



Grand Canyon Monitoring and Research Center

Biological Resources Program

- **Current Status and Trends Update for Humpback Chub (*Gila cypha*) in the Grand Canyon**





Trends in the Recruitment and Abundance of the Little Colorado River Population of Humpback Chub

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Presentation Outline

- Stock Assessment/Population Dynamics
Primer
- Partial History of HBC Research in Grand
Canyon
- Current Status & Trends

Definitions

- Stock Assessment

- Stock assessment involves the use of various statistical and mathematical calculations to estimate the past and current abundance and productivity of a fish population. The ultimate goal of stock assessment is to construct quantitative predictions about the reactions of fish populations to alternative management choices.

- Population Dynamics

- Population dynamics is the study and mathematical representation of how and why a population changes.

Definitions

- Cohort or Year Class
 - Animals resulting from reproduction during a single year.
- Recruitment (Recruits)
 - All animals entering a particular size or age class of the population. Age 1 for Supertag Model, length >150mm
- Brood Year
 - Year in which a particular cohort was spawned.

Assessing Abundance

- Estimating Abundance via Mark-Recapture
 - Closed population models
 - Estimate abundance but not mortality or recruitment.
 - Open population models
 - Estimate abundance, mortality, or recruitment

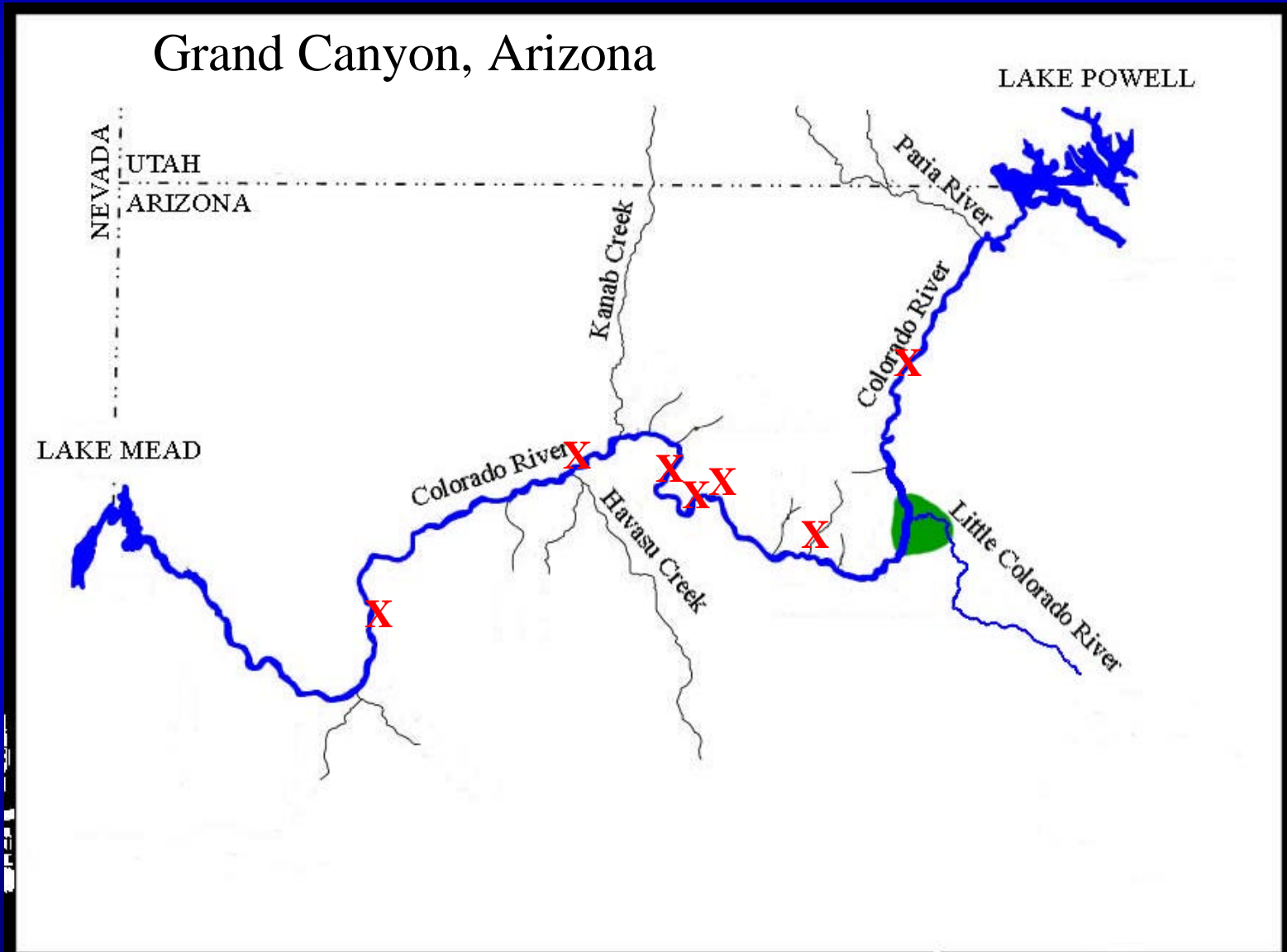
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HBC Research in Grand Canyon

