

I. Project Title: **Assessment of Stocked Razorback Sucker Reproduction in the Lower Green and Lower Colorado Rivers**

II. Bureau of Reclamation Agreement Number: R14AP00007

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IV. Abstract: Determining the location, timing, extent, and success of razorback sucker spawning is essential for evaluating the effectiveness of the stocking program, identifying recruitment, and guiding future management. This study was designed to determine spawn timing as well as presence/absence and distribution of larvae and young-of-year razorback suckers in the Green River (since 2009) downstream from the town of Green River and in the Colorado River (since 2014) downstream of Moab. The study was prompted by increasing razorback sucker encounters, the presence of multiple age classes, and congregations of ripe razorback suckers (2001-2003 and 2006-2008; Bestgen et al 2012, UDWR unpublished data) during Colorado pikeminnow surveys. Larval razorbacks have been successfully collected since the beginning of the project by either light trapping and/or seining. In 2016, the mean catch per unit effort for the Lower Green River was less than 2015 but substantially more than the initial three years of the study (2009 – 2011). Larvae were widely distributed throughout all sampling sites in the lower Green River. In the lower Colorado River larval abundance has shown an increase since sampling began in 2014 and were distributed through all sampling areas.

V. Study Schedule: Initial year 2009, final year ongoing.

VI. Relationship to RIPRAP:

GENERAL RECOVERY PROGRAM SUPPORT ACTION PLAN

V. Monitor populations and habitat and conduct research to support recovery actions (research, monitoring, and data management).

- V.A. Measure and document population and habitat parameters to determine status and biological response to recovery actions.
- V.B.2. Conduct appropriate studies to provide needed life history information.

GREEN RIVER ACTION PLAN: MAINSTEM

- V. Monitor populations and habitat and conduct research to support recovery actions (research, monitoring, and data management).
- V.A. Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

COLORADO RIVER ACTION PLAN: MAINSTEM

- V. Monitor populations and habitat and conduct research to support recovery actions (research, monitoring, and data management).
- V.A. Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

VII. Accomplishment of FY 2016 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Task 1: Lower Green River light trap sample collection: Light trap samples were collected at sites between river miles 119.6 (Saleratus Canyon) and 4.2 (Shot Canyon) during three sampling events from 5/5/2016 to 6/13/2016. A total of 111 light trap samples were collected and of those, 99 samples were sent to the Colorado State University Larval Fish Laboratory (CSU LFL) for identification. During the study, main channel temperatures ranged from 15.5°C to 20.6°C with a median temperature of 17.0°C. Habitat temperatures ranged from 15.5°C to 27.0°C with a median temperature of 18°C.

The total number of razorback larvae captured in 2016 was 6239 (Figure 1). Mean catch per unit effort (CPUE) was 56 larvae per trap night; less than 2015 but substantially more than the initial three years of the study (2009 – 2011). (Figure 2). Eighty-eight percent of all samples taken contained razorback larvae, similar to 2012 -2015. The mean total length of razorback larvae captured was 12 mm (n = 4231; SD = 1; the maximum number measured per sample was 100); consistent with previous years (Figure 3). Razorback larvae were distributed through all sampling sites in 2016 (Figure 4). The high number of total larvae and high capture rates of 2012 – 2016 as compared to 2009 – 2011 indicate consistent reproductive success of razorback sucker in the wild.

Spawning and hatch dates for razorback suckers were calculated using formulas developed by Muth et al. (1998) and Bestgen et al. (2002) and data presented by Bozek et al. (1990). In general, razorback suckers spawn in the lower Green River from early April through early May when water temperatures are between 10 – 16°C and when degree days range between 350 – 1100 (Bestgen et al. 2002). Degree days are the sum of instantaneous water temperatures between 1 January and the earliest date of spawning

(Bestgen et al. 2002). Spawning generally begins 28 to 78 days prior to the highest flow day during spring runoff and nearly always before water temperatures reach 14°C (Bestgen et al. 2002). Green River spawning in 2016 was estimated to have begun 71 days prior to the spring runoff peak (6/14/2016) (Figure 5) in early April when water temperature was 15°C (Figure 6) and when degree days were at 501. Water temperatures during estimated spawning times ranged between 12°C to 19°C. Spawning was estimated to have spanned approximately seven weeks from 4/7/2016 to 5/29/2016. Temperature and discharge data were taken from the USGS gage 09315000 at Green River, UT

Task 2: Lower Green River sample for YOY and age 1+ razorback sucker: Seine samples were collected between river miles 119.5 and 0.8 during two sampling trips (8/2/2016 – 9/1/2016). A total of 5,728 m² was seined in 112 seine hauls; 13 samples were not identified in the field, preserved in 100% ethanol, and sent to CSU LFL for identification. One sample was collected using a backpack electrofisher. An area of 90 m² was sampled and no fish were preserved. No razorbacks were collected during YOY and age 1+ razorback sucker sampling in the Green River. During the study, main channel temperatures ranged from 21.0°C to 26.0°C with a median temperature of 25.0°C. Habitat temperatures ranged from 21.0°C to 35.0°C with a median temperature of 26.0°C.

Additional native species collected during seining efforts in 2015 included: bluehead sucker, Colorado pikeminnow, flannelmouth sucker, *Gila sp.*, and speckled dace (see section VIII for totals).

