

I. Project Title: **EVALUATION IF *INTERAGENCY STANDARDIZED MONITORING PROGRAM (ISMP)* ADULT COLORADO PIKEMINNOW ABUNDANCE DATA**

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III. Project Summary: Data collected during the conduct of the Interagency Standardized Monitoring Program (ISMP) was analyzed to determine its utility to estimate abundance of adult Colorado pikeminnow. Data were useful to determine trends in catch per unit effort, and size-dependent survival rates but were not useful to estimate abundance. This analysis should be used to modify monitoring efforts and perhaps to guide procedures necessary to directly estimate abundance Colorado pikeminnow over large river reaches using capture-recapture techniques.

IV. Study Schedule: This study has been completed in FY 2000. An additional small amount of funding would be useful to publish this information because the original budget was very small.

V. Relationship to RIPRAP: V.A. (Measure and document population parameters); V.A.1. (Conduct standardized monitoring program); V.A.1.a, (Evaluate and refine procedures periodically).

VI. Accomplishment of FY 2000 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Tasks to be completed under this project.

- 1). Obtain *ISMP* data files from database coordinator Chuck McAda. This task was completed. Data files required considerable checking and editing to eliminate duplicate records and errors.
- 2.) Analyze data. This task was accomplished and results were reported at a meeting of the Biology Committee in March of 2000.
- 3). Short write-up of findings and recommendations. As stated in the scope of work, a complete analysis and write-up was not conducted. I would like the Program to consider an additional and like amount of funding to prepare this work for publication.

I have attached a Powerpoint presentation presented to the Biology Committee in March 2000 that details the findings of this investigation. Much of the budget was spent organizing and proofing data records in preparation for analysis. I would like the program to consider funding this study an additional year for a like amount so that the analysis can include 1998 and 1999 data. Additional funds would allow preparation of a more complete annual report and a manuscript for publication.

VII. Recommendations: The *ISMP* data collected to date are useful for a variety of purposes. These include documenting the presence, distribution, and relative abundance of adult Colorado pikeminnow. Ancillary information is also gathered that describes movement patterns of fish over time, documents recruitment of small fish into the adult population, and allows for size-dependent estimation of survival rates. Those data are useful to better understand the ecology of Colorado pikeminnow in the upper Colorado River Basin. These *ISMP* data are not sufficient for abundance estimation, because most of the assumptions of closed model estimators are violated or are difficult to evaluate. Recaptures are often sparse as well, which makes confidence intervals about point estimates extremely large.

VIII. Project Status: On track and ongoing.

IX. FY 2000 Budget Status

- A. Funds Provided: \$7,000
- B. Funds Expended:\$7,000
- C. Difference: \$0.
- D. Percent of the FY 2000 work completed, and projected costs to complete: An additional 7-10K would be useful to finish data analysis and do an appropriate write-up for publication.
- E. Recovery Program funds spent for publication charges: NA

X. Status of Data Submission (Where applicable): Data will be submitted when specimen identity is completed.

XI. Signed: Kevin R. Bestgen 5 December 2000
Principal Investigator Date

(Just put name and date here, since you will be submitting the report electronically)

APPENDIX: *[More comprehensive/final project reports (NOT to be used in place of a complete annual report.). If distributed previously, simply reference the document or report.]*

Acknowledge a cast of thousands
for data collection and Chuck,
Jay, and Gary for data analysis
assistance

Objectives

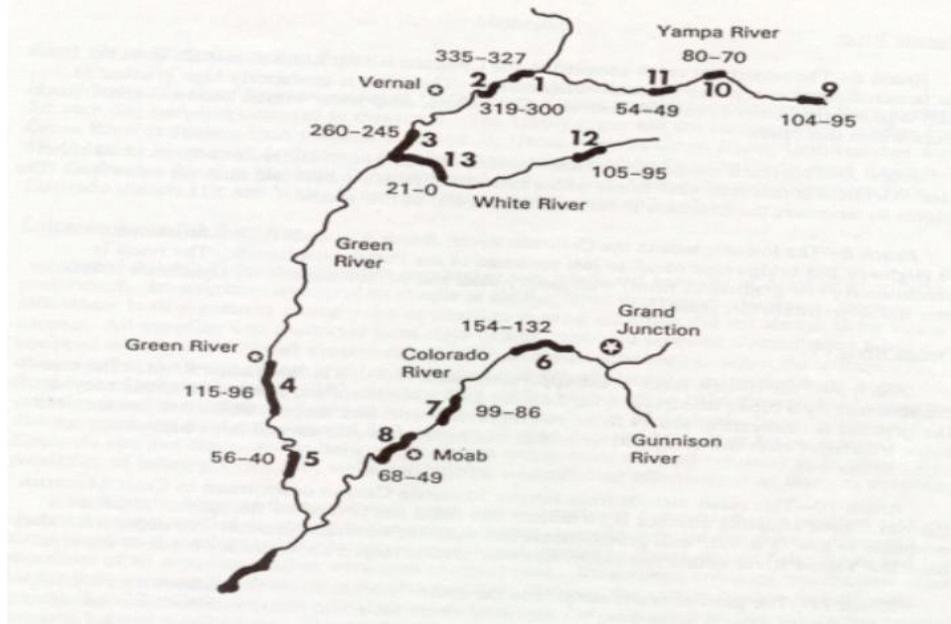
- Balance the Program budget
- Gain understanding of utility of ISMP data to estimate abundance and survival parameters