- 1944 Species Description (Miller 1946).
- 1944-80 Various researchers documenting HBC occurrence and distribution (Stone and Rathbun 1967-69; Holden and Stalnaker 1975; Suttkus and Clemmer 1977; Minckley and Blinn 1976; Minckley 1975,1977, 1979; Carothers et al. 1981).
- 1980-82 LCR Investigations (Kaeding & Zimmerman 1983)
- 1984-87 GCES Phase I (Maddux et al. 1987)
- 1987-90 LCR Investigations (Minckley 1988,89,90; Kubly 1990)
- 1990-95 Phase II (BioWest, USFWS, AGFD, ASU)
- 1995-01 Transitional/Monitoring (AGFD, USFWS, SWCA, ASU, Hualapai)

HBC Research in Grand Canyon



HBC Abundance Estimation Grand Canyon

Year	Month	Location	Size	Estimate	Source
1982	May	LCR	>200 mm	7500	Kaeding & Zimmerman (1982)
1987	May	LCR Confluence	>120 mm	5783	Minckley (1988)
1987	May	LCR Confluence	>140 mm	1800	Kubly (1990)
1988	May	LCR Confluence	>120 mm	7060	Minckley (1988)
1988	May	LCR Confluence	>140 mm	2900	Kubly (1990)
1989	May	LCR	>150 mm	18253	Minckley (1989)
1989	May	LCR Confluence	>150 mm	10120	Minckley (1989)
1989	May	LCR	>140 mm	25000	Kubly (1990)
1990	May	LCR Confluence	>150 mm	6492	Minckley (1990)
1990	May	LCR	>150 mm	11985	Minckley (1990)
1992	May	LCR Confluence	>150 mm	1320	Douglas and Marsh (1996)
1992	May	LCR	>150 mm	4508	Douglas and Marsh (1996)
2000	Oct.	LCR	>135 mm	1600	Coggins and Van Haverbeke (2001)
2001	May	LCR	>150 mm	2000	USFWS In Prep.