Task 3: Colorado River light trap sample collection: Light trap samples were collected at sites between river miles 67.1 and 21.3 during three sampling events from 5/16/2016 to 6/23/2016. A total of 90 light trap samples were collected and of those, 78 samples were sent to the CSU LFL for identification. During the study, main channel temperatures ranged from 14.0°C to 22.5°C with a median of 17°C. Habitat temperatures ranged from 14.5°C to 23.5°C with a median temperature of 19.0°C.

The total number of razorback larvae captured in 2016 by light trapping was 1687 (Figure 7). Mean CPUE was 19 larvae per trap night; an increase from the previous two years (Figure 8). Larvae were collected in 84% of all samples. Larvae had a mean total length of 12 mm (n = 1646; SD = 1; the maximum number measured per sample was 100). Larvae were found in all but one sample location. The number of razorback larvae captured increased from upstream to downstream with the highest concentrations of larvae found from river mile 27 – 20 (Figure 9).

Colorado River razorback sucker spawning was estimated to have begun 56 days prior to spring runoff peak (6/9/2016) in April (Figure 10) when water temperature reached 13.6°C (Figure 11) and degree days were at 554. Water temperatures during estimated spawning times ranged between 11°C – 17°C. Spawning was estimated to have spanned approximately seven weeks from 4/14/2016 to 6/4/2016 and began approximately 1 week later than lower Green River razorback sucker.

Task 4: Colorado River sample for YOY and age 1+ razorback sucker: Seine samples were collected between river miles 80 and 1.4 during two sampling passes in July, August, and September (7/27-7/29/16 and 8/5/16; 8/16-8/18/16 and 9/2/16). A total of 5699 m² was seined in 120 seine hauls; 5 samples were sent to CSU LFL for identification. No razorbacks were collected during YOY and age 1+ razorback sucker sampling in the Colorado River. During the study, main channel temperatures ranged from 22°C to 29°C with a median temperature of 24.0°C. Habitat temperatures ranged from 15.0°C to 31.0°C with a median temperature of 24.0°C.

Additional native species collected during seining efforts in 2016 included: bluehead sucker, Colorado pikeminnow, flannelmouth sucker, and *Gila sp.* (see section VIII for totals).

Task 5: Preliminary sample identification, data entry, analysis and reporting: All data has been entered. Collected samples were submitted to the CSU LFL for identification, and results are reported here.

VIII. Additional noteworthy observations:

Green River: Other native fishes captured in the Green River included bluehead sucker (n=5) ranging in total length from 29 to 48 mm, Colorado pikeminnow (n=142) ranging in total length from 18 to 56 mm, flannelmouth sucker (n=138) ranging in total length from 14 to 65 mm, *Gila sp.* (n=1; total length = 49 mm), and speckled dace (n=12; total length = 30 mm). Nonnative fishes captured on the Green River included red shiner, sand shiner, fathead minnow, channel catfish (n=21), common carp (n=67), gizzard shad (n=1), green sunfish (n=25).

Colorado River: Other native fishes captured in the Colorado River included bluehead sucker (n=15) ranging in total length from 77 to 130 mm, Colorado pikeminnow (n=82) ranging in total length from 17 to 146 mm, flannelmouth sucker (n=13) ranging in total length from 20 to 70 mm, *Gila sp.* (n=6) ranging in total length from 22 to 38 mm, and speckled dace (n=1). Nonnative fishes captured on the Colorado River included red shiner, sand shiner, fathead minnow, black bullhead (n=214), black crappie (n=2), bluegill (n=4), channel catfish (n=89), common carp (n=35), gizzard shad (n=507), green sunfish (n=1), largemouth bass (n=34), plains killifish (n=2), gizzard shad (n=507), and western mosquitofish (n=27).

IX. Recommendations:

- Continue sampling via light trapping for larval razorback sucker in both the Colorado and Green Rivers (May-June) to monitor the annual success and timing of reproduction.
- Continue seining in both the Colorado and Green Rivers (August-September) to monitor recruitment of YOY and juvenile razorback suckers.
- Consider expanding sampling reach below the confluence of the Green and Colorado Rivers in an effort to capture YOY and juvenile razorback sucker which may move

