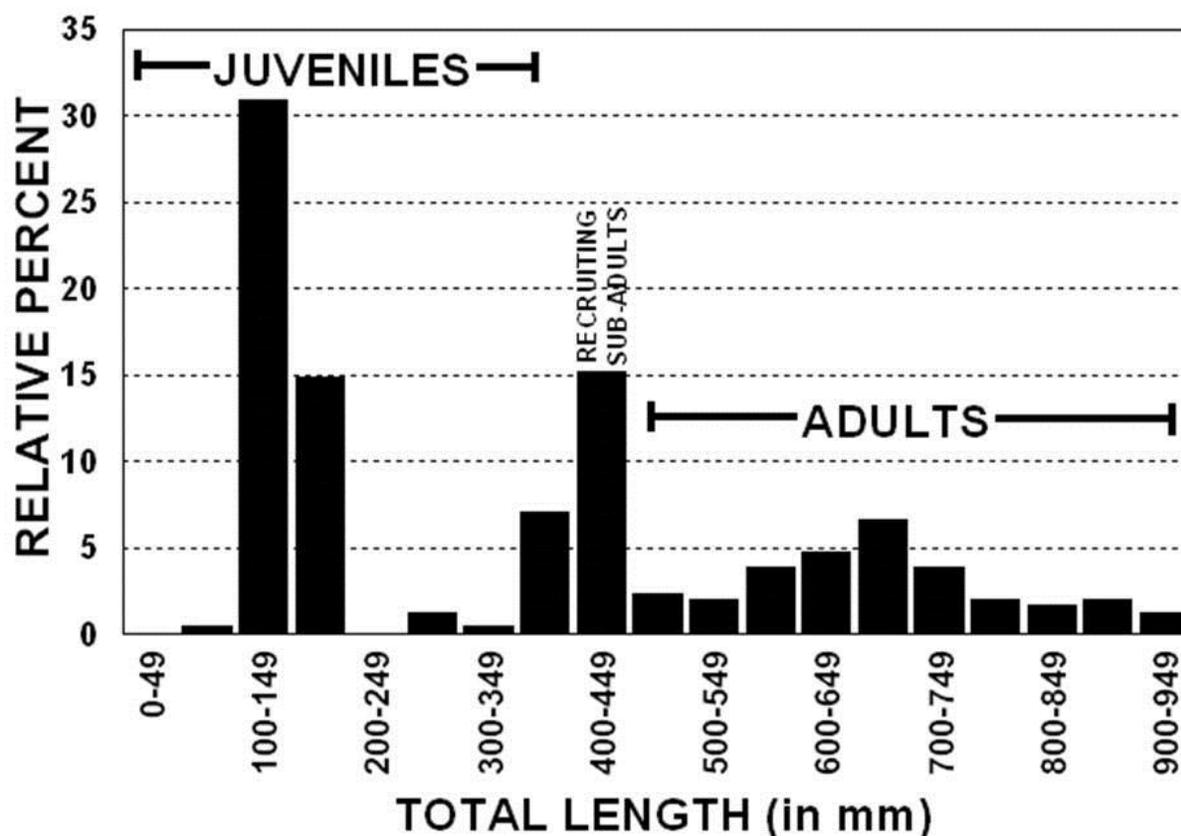


Figure 1. Length-frequency distribution of all 256 Colorado pikeminnow capture events during the population estimate study in the Colorado River in 2013.

VIII. Additional noteworthy observations:

Numerous other endangered fishes were collected during the 2013 Colorado pikeminnow population estimate study. These included: 1) 9 bonytail (range = 202–310 mm TL; 80–310 g) collected from RM 94.4–10.5. These fish were all unique individuals (i.e., no multiple recaptures); 2) 3 humpback chub (range = 271–335 mm TL; 176–286 g) collected at RM 136.5, 136.4, and 42.2. These fish were also all unique individuals (i.e., no multiple recaptures); 3) 708 razorback sucker recapture events (range = 106–630 mm TL; 5–3,350 g) collected from RM 193.6–0.0. These 708 capture events equate to 661 unique fish, among which there were 47 multiple recapture events (43 fish caught twice each and 2 fish caught three times each); and 4) 8 razorback sucker X flannelmouth sucker hybrids (range = 158–542 mm TL; 38–1988 g) collected from RM 62.6–3.0. These 8 capture events equate to 7 unique fish, with 1 fish being caught twice. None of the 7 razorback sucker X flannelmouth sucker hybrids had a PIT tag when first collected. The recapture event occurred with a razorback sucker X flannelmouth sucker hybrid that