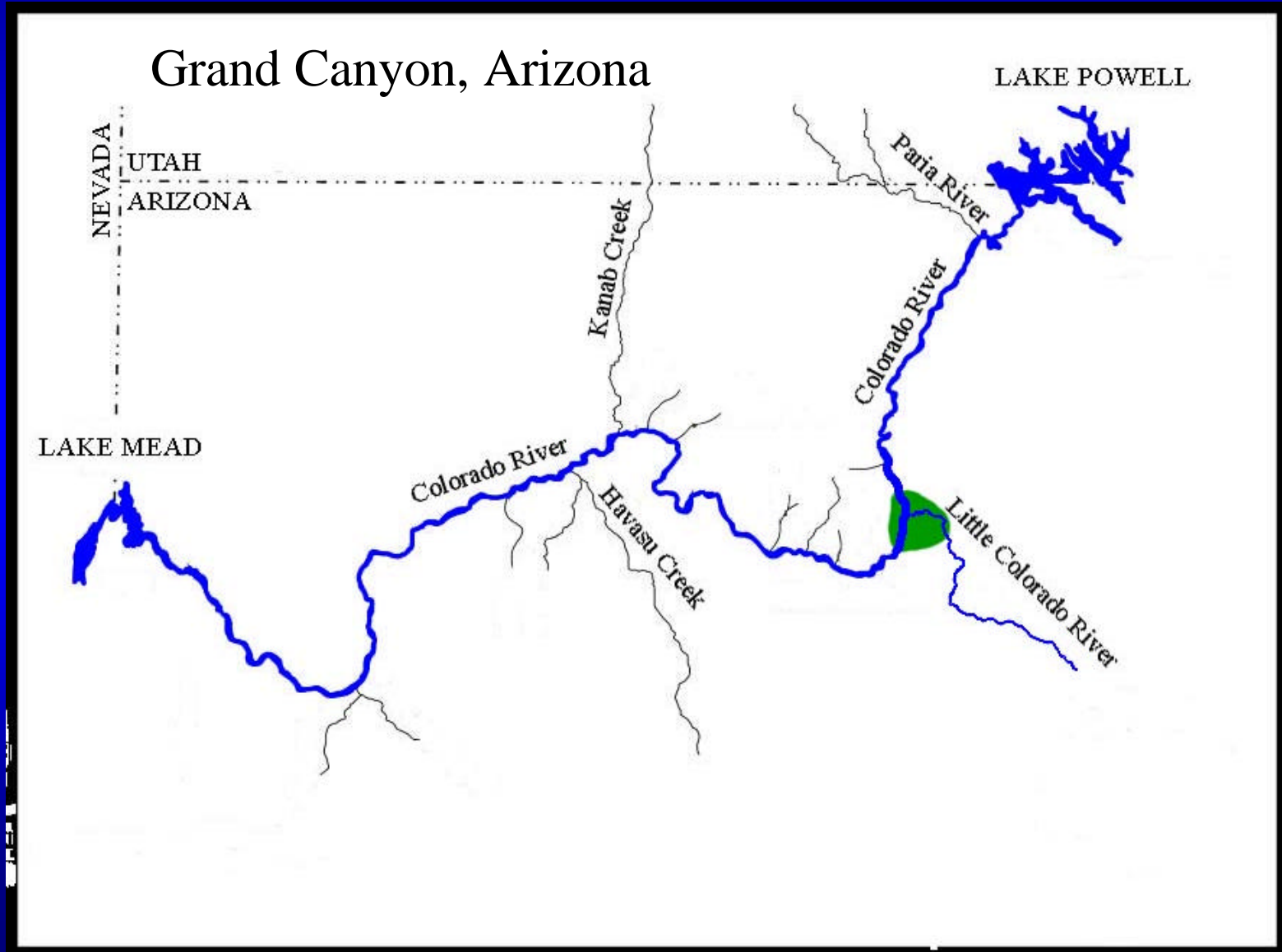
HBC Abundance Estimation Grand Canyon

Year	Month	Location	Size	Estimate	Source
1991-93	All	LCRI Aggregation	>200 mm	3000-4000	Valdez and Ryel (1995); Closed Population Model
1991-93	All	LCRI Aggregation	>200 mm	3200	Valdez and Ryel (1995); Open Population Model
1991-1993	?	MGG Aggregation	>200 mm	68-155	Valdez and Ryel (1995); Closed Population Model
1991-93	All	30-Mile Aggregation	>200 mm	55	Valdez and Ryel (1995); Closed Population Model
1991-93	All	Shinumo Inflow Aggregation	>200 mm	55	Valdez and Ryel (1995); Closed Population Model
1991-93	All	Havasu Inflow Aggregation	>200 mm	10	Valdez and Ryel (1995); Closed Population Model
1991-93	All	Pumpkin Spring Aggregation	>200 mm	5	Valdez and Ryel (1995); Closed Population Model

