

- I. Project Title:: **Interagency Standardized Monitoring Program (IsmP)
Assessment of Endangered Fish Reproduction in Relation to
Flaming Gorge Operations in the Middle Green and Lower
Yampa Rivers.**
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- III. Project Summary: The goal of the recently approved Flaming Gorge flow and temperature recommendations (Muth et al., 2000) was to improve the status and prospects for recovery of endangered fish populations in the Green River. A major emphasis of those recommendations was to enhance the reproductive and recruitment success of endangered fishes in the middle Green River, in particular razorback sucker and Colorado pikeminnow. The primary means to achieve enhanced populations will be to pattern flows after a more natural hydrograph, the timing and duration of which will be based on anticipated annual hydrologic conditions and the biology of the fish. Because of vagaries in timing and runoff patterns within and among various hydrologic scenarios, and uncertainties in anticipated effects of flow and temperature recommendations on endangered fishes, Muth et al. (2000) suggested that real-time data be gathered to guide and fine tune operation of Flaming Gorge dam each year. Two existing studies that have provided data to guide operations of Flaming Gorge Dam in the past are "Basin-wide Monitoring Program for Razorback Sucker" (Project 22C) and "Interagency Standardized Monitoring Program (ISMP) Assessment of Colorado Pikeminnow Reproduction and Larval Abundance in the Lower Yampa River, Colorado" (Project 22f). This annual report, which is an extension of portions of those existing studies, is intended to provide a summary of the necessary real-time data.

Larvae of razorback sucker *Xyrauchen texanus* and Colorado pikeminnow *Ptychocheilus lucius* (formerly, Colorado squawfish) were in the Green River basin in spring and summer 2003. Razorback sucker sampling was conducted with light traps primarily in the Green River between Jensen and Ouray and Colorado pikeminnow sampling was with drift nets in the lower Yampa River. Sampling was designed to provide a measure of timing of reproduction and a measure of annual reproductive success of each species. Diel variation in abundance of Colorado pikeminnow larvae in the drift was also assessed. This data will be used to assess effects of flow and temperature regimes on reproduction by razorback suckers and Colorado pikeminnow and to correlate abundance of larvae to abundance of juveniles in autumn.

- IV. Study Schedule: It is anticipated that this study will continue and will be a component of studies designed to evaluate operations of Flaming Gorge Reservoir.
- V. Relationship to RIPRAP: Reproduction and recruitment of early life stages are critical components of the life history of endangered razorback sucker and Colorado pikeminnow. Understanding trends in reproductive success may help define status of razorback sucker and Colorado pikeminnow in specific river reaches in the Colorado River Basin and should play a role in determining when recovery has been achieved.

Relationship to specific 2003 RIPRAP items:

Green River Action Plan: Mainstem (pg. 26)

- I. Provide and protect instream flows (habitat management).
 - I.A. Green River above Duchesne River.
 - I.A.3. Deliver identified flows.
 - I.A.3.a. Operate Flaming Gorge pursuant to the Biological Opinion to provide summer and fall flows.
 - I.A.3.d. Operate Flaming Gorge Dam to provide winter and spring flows and revised summer/fall flows, if necessary.
 - II. Restore habitat (habitat development and maintenance).
 - II.A. Restore and manage flooded bottomland habitat.
 - II.A.1. Conduct site restoration.
 - II.A.1.a. Old Charlie Wash.
 - II.A.1.a.(3) Monitor and evaluate success.
- V. Monitor populations and habitat and conduct research to support recovery actions--research, monitoring, and data management. (pg. 27)
 - V.A. Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

VI. Accomplishment of FY 2003 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Project Objectives

- 1). To determine timing and duration of spawning by razorback suckers and presence and abundance of larvae in the system as measured by capture of larvae in light traps.
- 2). To determine timing and duration of spawning by Colorado pikeminnow and presence and abundance of larvae in the system as measured by capture of larvae downstream of spawning areas in the lower Yampa River.

Task Description (FY 2003)

- 1). Collect light trap samples for razorback suckers. The CRFP office in Vernal will be responsible for this task.
- 2). Collect drift net samples for Colorado pikeminnow. The Larval Fish Laboratory will be responsible for this task.
- 3). Identify light trap and drift net samples. Preliminary identifications will be conducted by the responsible sampling entity, with assistance from the LFL, as samples are collected to provide real-time data. Final specimen identification and curation will be conducted by the LFL.
- 4). Summarize specimen data collection in an annual report.

Accomplishments by Task.

- 1). Collect light trap samples for razorback suckers. A total of 73 light trap samples were collected from mid-May until late -June 2003 by the Vernal CRFP, all from Cliff Creek. An additional 10 seine samples were collected from Green River backwaters in early July.
- 2). Collect drift net samples for Colorado pikeminnow. Drift net samples were collected daily from 29 June until 18 August 2003 by the Larval Fish Laboratory. A total of 213 samples were collected during this time period, which includes some diel net sets.
- 3). Identify light trap and drift net samples. Ongoing.