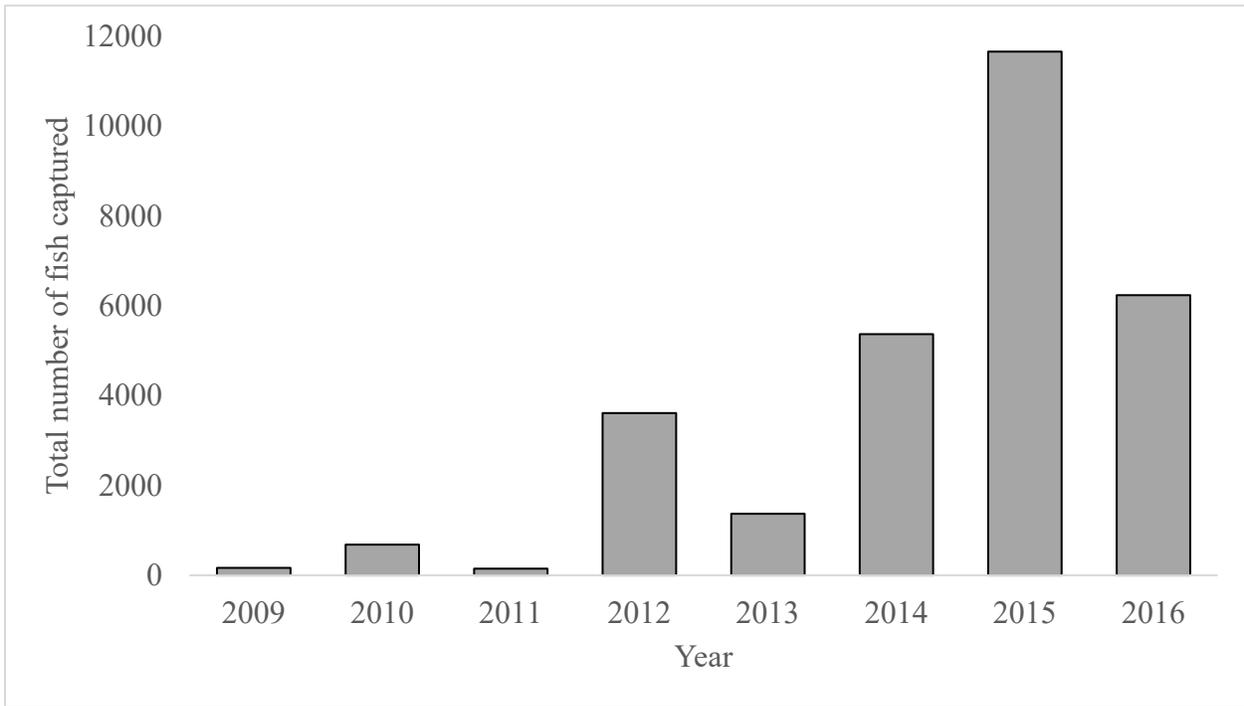


Figure 1. Total numbers of razorback sucker larvae captured by light trapping at all sites in the lower Green River by year.

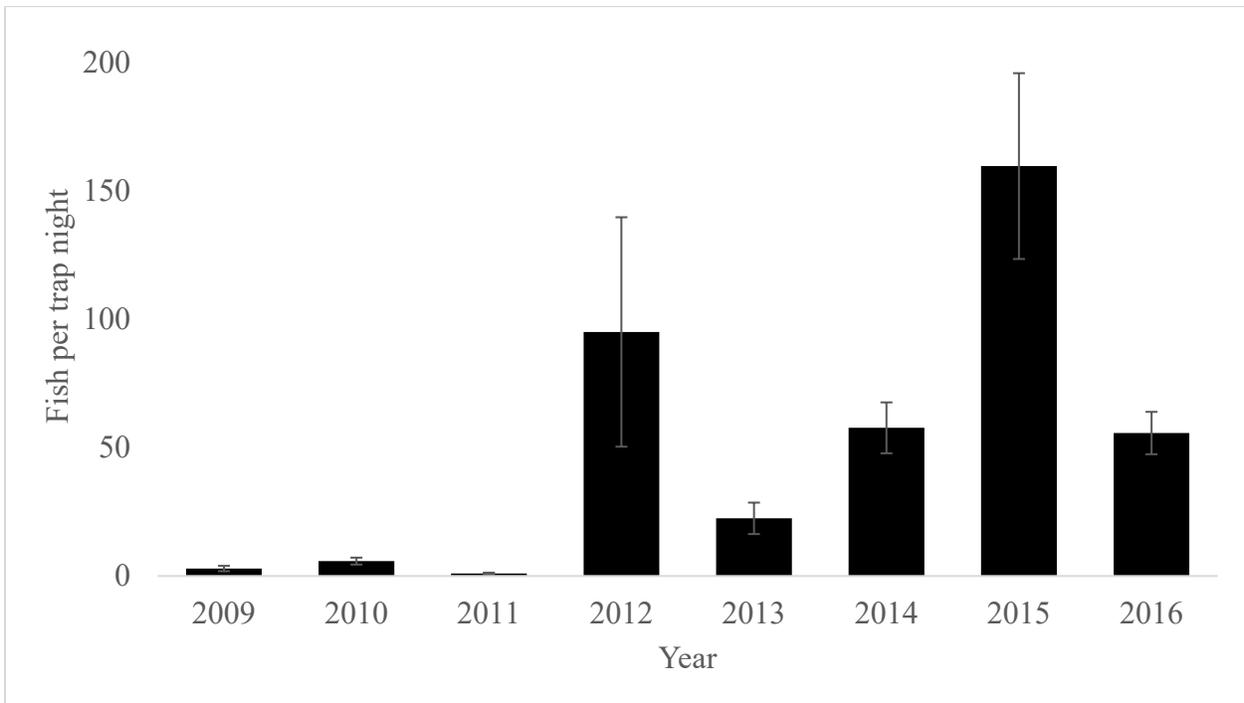


Figure 2. Mean catch per unit effort (razorback sucker larvae per trap night) for larval light trapping by year for all sites on lower Green River. Error bars represent standard error.