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Background



Motivation

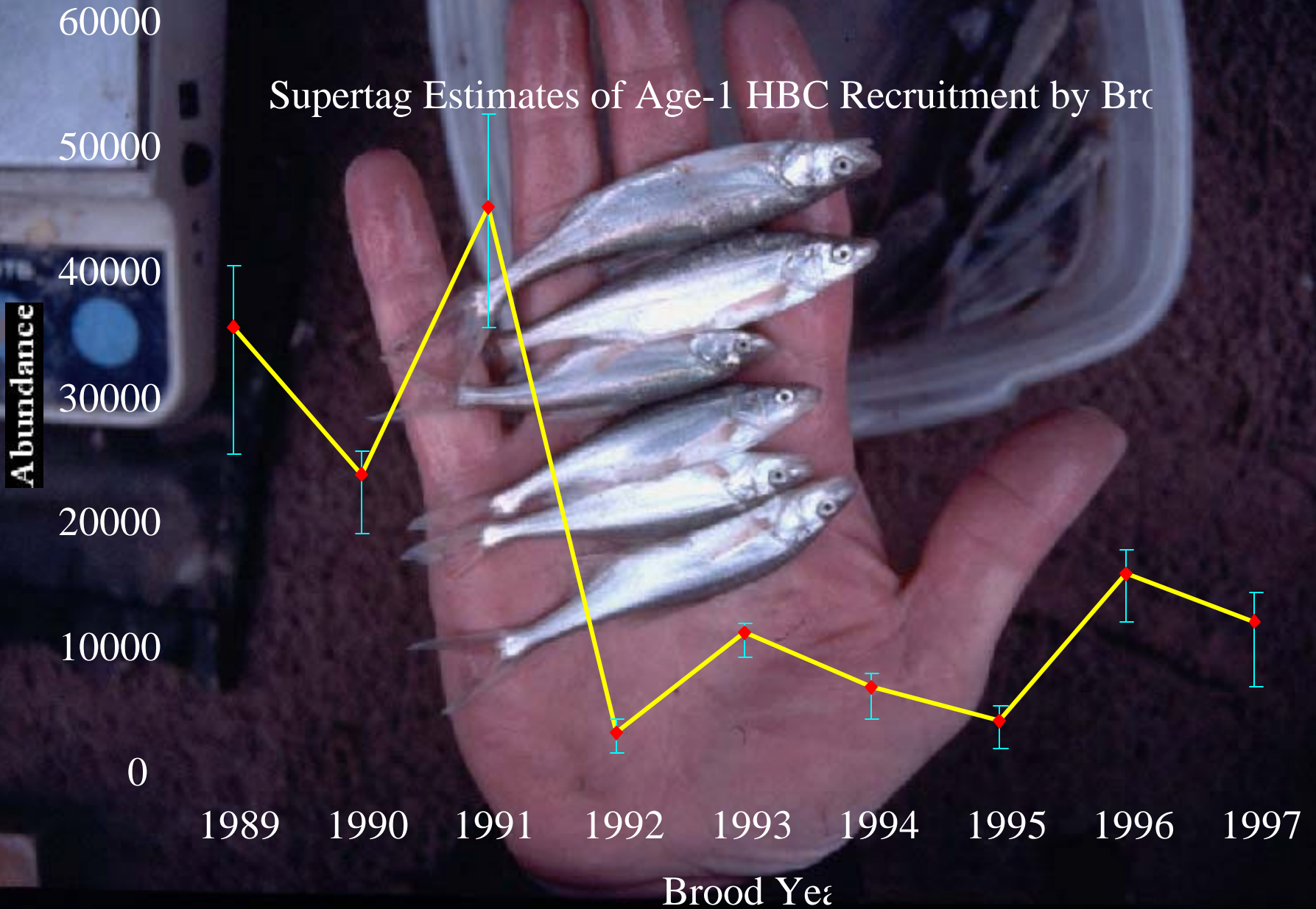
- Little Colorado River HBC Population
 - Historical (even recent) studies not designed to determine status and trends of HBC popl'n
 - After 20+ years of study, we did not have a clear understanding about the status and trends of the population
 - Opportunity to reanalyze existing data to determine if it was possible to reconstruct population trends as well as develop consistent long term monitoring for status & trends

Methods – Data Types

- **Mark-Recapture (PIT Tags)**
 - **1989 – 2000 mark-recapture data from the Little Colorado River and mainstem Colorado River (RM 57 to 68).**
 - **12,937 fish marked, 13,948 recaptures (includes multiple recaptures)**