Middle Green River light trap samples. Preliminary screening of light trap samples by B. Haines, Vernal CRFP, was completed in October. Razorback sucker larvae were first captured on 28 May and last captured on 16 June 2003. Preliminary identification of samples suggested presence of about 37 razorback sucker larvae in 2003 samples. Samples sent to the Larval Fish Laboratory will be identified and verified in early 2004.

Lower Yampa River drift net sampling. Samples were collected in the Yampa River about 0.2 to 0.8 km upstream from the Green River, the same site that samples were collected from 1990 to 1996 (Bestgen et al. 1998) and in 1998 to 2002. A total of 213 samples were collected between 29 June and 18 August 2003. These included samples collected at dawn, noon, dusk, and midnight on six days to detect diel variation in drift abundance.

Preliminary identification of some samples has been completed, but identification of many other samples and questionable or difficult specimens has not yet been completed, nor has curation. We expect final verification to be completed in early February or March 2004. This data will be integrated in an analysis of young-of-year captures of pikeminnow in backwaters in autumn to determine if the two metrics are related.

2002 light trap sampling data. Only preliminary data were available from 2002 light trap samples at the time of the December 2002 report deadline so we present that data now. A total of 94 razorback sucker larvae were captured in light traps and 21 were captured in seine hauls (including several specimens classified as razorback sucker?). Larvae were captured in light traps from 20 May to 20 June when average daily water temperature ranged from 11.4 to 22.2°C range (Fig. 1). Seine haul captures were from 19 and 20 June in Green River backwaters near the Jensen Bridge. Larvae in light trap samples ranged in size from 10.2 to 16 mm TL; most (N = 55) were 12 to 13.9 mm TL (Fig. 2). The largest 15 to 16 mm TL larvae captured in light traps were from later in the season, after 4 June (Fig. 3). All larvae captured that were larger than 16 mm TL were from seine samples collected on 19-20 June. Those larvae ranged in length from 14.5 to 22 mm TL, average lengths of those fish were > 19 mm TL on each day. Razorback sucker larvae captured in 2002 were larger than those captured in 2001 (Fig. 4). The 2002 captures represented some of the largest early life stages of razorback suckers captured in the main channel of the Green River since sampling conducted in 1994, another low flow year.

All larvae were captured after discharge in the Green River peaked on 23 May at 7,120 cfs. This was similar to the pattern for 2001 data (Fig. 5). Capture of razorback sucker larvae in light trap samples in both years appears to be well after flows in the Green River peak and after connections with the flood plain have ceased.

Similar to the razorback sucker data, drift net data for 2002 were not available for reporting in the 2002 annual report so we do that now. Number of drift net captured Colorado pikeminnow larvae was very low in 2002. Only 12 larvae were captured in dawn sets for the entire season, and an additional 248 were captured in diel net sets, all at midnight (Fig. 6). In summer 2002, flows were very low and clear, conditions similar to 1994 when dawn Colorado pikeminnow

drift net captures were also very low ($N = 35$). In 1994, diel net sets captured an additional 89 larvae. This suggested that in low flow years when water is very clear, larvae were susceptible to downstream transport mostly after light levels were reduced. Overall, abundance of larvae captured in drift nets in low flow years appears reduced compared to other years.

Temperature monitoring. Temperature differences between the Green and Yampa rivers in Echo Park are potentially important because of potential for cold shock of Colorado pikeminnow larvae drifting from the Yampa into the normally colder Green River. Warmer water temperatures in the Green River also increase the likelihood of spawning by rare native fishes upstream of the Yampa River. Temperature data gathered in the Green and Yampa rivers in Echo Park were compared to determine if temperature differences fall within recommended constraints that the Green be no more than about 5°C colder than the Yampa River (Muth et al. 2000). In 2000 (Fig 7.), water temperatures in the Green River were relatively cool and exceeded 20°C for only a couple of days. Average water temperature in the Green River from 1 June to 30 September was 17.0°C compared to 19.7°C in the Yampa River for the same period (Table 1). In 2001 and 2002, water temperatures in the Green River were considerably warmer and averaged about 19°C in each year (Figs. 8 and 9). Water temperatures in the Yampa River in 2001 and 2002 averaged 20.5 and 20.4°C, respectively. In seven instances (twice in 2000, once in 2001 and four times in 2002) water temperatures exceeded the recommended maximum summer difference of 5°C and none were within the period when Colorado pikeminnow were drifting downstream from the Yampa River. In 2002, summer water temperatures in the Green River upstream of the Yampa River were likely the highest observed since Flaming Gorge Reservoir filled.