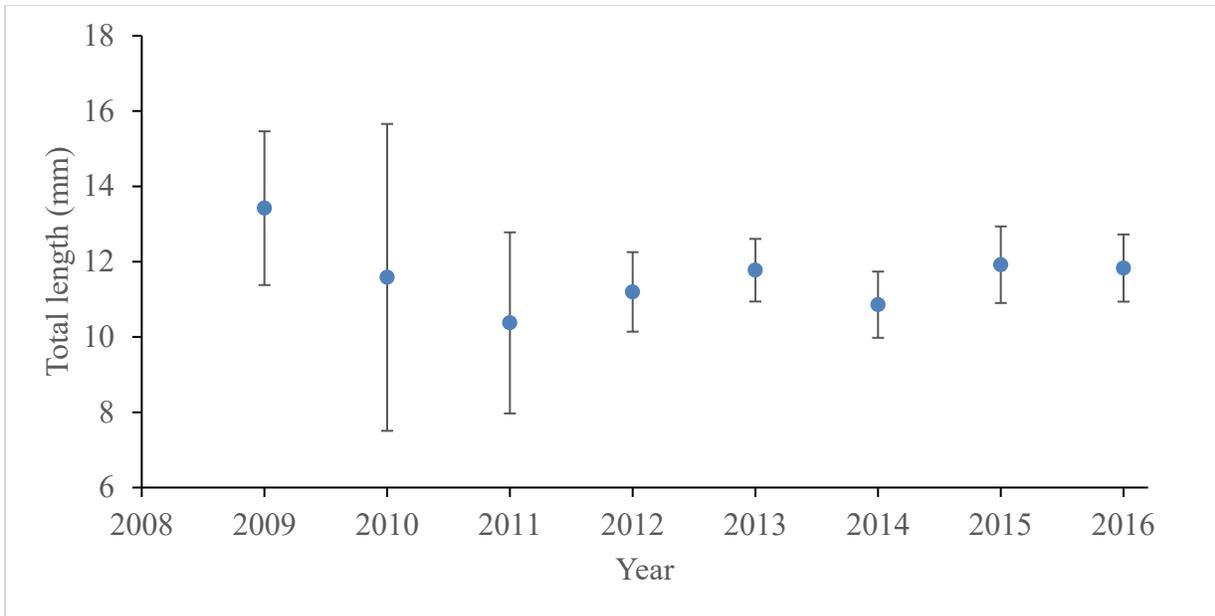


Figure 3. Mean total length (mm) of razorback larvae collected via light trapping by year on lower Green River, 2009-2016. Error bars represent standard deviation.

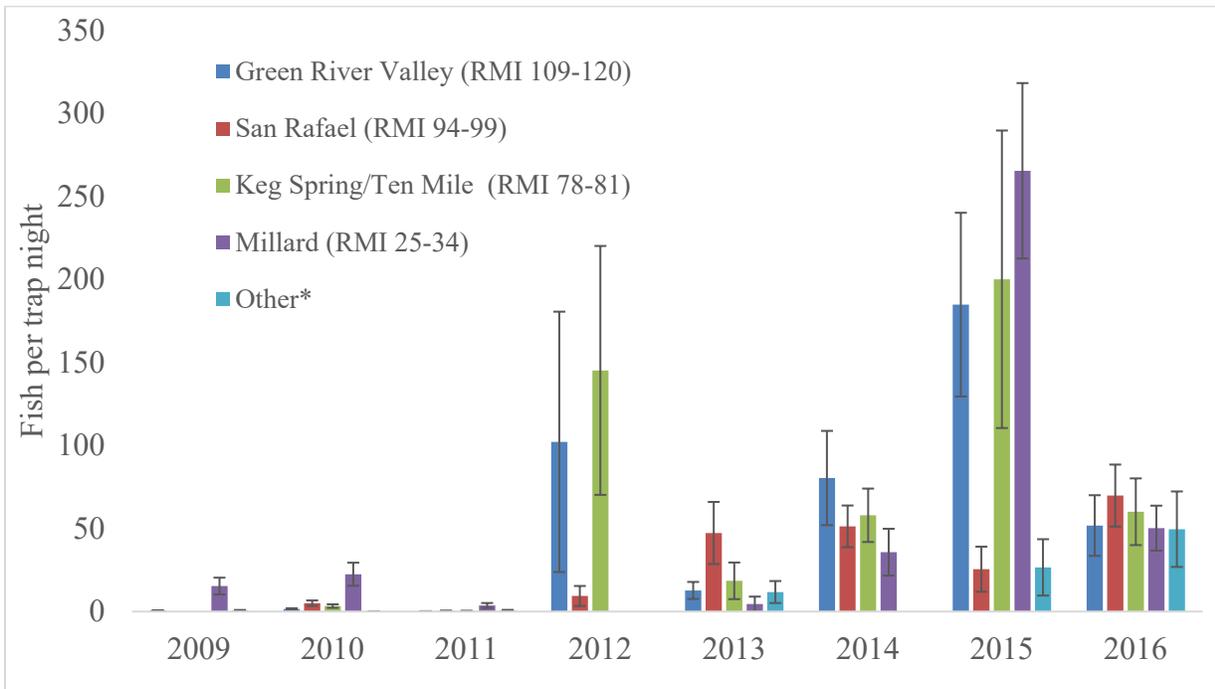


Figure 4. Catch per unit effort (razorback sucker larvae per trap night) for larval light trapping by year and by reach in the lower Green River. *Other sites include: river miles 101.7 (2009); 19.5, 101.5, and 105.4 (2010); 59.2 (2011); 19.8, 21.6, 67.5 (2013); 4.2, 14.2, 15.1, 39.4 (2016)