Results – Recruitment Trend

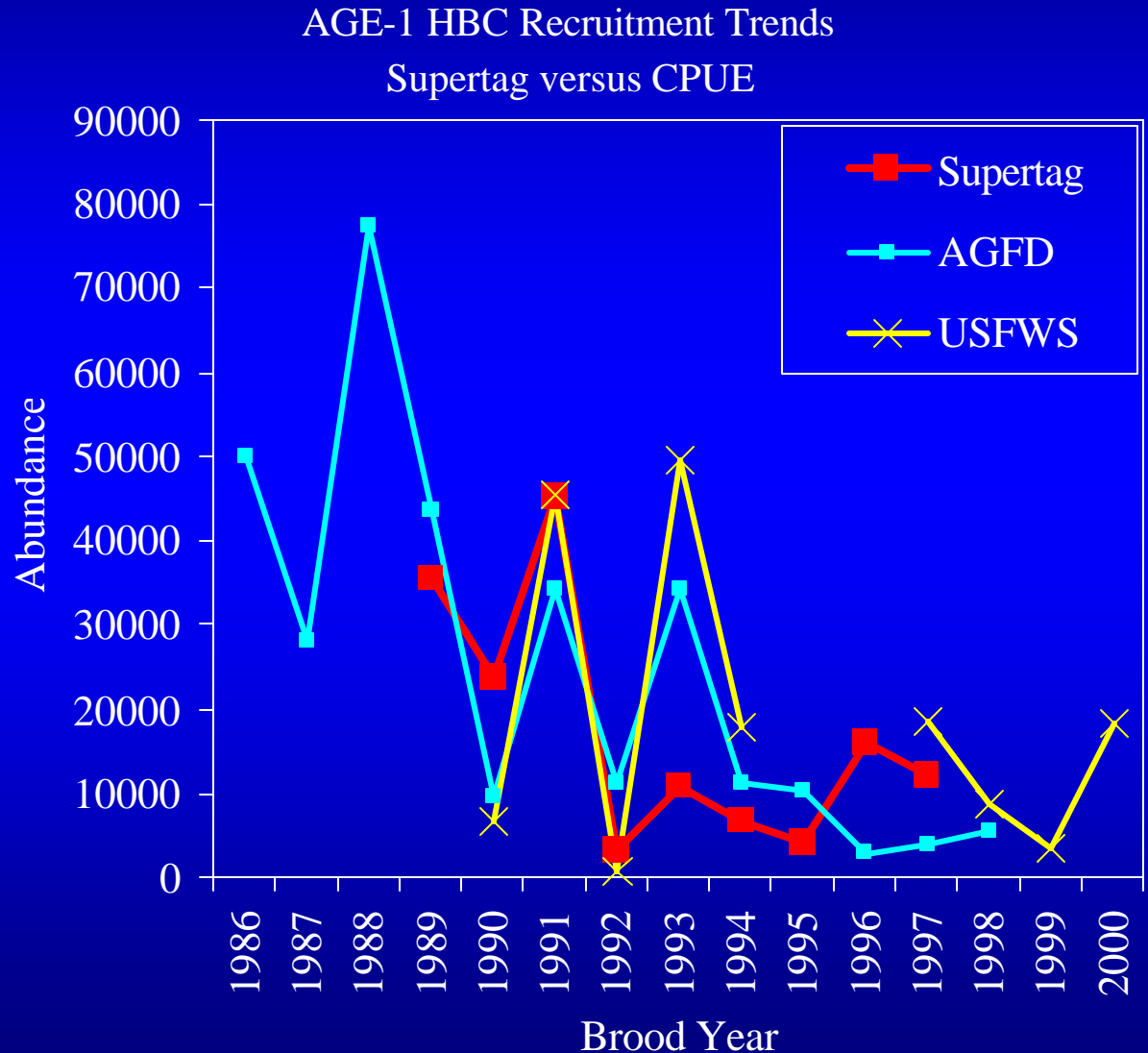
Supertag Estimates of Age-1 HBC Recruitment by Brood Year