ISMP data collection

- 13 regularly sampled sites, + wildcards
- About 20% of existing habitat is sampled
- 1991 to 1997 data used for analysis

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ISMP Sampling Locations



All Upper Basin Colorado Pikeminnow Captures (ISMP included)

	90	91	92	93	94	95	96	97	98	99
Green River										
Total		79	122	111	192	429	287	303	479	116
# Recaptured		0	7	2	16	41	39	50	86	22
Colorado River										
Total	23	118	132	209	206	115	117	132	77	21
# Recaptured		12	21	63	78	66	55	74	37	3
White River										
Total		21	19	69	33	37	41	58	42	63
# Recaptured		0	1	14	7	13	11	11	12	10
Yampa River										
Total	1	66	49	42	19	21	40	22	50	21
# Recaptured		9	6	10	8	10	15	6	14	12
Gunnison River										
Total		3	4	10	42	20	16	4	35	
# Recaptured				2	16	10	13	2	14	

ISMP Capture Data

	91	92	93	94	95	96	97	98	99
Green River									
Total	67	67	81	137	141	152	99	188	116
# Recaptured		1	2	8	13	10	11	20	13
Colorado River									
Total	18	31	27	31	41	50	31	31	21
# Recaptured			1	5	7	10	8	6	2
White River									
Total	13	19	20	30	33	38	45	37	63
# Recaptured			3	4	11	9	5	7	7
Yampa River									
Total	13	17	14	14	14	13	17	19	21
# Recaptured		1	1	3	2	6	1	7	8

Abundance estimation

- Very restrictive assumptions, including demographic closure, equal probability of capture of marked and unmarked animals
- Uses ratio of marked to unmarked animals in population to obtain estimate, assumes that ratio in sample and population equal
- Good estimates require high recapture rates and enough occasions to evaluate assumptions

Intuitive Abundance Estimation Example

$$N \times M/R = N_{\text{hat}}$$

or

$$100 \times 100/10 = 1,000$$

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Biased Abundance Estimation

$$100 \times 100/5 = 2,000$$

or

$$100 \times 100/20 = 500$$

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Parameter estimates from capture-recapture data 1998-1999

Abundance estimates were poor, because confidence intervals for point estimates for each river ranged from a couple hundred to over 30,000 fish, suggesting that they are extremely unreliable and **should not be used.**

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Estimates fraught with peril

- All assumptions likely badly violated
- Data collection not designed for abundance estimation
- Reliable abundance estimation not possible with existing framework

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Incidental Data from ISMP

Growth of recaptured fish, some
over a 15 year period

Movement and home range data

Recruitment of small fish in
lower Green River population

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Survival estimation

- Assumptions less restrictive, but S_{hat} and emigration confounded unless the former is directly estimated
- Uses only recapture data

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Intuitive Survival Estimation Example

$$N_{i+1} / N_i = S_{\text{hat}}$$

or the ratio of the number of animals marked
at one time interval to the number of those
alive at the next time interval

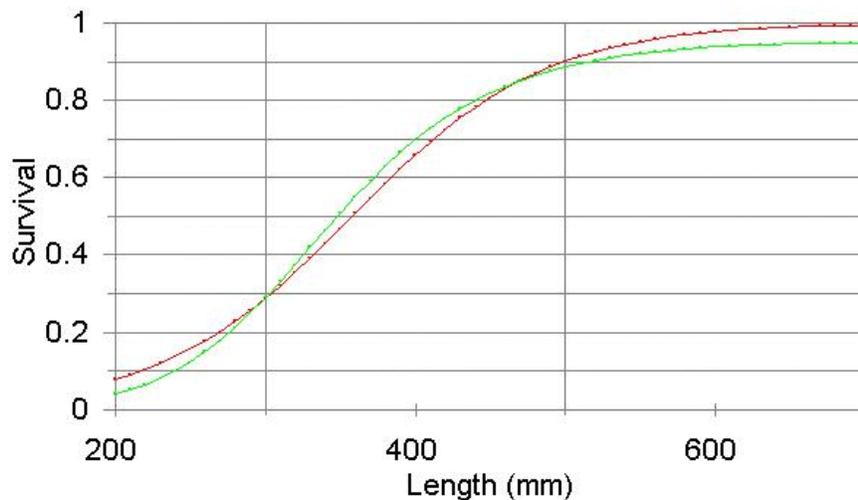
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Survival Estimation with the Barker Model