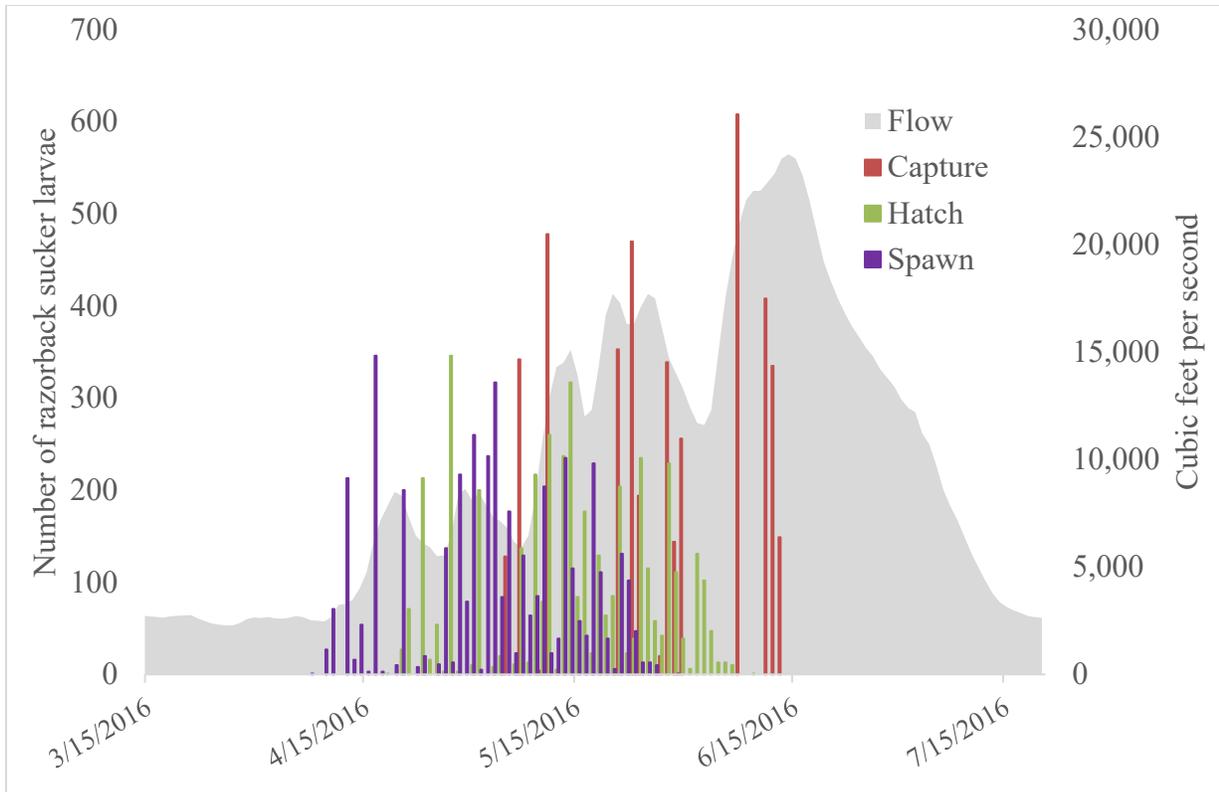


Figure 5. The number of razorback sucker larvae captured in the lower Green River by date, the number of individuals per estimated hatching date, the number of individuals per estimated spawning date, and corresponding discharge from USGS gage 09315000 at Green River, UT.