was collected without a tag, PIT-tagged, and returned to the river, then recaptured about a month later.

Thirty-nine of the razorback sucker collected during 2013 Colorado pikeminnow sampling were juvenile fish (thought to be age-2 to age-3 fish). These fish (range = 106–240 mm TL; 8–162 g) were all collected from the lower river (from RM 83.9–14), using boat-mounted, shoreline electrofishing. They were collected during all three sampling passes (i.e., from 6 May to 14 June) in the lower river: 20 during Pass 1, 6 during Pass 2, and 13 during Pass 3. They were also collected over a wide variety of flows. Twenty-five were collected from backwaters, 7 from main channel shoreline run habitats, 4 from shoreline pool habitats, and 1 from an eddy. None of these fish had PIT tags when captured. Twenty-three were implanted with PIT tags prior to release, the other 16 were considered to be too small to be safely implanted with PIT tags.

In addition to these endangered fish collections, a large number of nonnative fish were encountered during the population estimate study in 2013. These included: 456 smallmouth bass, 259 walleye, 256 green sunfish, 76 largemouth bass, 76 bluegill, 70 gizzard shad, 46 black crappie, 6 grass carp, 5 northern pike, and 2 yellow perch. A more in depth discussion of the walleye collected in 2013 is attached as an appendix to this report.

IX. Recommendations:

- Continue the current schedule of three years of active sampling followed by a two-year rest period. Four passes per year continues to be the sampling goal (if river flows allow), with a fifth pass recommended when capture-recapture rates are low and runoff conditions or bass removal sampling allow a fifth pass.
- Continue to identify and remove problematic nonnative fish species encountered during the Colorado pikeminnow population estimate study. As in 2013, use the data from the spring Colorado pikeminnow sampling effort to help make adaptive management decisions about if and how to modify summer smallmouth bass removal efforts. Data gathered on Colorado pikeminnow sampling trips can be used to help guide reallocation and/or addition of nonnative fish removal efforts in the summer and fall (specifically what sections of river may need to be targeted for nonnative species of concern).

X. Project Status: On track and ongoing

XI. FY 2013 Budget Status

- A. Funds Provided: \$208,620
- B. Funds Expended: \$208,620
- C. Difference: \$0
- D. Percent of the FY 2013 work completed, and projected costs to complete: 100%

- E. Recovery Program funds spent for publication charges: \$0
- XII. Status of Data Submission: Data from the 2013 field season has been entered into spreadsheets and will be submitted to the UCREFRP database manager, once QA/QC work has been completed on the data set.
- XIII. Signed: Dale Ryden, Travis Francis 11/18/2013
Principal Investigator(s) Date

Appendix:

**Walleye captures during Colorado pikeminnow
sampling in the Colorado River
(updated 18 November 2013)**

Until this year, funded projects dedicated to non-native fish removal in the Colorado River have been confined to the ‘upper reach’ (Palisade to Westwater) and reaches further upstream (Rifle to DeBeque Canyon). For reaches occupied by the endangered fish, the only river-wide index to non-native fish relative abundance is the catch rate derived during the Colorado pikeminnow monitoring effort that runs from April through June. This spring monitoring effort includes electrofishing shorelines and trammel-netting backwaters. Three to five passes are made through occupied habitat per year. In addition to the aforementioned upper reach, surveys include the lower reach, which extends from the base of Westwater Canyon (Cottonwood Wash) to the confluence with the Green River. These surveys typically occur for three years in a row followed by a two-year non-sampling period. Since 2000, there have been two complete 3-year efforts (2003–2005 and 2008–2010) with 2013 being the first year of the next 3-year effort.