- VII. Recommendations: Continue to sample early life stages of razorback sucker and Colorado pikeminnow annually at these sites. This information is critical to establishment of long-term data that can guide informed management decisions regarding population viability and recovery. Data were also used to monitor effects of Flaming Gorge flows and water temperatures in relation to endangered fish reproduction in spring and summer. This information can also be used to make real-time recommendations for flow and temperature regimes for Flaming Gorge Dam during the critical time of reproduction for endangered Colorado pikeminnow. The Recovery Program should increase funding for this project to cover costs for additional sample processing costs incurred for the Green River samples. Sampling may also need to be expanded to assess reproduction by razorback suckers in the Yampa River. Verification of yet unidentified sucker specimens may shed additional light on the prevalence of razorback sucker larvae in the Yampa River.
- VIII. Project Status: On track and ongoing. This project was approved for funding in 2004

and perhaps beyond. That information, combined with more sophisticated water temperature data acquisition, should provide some tools for making flow and temperature recommendations to guide operation of Flaming Gorge Reservoir.

IX. FY 2003 Budget Status

- A. Funds Provided: \$ 90,000
- B. Funds Expended: \$ 86,000
- C. Difference: Remaining funds for sample analysis
- D. Percent of the FY 2003 work completed, and projected costs to complete: About 90% complete.
- E. Recovery Program funds spent for publication charges: None.

X. Status of Data Submission (Where applicable): Data will be submitted when identification and analysis is complete.

XI. Signed: Kevin R. Bestgen 10 Nov. 2003
Principal Investigator Date

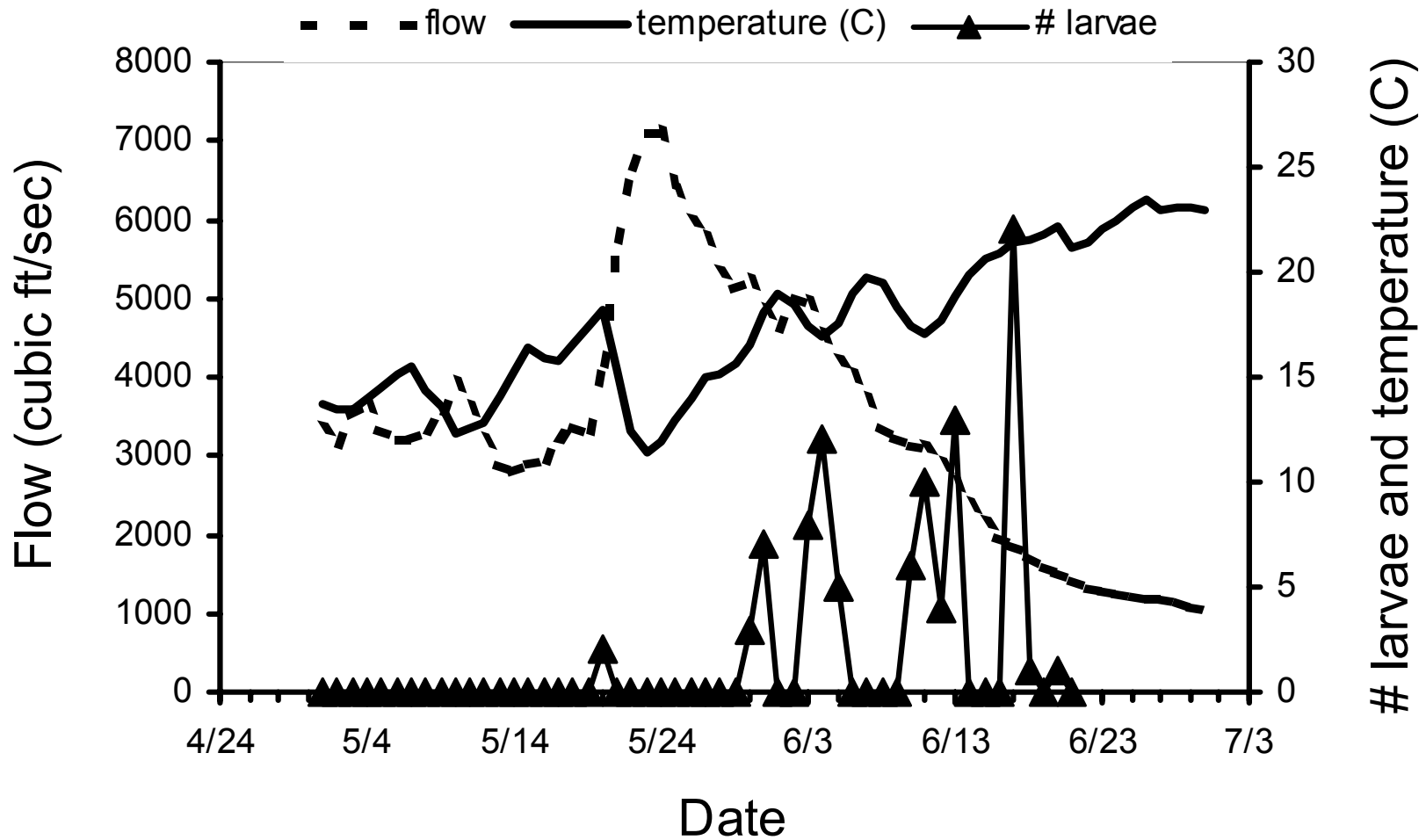


Fig. 1. Number and timing of razorback sucker larvae captured in light traps in the middle Green River, Utah, 2002 related to flow

and temperature regimes (Jensen gage).