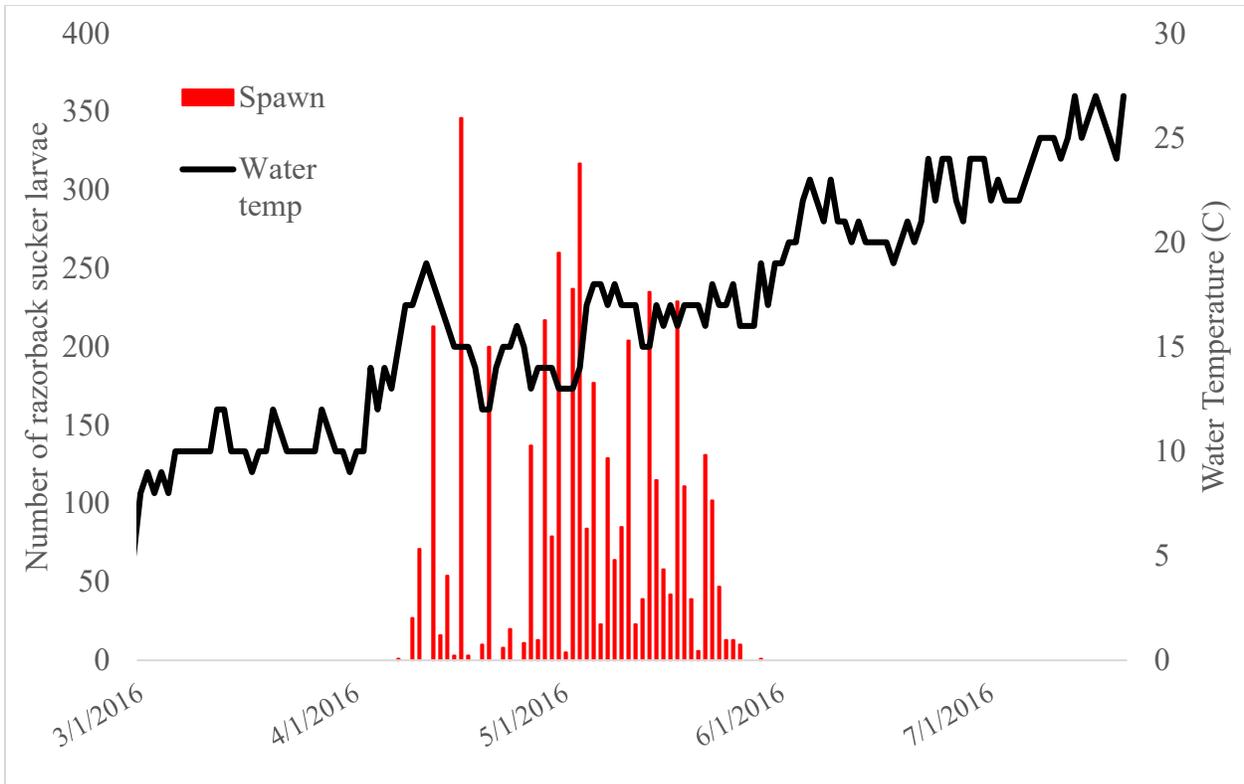


Figure 6. Water temperature from USGS gage 09315000 at Green River, UT, and estimated spawn dates for razorback sucker larvae captured by light trapping in the lower Green River.

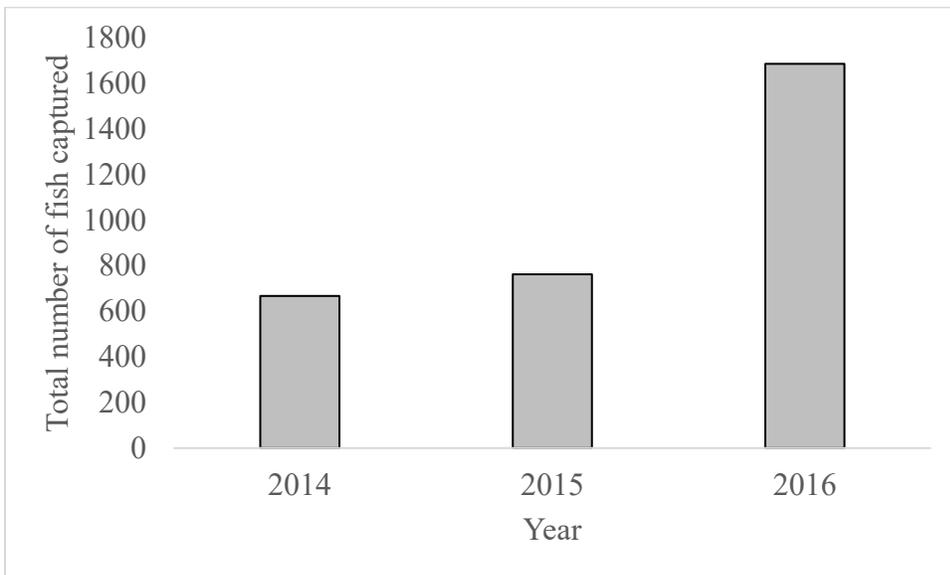


Figure 7. Total numbers of razorback sucker larvae captured by light trapping at all sites in the lower Colorado River by year.

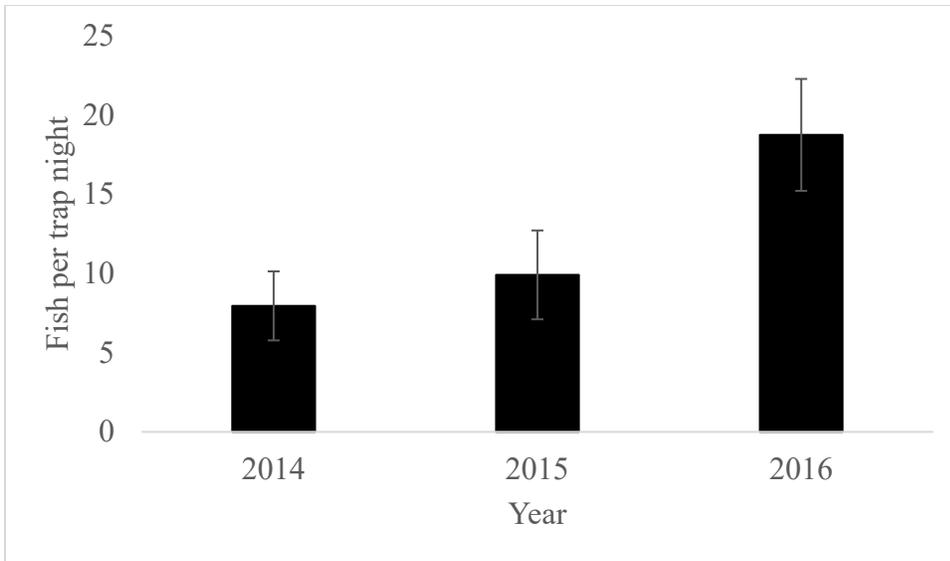


Figure 8. Mean catch per unit effort (razorback sucker larvae per trap night) for light trapping by year for all sites on lower Colorado River. Error bars represent standard error.