Three non-native species have significantly increased in the Colorado River since 2000: smallmouth bass, gizzard shad, and walleye. Another species of concern is northern pike, because significant numbers were detected near Rifle, Colorado in recent years. There is an annual centrarchid removal project conducted during July–October in the upper reach. Results of that project are reported at workshops and in annual and final reports. Captures of invasive species during the spring Colorado pikeminnow project are not routinely reported but are instructive in that they provide a river-wide perspective on distributional trends.

Gizzard shad first showed up in the study area in 2009. Northern pike and walleye have been captured rarely since at least 1980 (Valdez et al. 1982). Smallmouth bass were first detected in the Grand Valley in 1999 (Osmundson 2003). Annual catch-per-effort has not yet been calculated for these species, but total numbers captured during April–June provide a rough index from which we can draw some interim conclusions regarding distribution and trends in abundance (see Fig. 1).

Walleye captures in the Colorado River went from being ‘rare’ during 2003–2009 to ‘common’ in 2010, and then increased dramatically by 2013. Through 2009, total annual captures in the

lower reach ranged from two to six. In 2010, there were 46 captures. Captures of unique Colorado pikeminnow in 2010 in the lower reach totaled 92. Walleye captures were therefore about half those of Colorado pikeminnow. In 2013, total walleye captures soared to 259, almost four times that of adult Colorado pikeminnow captures ($n = 70$). Although a few walleye were captured in the upper reach during the 2012, summer, non-native removal project, none have been captured in the upper reach during spring Colorado pikeminnow sampling. To date, this sudden invasion of walleye into Colorado pikeminnow habitat appears to be largely restricted to the lower reach.

Length frequency of captured walleye was fairly similar between 2010 and 2013 with most individuals between 400 and 550 mm TL (Fig. 2). The most abundant 50-mm length group did, however, increase from 400-449 mm to 450-499 mm.

Distribution within the lower reach in 2010 appeared to be restricted to the lowest 80 miles of the study area (ending at the Green River confluence); however, by 2013, captures extended upstream to RM 112 at the top of the lower reach, indicating an upstream range expansion (Fig. 3). In both years, the area with the greatest number of captures was between RM 60 and 80, the reach between Moab and Onion Creek (Professor Valley). This 20-mile segment made up 18% of the lower reach yet yielded 46% (2010) and 38% (2013) of the captures, suggesting there may be a preference for this area. However, there were also a considerable number of captures in the primary nursery area of Colorado pikeminnow (downstream of Moab): 54% of captures in 2010 and 43% in 2013. Walleye distribution also overlapped that of young, naturally-produced razorback sucker captured in 2013 (Fig. 3).

Unlike smallmouth and largemouth bass, whose primary distribution is in the upper reach, walleye directly overlap with small size classes of both Colorado pikeminnow and razorback sucker. If probability of capture of walleye is similar to that of Colorado pikeminnow, our removal of 259 in 2013 may have only represented 10-20% of what was there. This invasion by a large-bodied piscivore constitutes a new and very significant threat to recruitment of both endangered species.

Other non-native fish observations include: 1) gizzard shad were most abundant in the lower reach; 2) northern pike remain relatively uncommon in both the lower and upper reaches with 0-5 captures per year; 3) the annual number of smallmouth bass captured in the lower reach has remained relatively low; 4) high numbers of smallmouth bass were captured in the upper reach in both 2004 (prior to removal efforts) and in 2013 (Fig. 1).