Results – Recruitment Trend

Independent Estimators

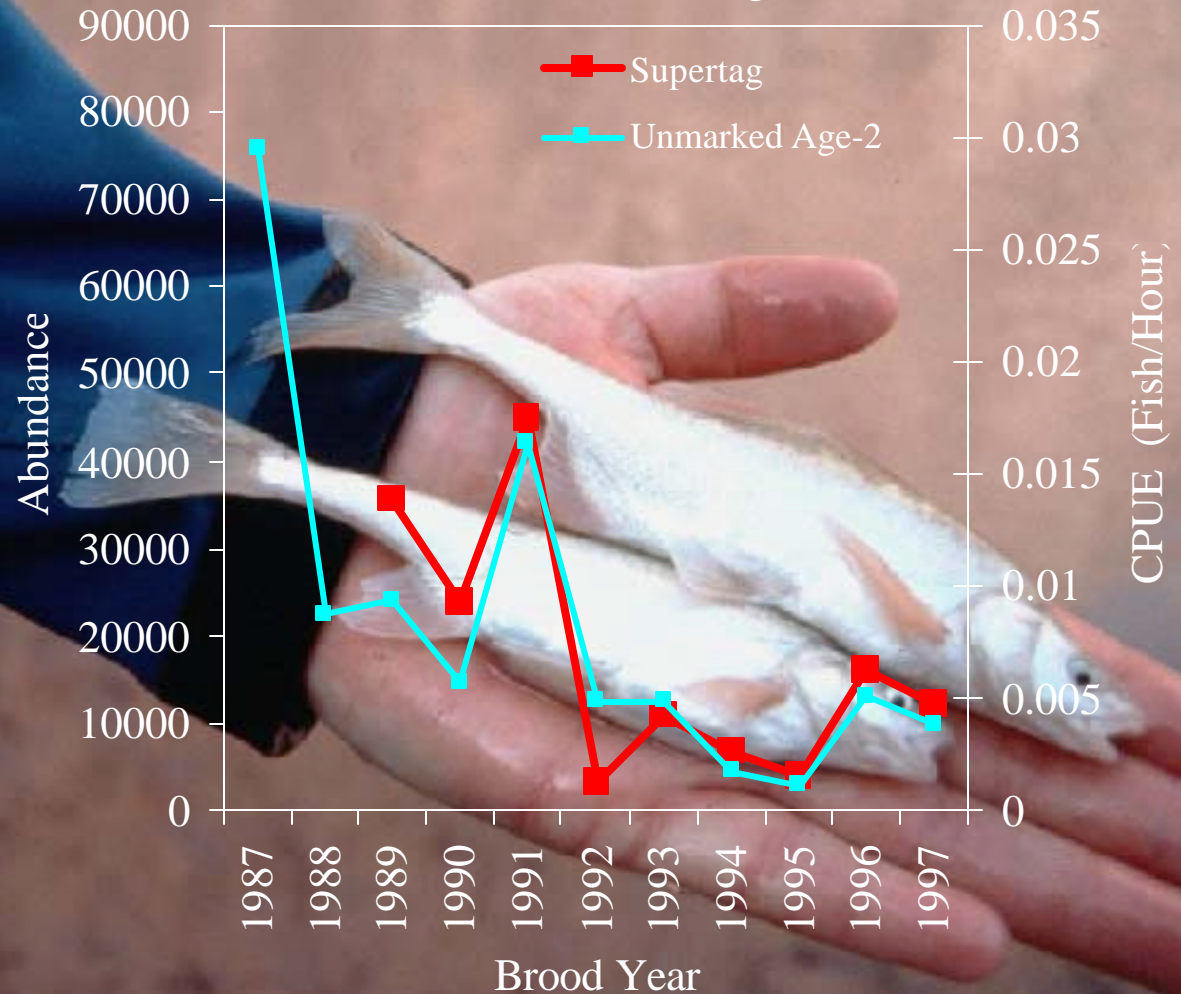
- Spring/Summer hoopnet CPUE indices of AGE-1 in the Little Colorado River
- AGFD data is longest and most consistent sampling protocols over time (lower 1200 meters)
- USFWS data primarily from two locations in the Little Colorado River (3 km and 11 km)
- Catch-rate scaled to abundance by calculating catchability coefficient



Results – Recruitment Trend

- Annual hoopnet CPUE of unmarked AGE-2 fish in the Little Colorado River
- Humpback chub reach tagging size (150 mm) at Age-2.
- Suggests 1993 cohort suffered increased mortality as compared to the 1991 cohort