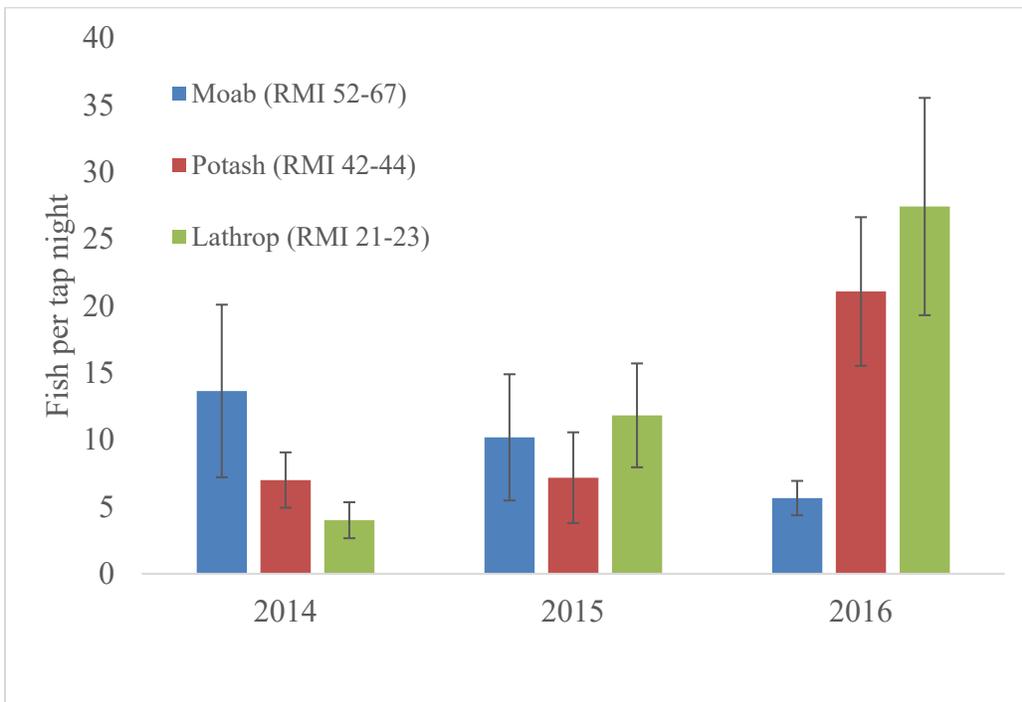


Figure 9. Catch per unit effort (razorback sucker larvae per trap night) for larval light trapping by year and by reach in the lower Colorado River.

