

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

II. Principal Investigator(s):

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III. Project Summary:

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 replaced in 1998 with 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 and 1998-2000. In 2003, a new three-year effort began. For this round of estimates, annual effort was expanded in hopes of producing estimates with smaller confidence intervals. Four complete passes were made through the 185-mile reach (excluding 12-mile-long Westwater Canyon) using a combination of electrofishing and backwater trammel-netting. In addition to more passes, effort per pass was also increased from one 2-person crew to two 2-person crews. This schedule was completed during a 12-week period from early April to mid-June. The field effort went very well, especially considering the large crew, other concurrent projects, equipment demands, etc. However, the number of Colorado pikeminnow captured was relatively low compared with previous years. There was an especially low number of fish marked in the first passes that were subsequently recaptured in later passes. Mean number of Colorado pikeminnow per net set was lower than in any year since 1991. Model M_0 from Program CAPTURE (White et al. 1982) provided a preliminary point estimate of 784 individuals 450 mm TL and longer (95% CI: 350-1,940). However, the probability of capture was very low ($p = 0.03$), and the coefficient of variation was unacceptably high ($CV = 47\%$).

IV. Study Schedule: 2003-2005.

- V. Relationship to 2003 RIPRAP:
Colorado River Action Plan: Colorado River Mainstem (pg 35–36)
V. Monitor populations and habitat and conduct research to support recovery actions.
V.D. Estimate pikeminnow populations in the Upper Colorado River (including the Gunnison)

VI. Accomplishment of FY 03 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Tasks

1. Capture and pit-tag Colorado pikeminnow (this task was met).
2. Analyze data (Initial population estimate and catch per unit effort calculated).

Four complete passes were made through the 185-mile reach (excluding 12-mile-long Westwater Canyon) using a combination of electrofishing and backwater trammel-netting. In addition to more passes than in previous years, effort per pass was also increased from one 2-person crew to two 2-person crews. This schedule was completed during a 12-week period from early April to mid-June. The field effort went very well, especially considering the large crew, other concurrent projects, equipment demands, etc. However, despite the large field effort, the number of Colorado pikeminnow captured was surprisingly low. There was an especially low number of fish marked in the first passes that were subsequently recaptured in later passes. Preliminary abundance estimates were produced (Table 1) using Program CAPTURE (White et al. 1982). The model selection algorithm indicated that model M_0 best fit the data for fish ≥ 450 mm. However, the probability of capture (\hat{p}) was only 0.03. In past years, \hat{p} in the upper reach averaged 0.12 for fish ≥ 450 mm TL. In the lower reach, there were estimates and associated probabilities of capture for CPM > 450 mm for years 1992, 1993, 1994, 1998, and 2000. There are two P-hats provided for each estimate (I assume one for each pass). I first averaged the two to give one value for each year and then averaged that number for the five years. The overall average p-hat for the lower reach was 0.143. Model M_0 was able to calculate a point estimate of 784 individuals (SE: 370.4; 95% CI: 350-1,940) from the capture history of 89 fish, but the precision of this estimate was very low. A ‘rule of thumb’ for acceptable precision is to achieve a coefficient of variation (CV) of 20% or less (Pollock et al. 1990). The CV for our whole-river estimate of Colorado pikeminnow was 47%. Other models provided a wide range of point estimates: from 147 to 1,938.

Catch per unit effort (CPUE), as measured by mean number of Colorado pikeminnow (all fish ≥ 250 mm TL) caught per net set, was significantly lower than during the 1998-2000 period in both the upper reach (upstream of Westwater Canyon) and in the river as a whole (Fig. 1). In the lower reach, CPUE in 2003 was not significantly lower than in 1999 and 2000. In the upper reach, catch rates were low in backwaters that traditionally yielded relatively high numbers in the past. We might speculate that many adults that formerly resided in the Grand Valley perished or were redistributed downstream during the preceding year (2002) when flows were extremely

low for an extended period. If they were redistributed, it may take some time for these fish to move back to their former home ranges. Additional years of data will be needed to sort this out.

Recruitment was also not clear. The Recovery Goals document for Colorado pikeminnow (USFWS 2002) considers age 6 fish as those about to recruit, and defines these as fish 400-449 mm long. If we use the estimate of 784 fish > 450 mm, we can calculate a rough estimate of those fish 400-449 mm TL. Of 162 fish (> 250 mm) captured, 55% were > 450 mm, suggesting a population of 1,427 fish > 250 mm. Of the total 162 fish captured, 23 were 400-449 mm long, or 14.2%. This would equal 203 fish, considerably more than the number needed to replace the 118 expected to die (15% of the estimated 784 fish >450 mm).