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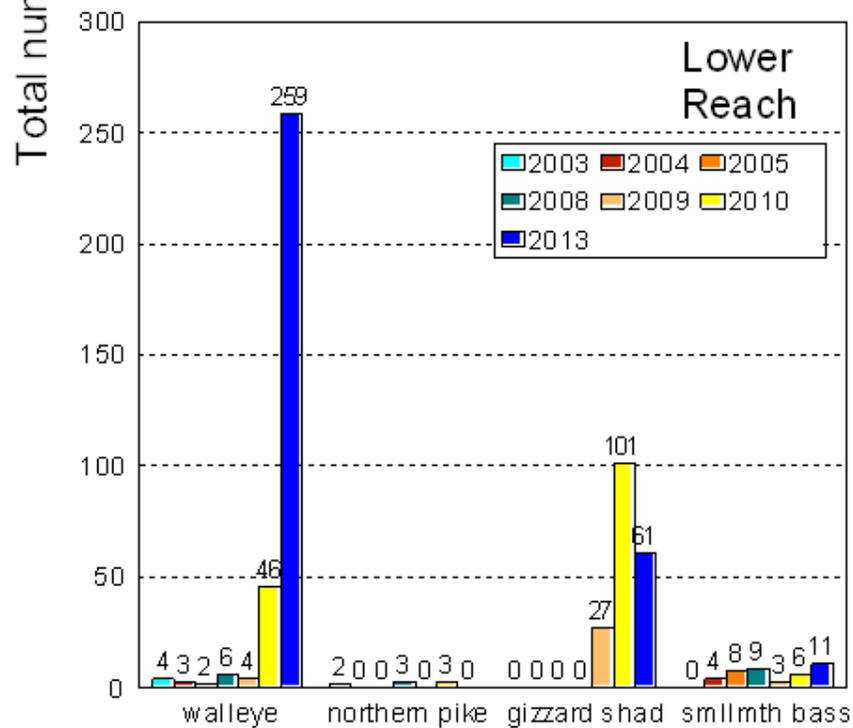
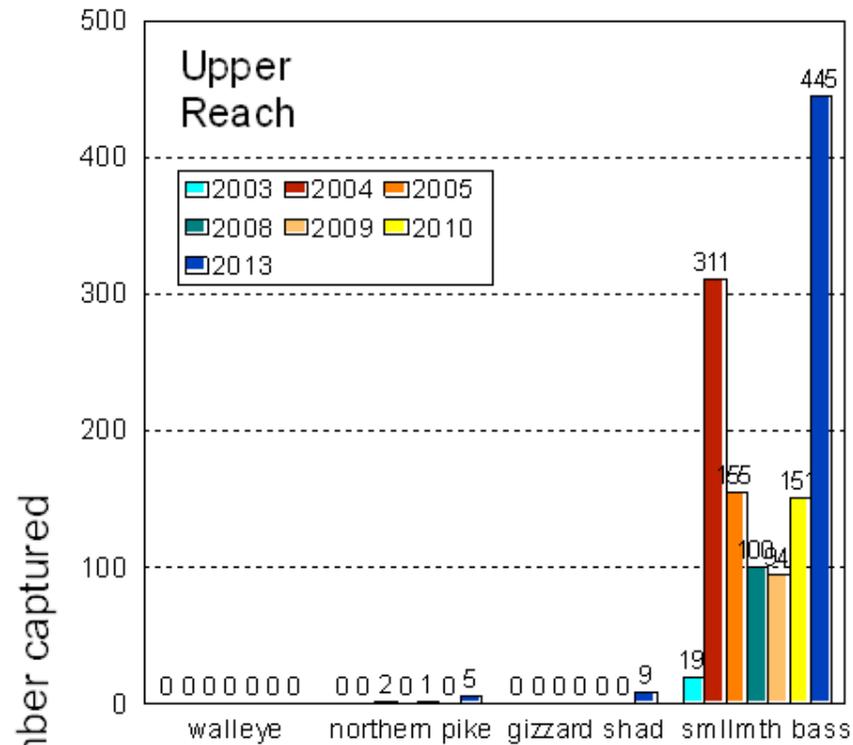


Table 1. Four species of non-native fish captured during April-June, river-wide sampling for endangered fish in the Colorado River using electrofishing and trammel netting, 2003-2013.