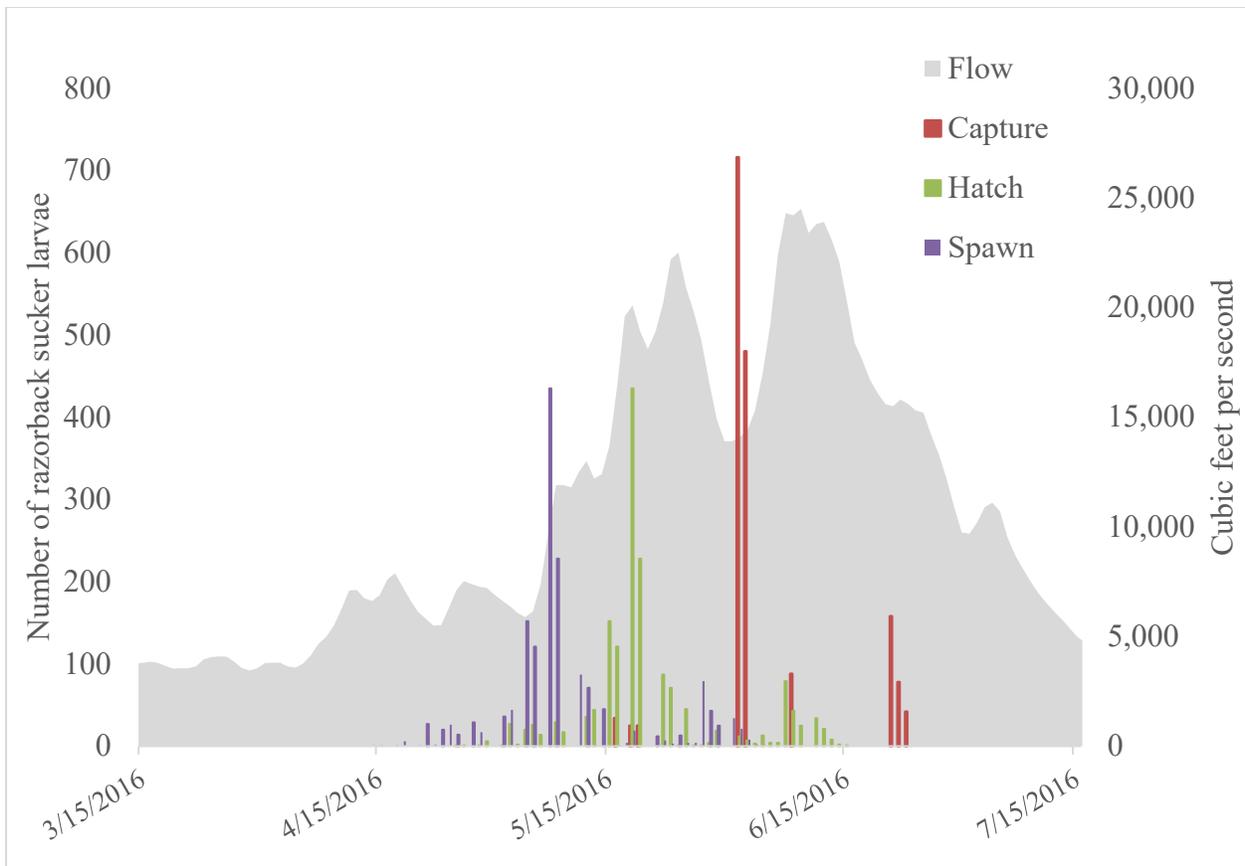


Figure 10. The number of razorback sucker larvae captured in the Colorado River by date, the number of individuals per estimated hatching date, the number of individuals per estimated spawning date, and corresponding discharge from USGS gage 09180500 at Cisco, UT.

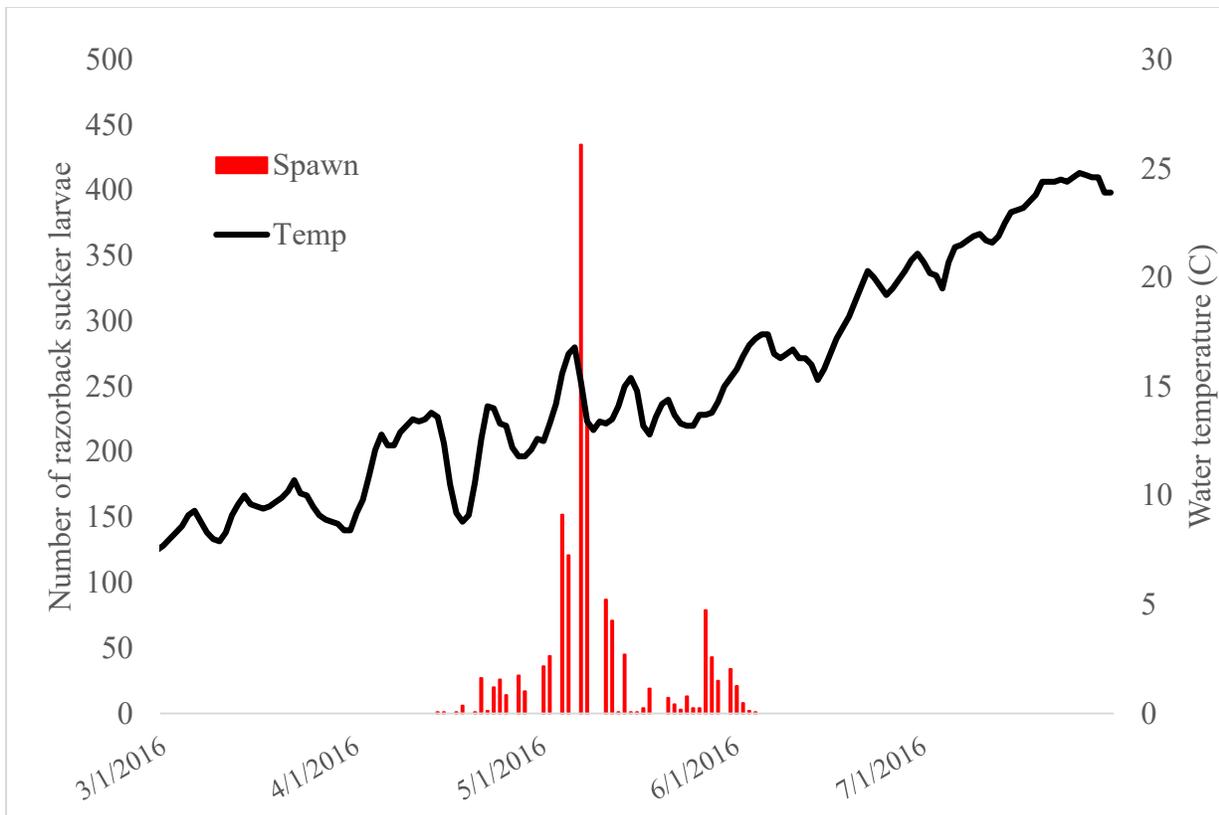


Figure 11. Water temperature from USGS gage 09180500 at Cisco, UT, and estimated spawn dates for razorback sucker larvae captured by light trapping in the lower Colorado River.