However, although there was definitely a very strong year class present in the 2003 population, length frequency analysis suggests that it was likely a cohort of age 5 fish (Fig. 2). This unimodal group ranged from 337 to 435 mm long, with a mean length of 389 mm. If there was an age 6 year class mixed in with these, we would expect to see some fish in the 440-449 and 450-459 10-mm length classes, but there was none. The unimodal nature of the histogram suggests that those fish longer than 400 mm and shorter than 450 mm (400-435 mm), were likely part of the age 5 cohort rather than age 6 fish. Year classes just prior to and after this strong 1998-produced cohort were evidently very weak.

VII. Recommendations: Continue as planned for 2004 and 2005. However, we recommend that to get three years of reliable estimates of acceptable precision (to comply with Recovery Goal monitoring criteria), an additional year be added in 2006 to replace the low-quality 2003 estimate. This decision might wait until after the 2004 and 2005 estimates are in; if these indicate the 2003 estimate is reasonable, perhaps an additional year will not be needed.

VIII. Project Status: On track

IX. FY 02 Budget

A. Funds Provided:	129,500
B. Funds Expended:	129,500
C. Difference:	0
D. N/A (BR projects)	0
E. Publication Charges	0

X. Status of Data Submission: Capture data for razorback sucker and bonytail encountered during this project have been submitted to the database manager. Colorado pikeminnow data will be submitted by the end of December.

XI. Signed: Doug Osmundson Date: December 2, 2003.

Literature

Pollock, K. H., J. D. Nichols, C. Brownie, and J. E. Hines. 1990. Statistical inference for capture-recapture experiments. *Wildlife Monographs* 107.

White, G. C., D. R. Anderson, K. P. Burnham, and D. L. Otis. 1982. Capture-recapture and removal methods for sampling closed populations. Los Alamos National Laboratory, LA-8787-NERP, Los Alamos, New Mexico.

USFWS. 2002. Colorado pikeminnow (*Ptychocheilus lucius*) Recovery Goals: amendment and supplement to the Colorado Squawfish Recovery Plan. U. S. Fish and Wildlife Service, Denver.

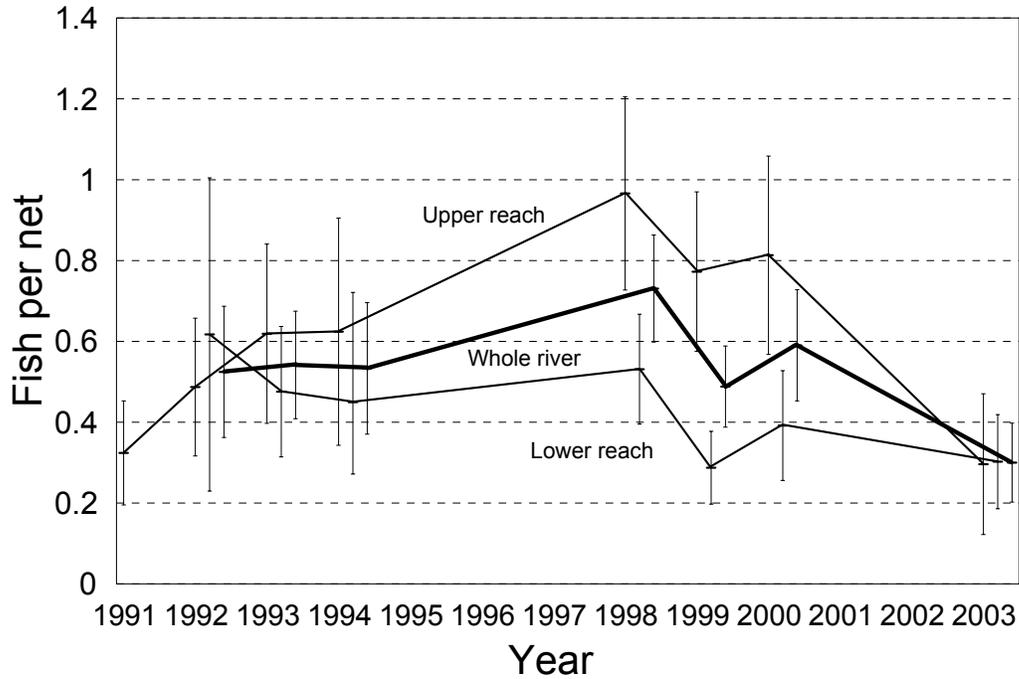


Figure 1. Annual catch per unit effort, as measured by mean number of Colorado pikeminnow (all > 250 mm TL) caught per net set, 1991-2003. Error bars are 95% confidence intervals.