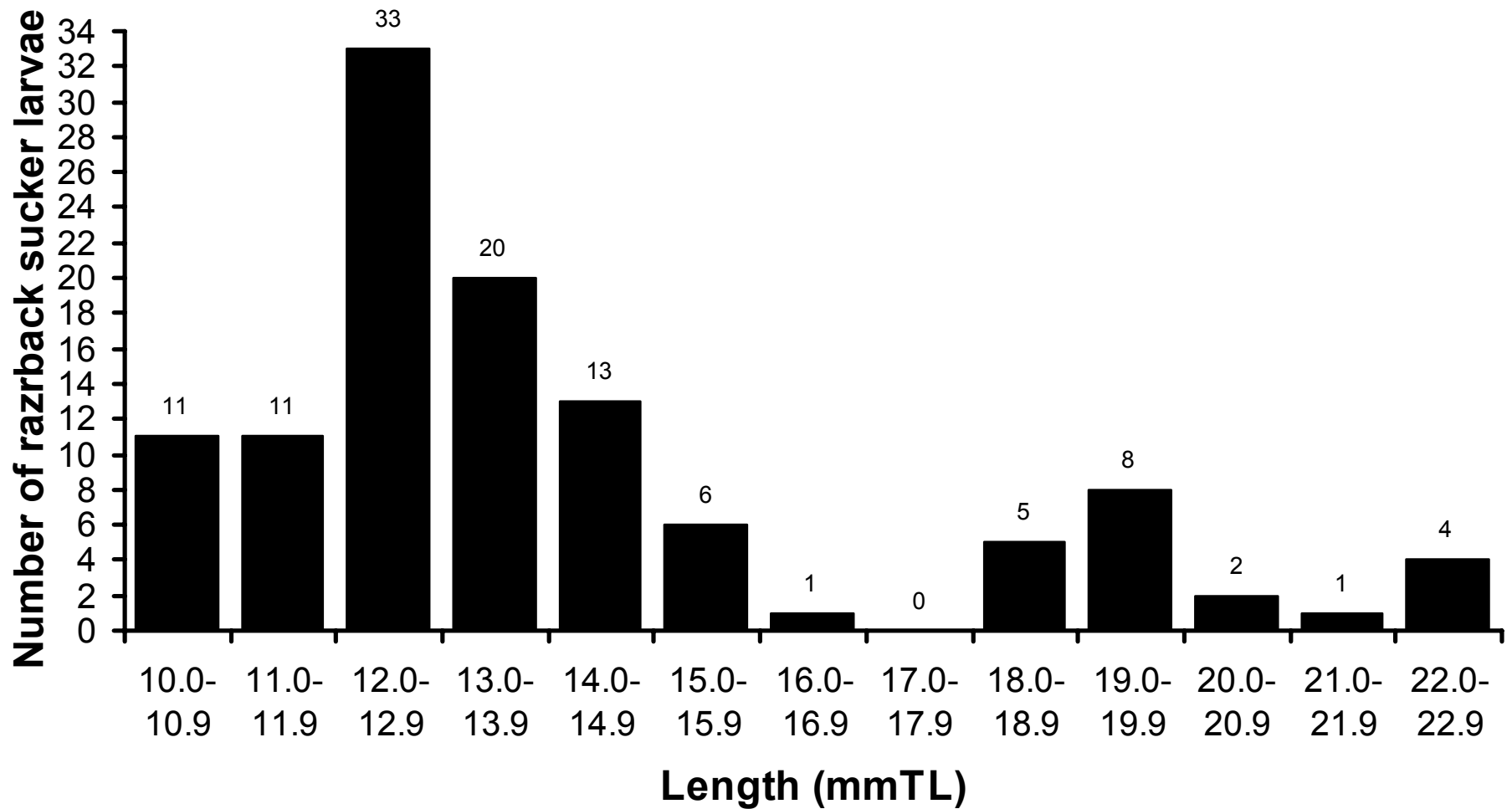


Fig. 2. Length-frequency histogram of razorback sucker larvae captured in the middle Green River, 2002, with light traps and seines. All fish less than 16 mm were captured in light traps, all fish greater than 16 mm TL were captured in seines.