Supertag Estimates of Age-1 HBC Recruitment versus
CPUE of Unmarked Age-2



How we sample and track a cohort: e.g. 1997 year class

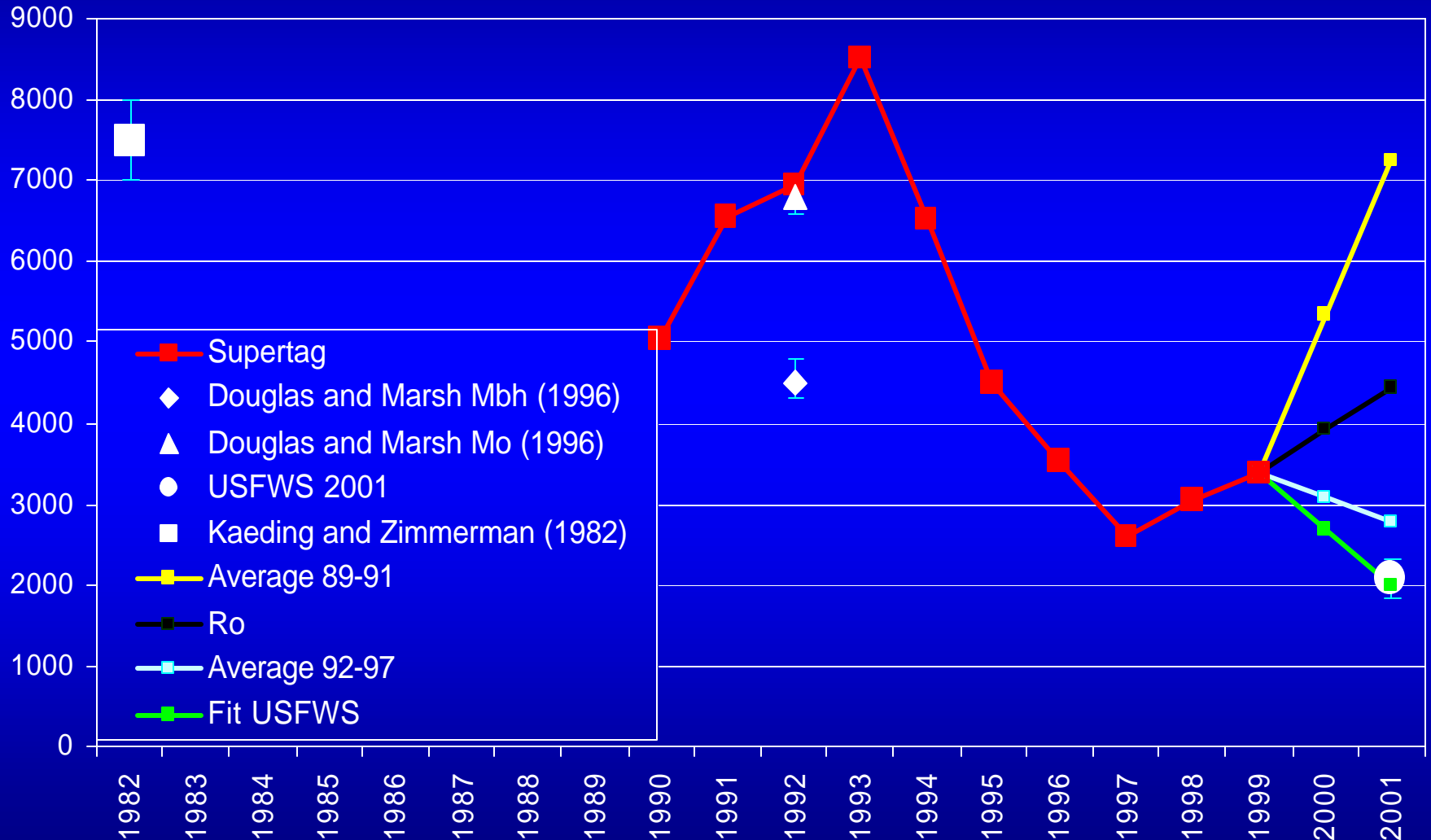
1997	1998	1999	2000	2001
H B C hatch in L C R and are age 0	1997 cohort attain stage 1, - first available for tagging	1997 cohort attain stage 2, all of this cohort subject to tagging, some recaptures	1997 cohort marked as age 1&2 first fully subject to recapture and use in model	1997 cohort data first available for inclusion in model (w/ em ay improve)

Population Trend

A consequence of chronic low recruitment may be a decline in the overall abundance of the population