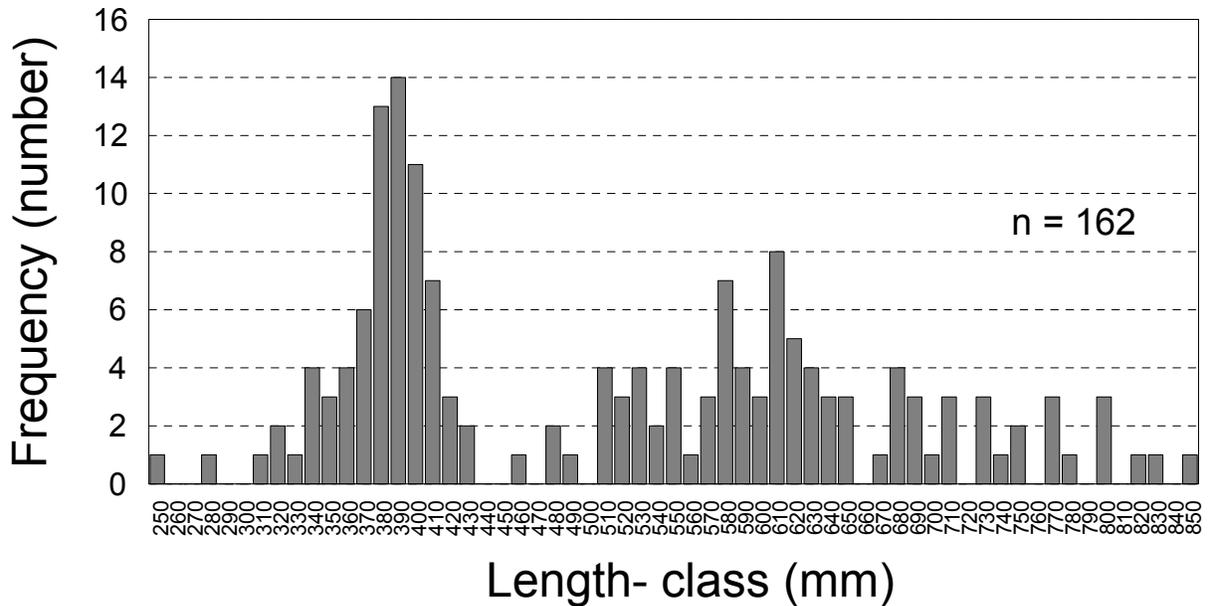


Figure 2. Length frequency of Colorado pikeminnow captured from throughout the upper Colorado River during April-June 2003. Length classes are in 10-mm increments with each

labeled with the lower end of the range (example: 350 = those fish 350-359 mm long).

Table 1. Summary of Program CAPTURE results for 2003 Colorado pikeminnow data from the upper Colorado River. These results should be treated as preliminary. MSC = model selection criteria. P = probability of capture. N = point estimate of population size.

Model	Fish >250 mm				Fish >450 mm				Fish >500 mm			
	MSC	N	95% CI	P	MSC	N	95% CI	P	MSC	N	95% CI	P
M ₀	0.78	2045	951-4662	0.0204	1.00	784	350-1940	0.0296	1.00	717	322-1774	0.0310
M _h Chao	0.89	4323	1568-12480	0.1052	0.85	1938	596-6837	0.0120	0.85	1766	545-6234	0.0126
M _b	0.11	Failed	--	--	0.31	Failed	--	--	0.32	Failed	--	--
M _{bh}	0.07	Failed	--	--	0.64	Failed	--	--	0.64	Failed	--	--
M _t Chao	0.00	2403	1014-6049	0.01, 0.01, 0.02, 0.02	0.00	1005	390-2878	0.02, 0.02, 0.03, 0.03	0.00	918	358-2629	0.02, 0.02, 0.03, 0.03
M _{th} Chao	0.32	4356	1440-13928	0.01, 0.01, 0.01, 0.01	0.42	1958	571-7339	0.01, 0.01, 0.01, 0.01	0.43	1785	523-6694	0.01, 0.01, 0.02, 0.01
M _{tb}	0.42	1939	190-115-108	0.011, 0.017, 0.031, 0.027	0.33	147	96-574	0.123, 0.153, 0.254, 0.287	0.33	124	91-378	0.137, 0.184, 0.315, 0.338

M_{tbh}	1.00	No model	--	--	0.75	No model	--	--	0.75	No model	--	--
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