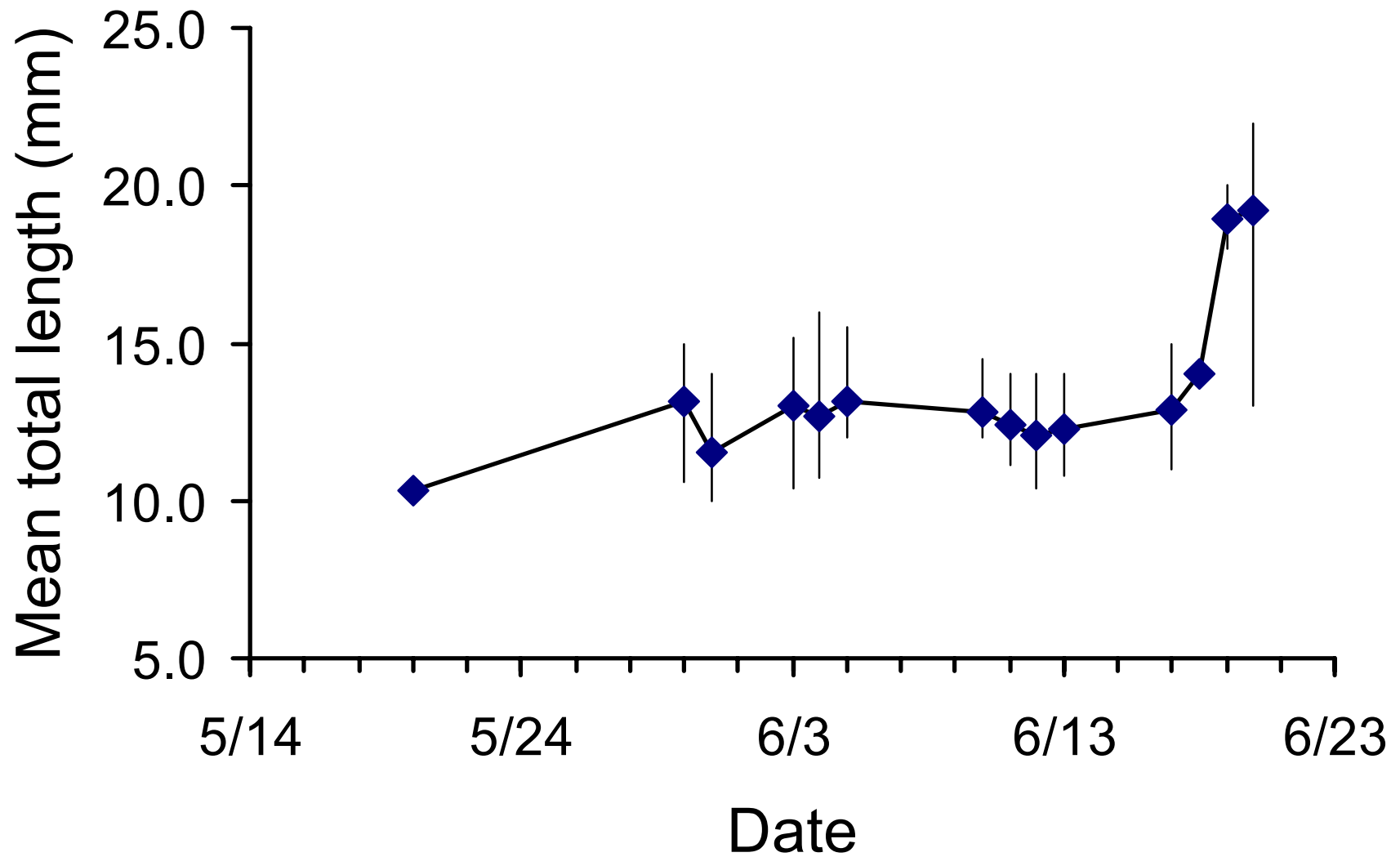


Fig. 3. Mean total length (mm) of razorback sucker larvae captured in light trap (through 18 June) and seine samples (19-20 June) in the middle Green River, Utah, 2002. Vertical bars are the range of lengths.