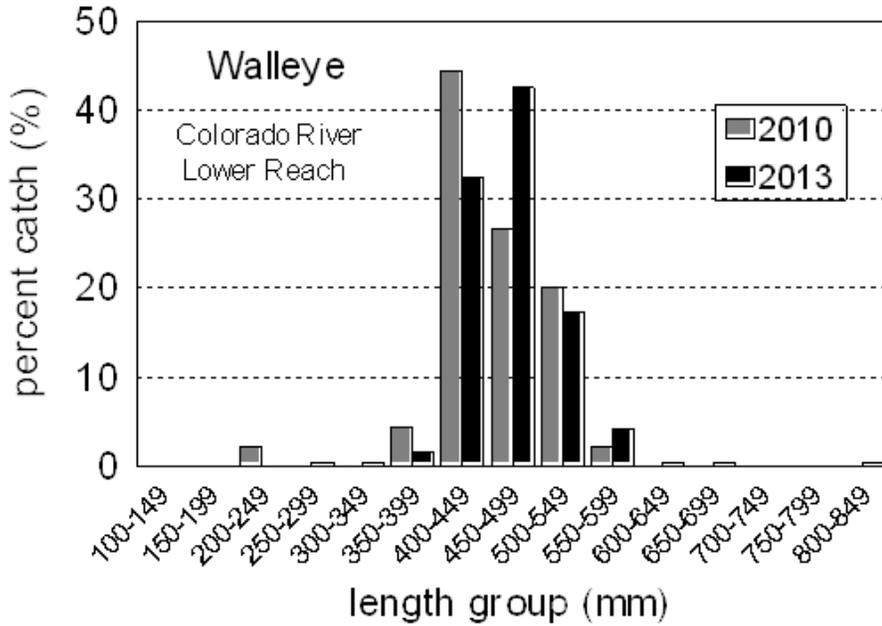


Figure 2. Length frequency of walleye captured from the lower Colorado River reach, 2010 and 2013

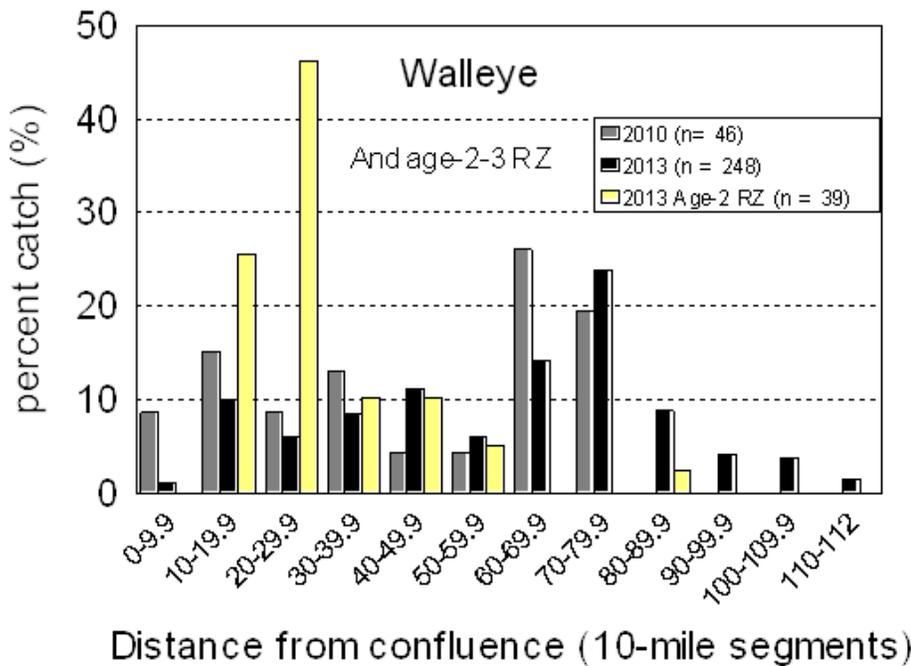


Figure 3. Distribution of walleye captures in the lower Colorado River reach, 2010 and 2013. Also shown is the distribution of age-2-3 naturally-produced razorback sucker captured in 2013.