- A version of standard CJS model
- Used ISMP and all other capture data
- Modeled survival as a function of river,
with river specific probabilities of capture,
river specific re-sighting rates between
survival periods, and continuous covariates
Capdays and fish size
- Movement assumed low

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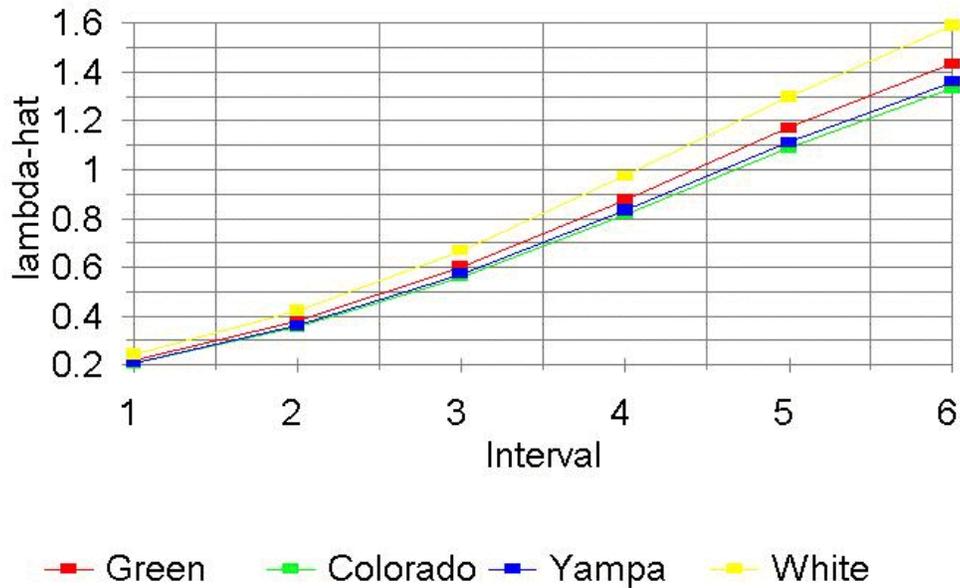
Colorado Pikeminnow Survival as a Function of Fish Size (TL)



Survival estimation conclusions

- Survival strongly size-dependent
- $S = 0.86$ (0.82 to 0.89), for fish of average TL in all rivers. Osmundson estimated $S = 0.86$ (0.66 to 0.95)
- P_{hat} varies by river
- CapDays matters, $\frac{1}{2}$ annual mortality occurs between May and August

Rate of Population Change



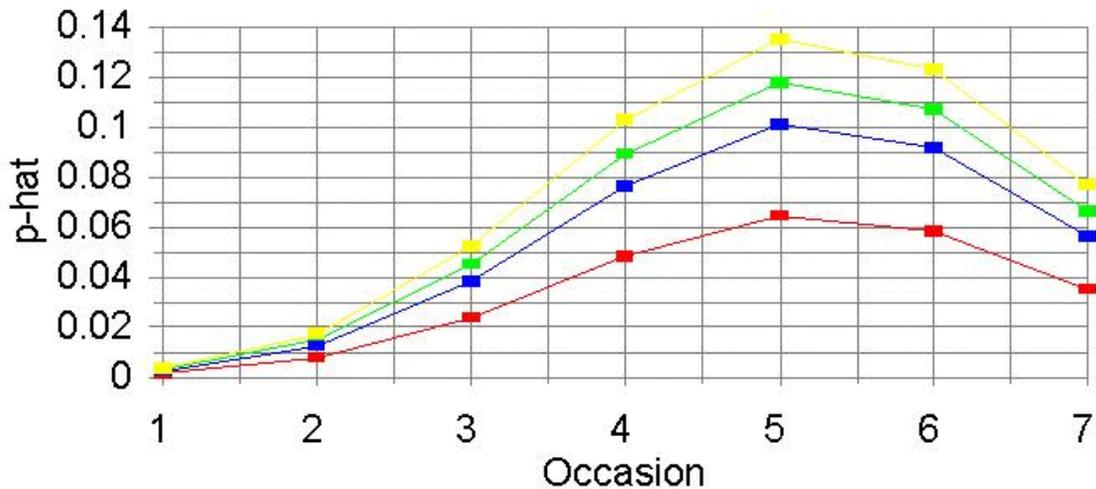
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Pradel's Population Rate of Change Model

- Requires constant sampling area over time, ISMP data ideal for this
- Ratio of estimates between years that are a function of survival and recruitment rates
- Estimate of 1.0 equals stable population (mortality = recruitment/immigration)

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Capture Probabilities



— Green — Colorado — Yampa — White

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Future Directions?

- Complete analysis with 98 and 99 data
- Resolve Pradel model fidelity parameters
- Write a report