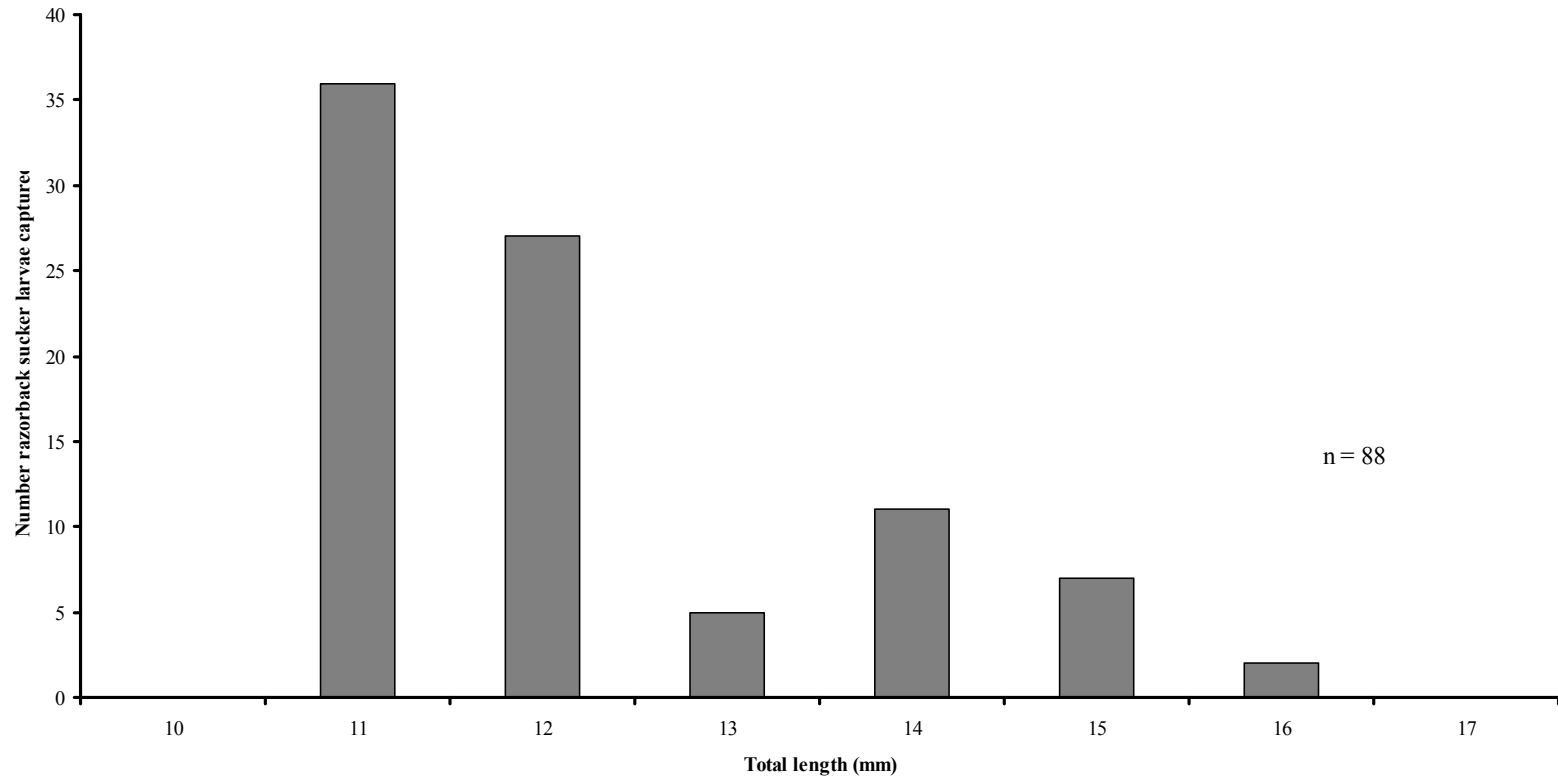


Fig. 4. Length-frequency histogram of lengths (TL, mm) of razorback sucker larvae captured in light traps in the middle Green River, Utah, 2001.