Results – Abundance Trend

Estimated Abundance of Humpback Chub > 150** mm during May

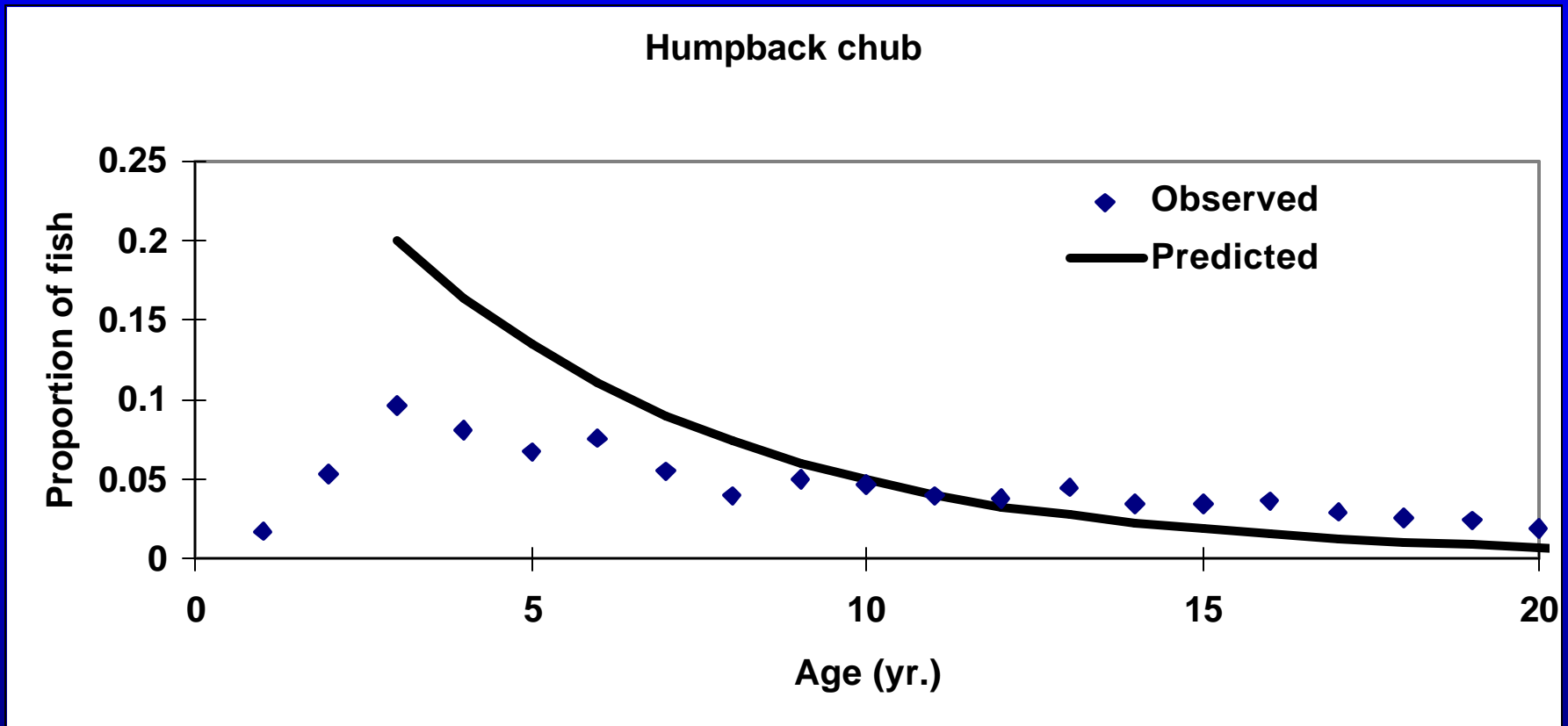


** Kaeding & Zimmerman estimate for HBC >200 mm

Conclusions – HBC Population Dynamics

- Data sources suggest that post-1993 recruitment is lower than pre-1992 recruitment.
- This lower recruitment rate is contributing to an overall decline in abundance for the LCR Humpback Chub population in Grand Canyon

Conclusions – HBC Population Dynamics



Conclusions – HBC Population Dynamics

- Data sources suggest that post-1993 recruitment is lower than pre-1992 recruitment.
- A Few Hypotheses:
 - Predation or Competition
 - Mainstem Colorado
 - Little Colorado River
 - Hydrology
 - Dam Operations (Interim flows August 1991, GCD EIS)
 - Little Colorado River Hydrology (1992 poor year class)
 - Parasitism
 - Asian Tapeworm
 - Is this just natural variability?
 - **Others and interactions**

Future Work & Collaborations

- GCMRC Cooperators-AGFD, USFWS, SWCA, Walters continue to refine long term monitoring strategy
- GCMRC working on expediting data analysis
- GCMRC participation in ES Population Estimation Workshop w/Upper Basin
- GCMRC to host workshop w/Upper Basin biologists to facilitate comparable methodologies