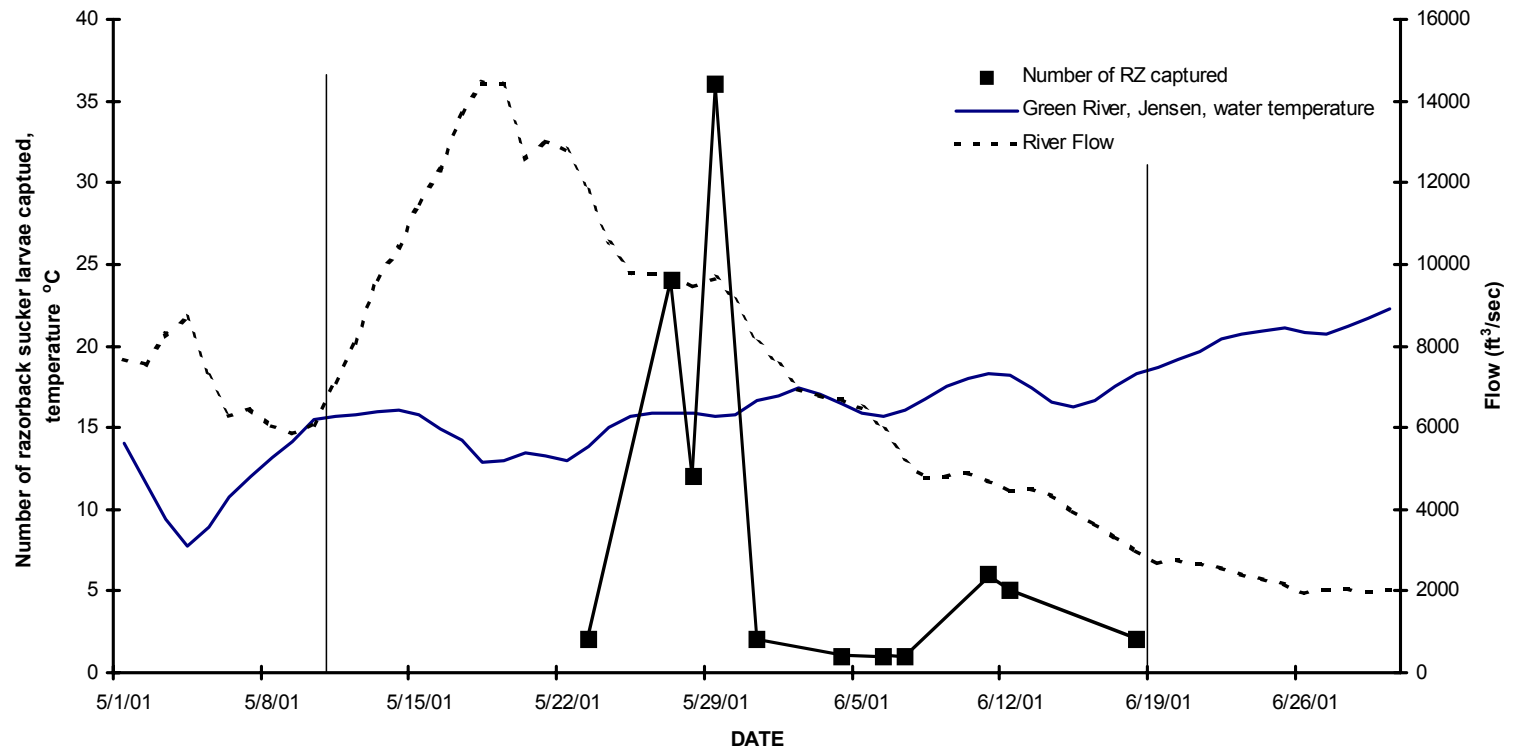
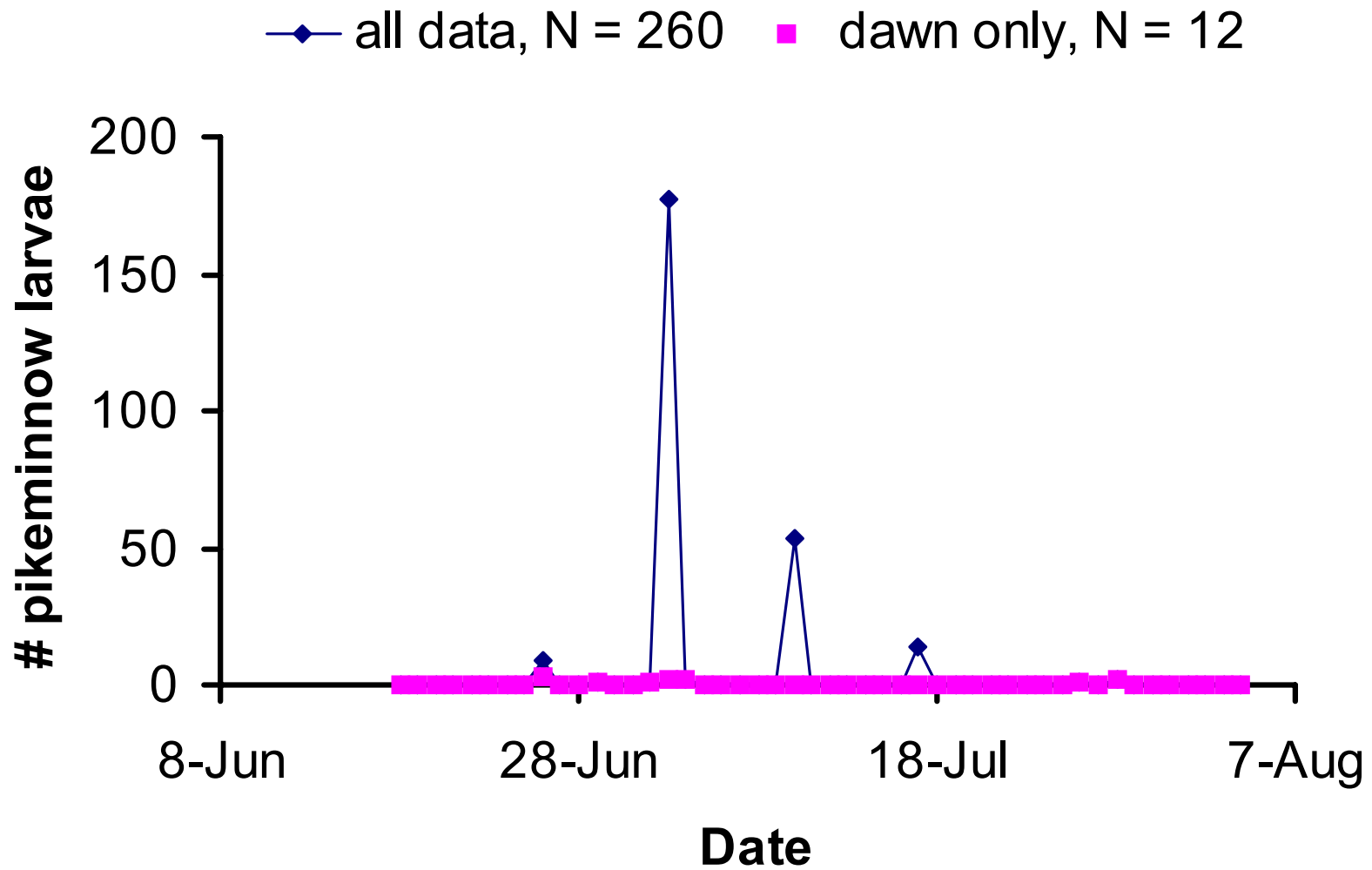


Figure 5. Number and timing of razorback sucker larvae captured in light traps in the middle Green River, Utah, 2001 overlaid on



flow and temperature regimes (Jensen gage). Solid vertical lines depict the first and last dates of sampling.

Fig. 6. Drift-net captures of Colorado pikeminnow larvae during dawn samples and for all diel samples combined, Yampa River, 2002.

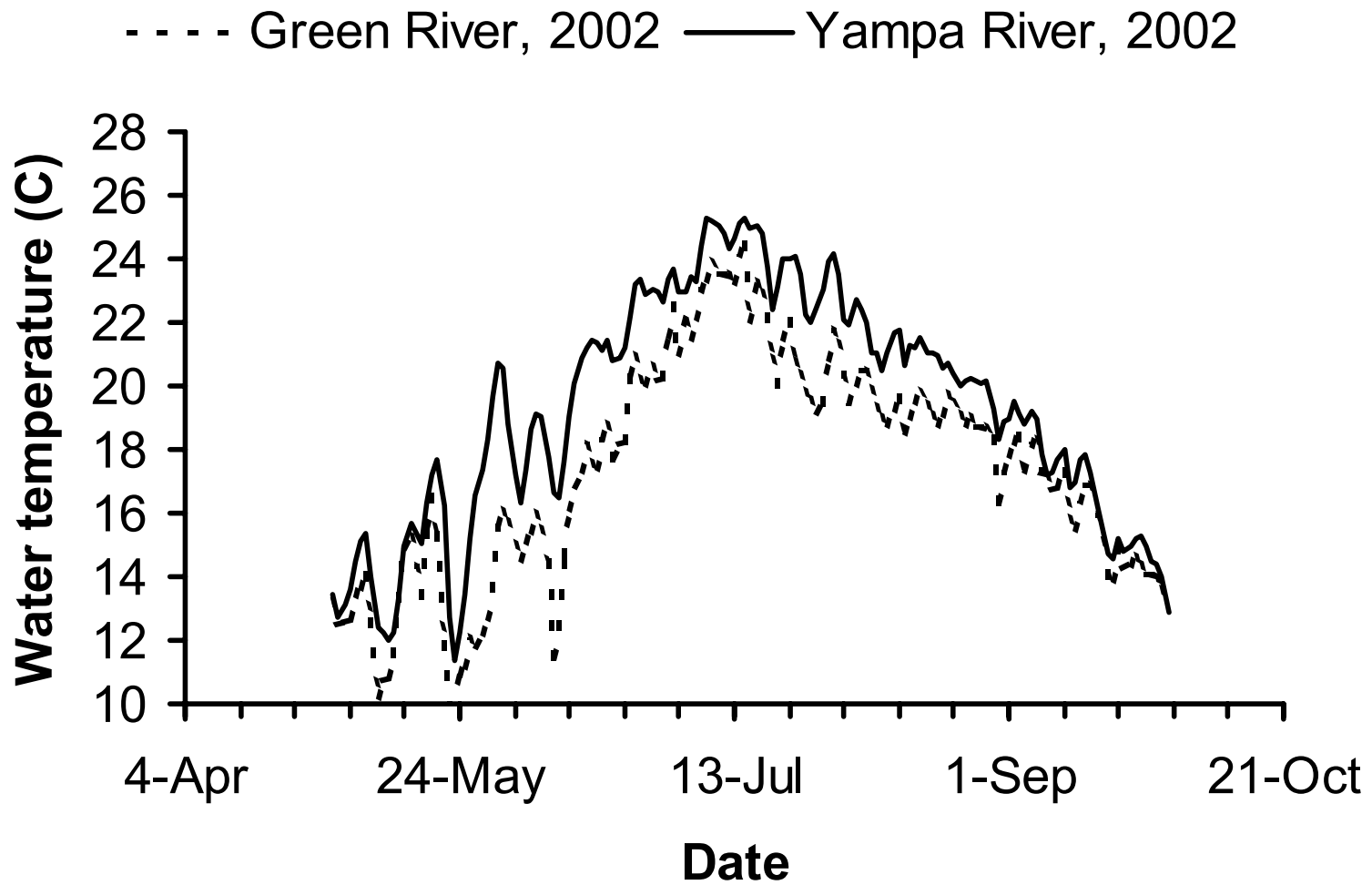


Fig. 7. Water temperatures in the Green River and Yampa River, Echo Park, Colorado, 2002.

Table 1. Average daily summer (1 June to 30 September) water temperature (maximum) of the Green and Yampa rivers, Echo Park, Dinosaur National Park, Colorado, 2000 to 2002. Number of days where temperature of the Green River was 5°C or more cooler than the Yampa River is also shown; none of those days were in the period when Colorado pikeminnow larvae were drifting from the Yampa River.

Year	<u>Mean summer water temp C (maximum)</u>		Number of days difference exceeded 5°C
	Green River	Yampa River	
2000	17.0 (20.7)	19.7 (24.1)	2
2001	19.0 (23.4)	20.5 (25.6)	1
2002	18.5 (24.5)	20.4 (25.3)	4