



Monitoring Humpback Chub in Grand Canyon 2007; Concurrent Sampling

M.E. Andersen and L.G. Coggins, Jr.
Southwest Biological Science Center
Grand Canyon Monitoring and Research Center
Technical Work Group Meeting April 2007

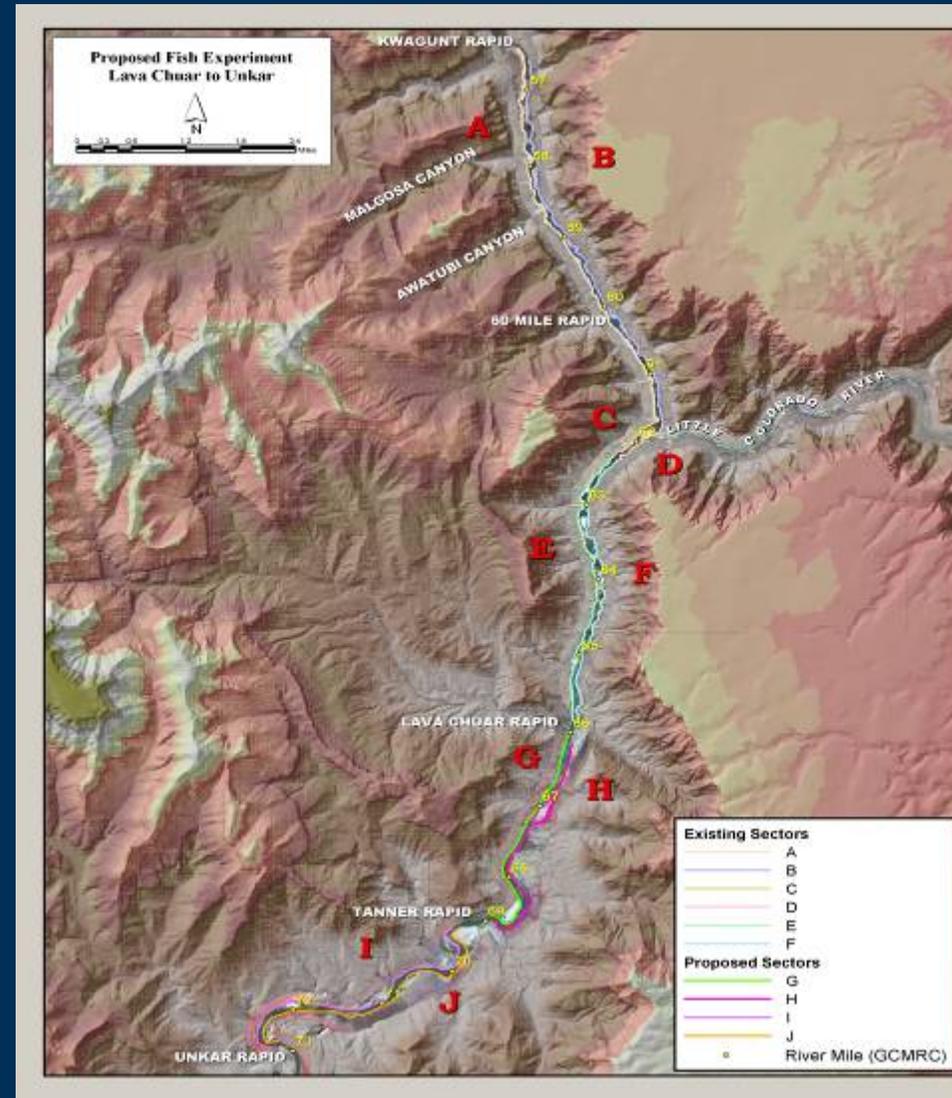
Goal

- Provide accurate estimate of adult (4+ years) humpback chub population in Grand Canyon



Location

- More than 90% of Grand Canyon humpback chub are found in the LCR and mainstem Colorado in the LCR reach (Paukert, Coggins, Flaccus 2006)



Sampling through 2006

- Humpback chub in Grand Canyon have been monitored in the Little Colorado River and/or the mainstem Colorado River since the late 1980s
- Sampling in different rivers has not always taken place at the same time

Population Estimation Models

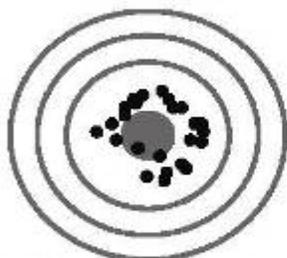
- **Closed models (e.g., CAPTURE) used historically**
 - **Population estimates based on data from one year**
- **Age-structured mark recapture (ASMR) open model peer-reviewed and currently in use (Coggins et al. 2006)**
 - **Population estimates based on data from multiple years**

Problem Statement

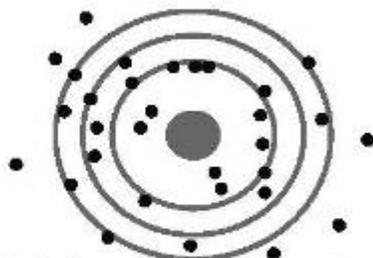
- If sampling for population estimation takes place in mainstem and tributary at different times, some individuals may be missed
- Potential sources of estimation error:
 - Movement in and out of sampling location
 - Gear avoidance following first capture
 - Skip spawning

Bias (accuracy) and Precision

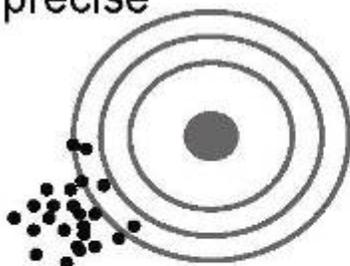
STATISTICAL PROPERTIES OF ESTIMATORS



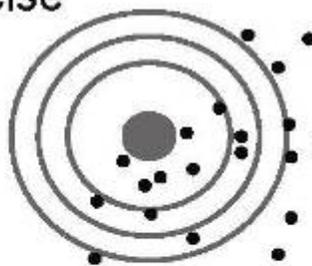
Unbiased and precise



Unbiased but not precise



Biased but precise



Biased and not precise

- Percent Relative Bias (Accuracy)
- Standard Deviation (Precision)

Kitchell panel (2003) recommendations

- **Compare ASMR to other open models**
 - Completed in Coggins et al. 2006
 - Favorable comparison
- **Computer modeling to assess bias**
 - Completed by Otis and Wickham 2006
 - Favorable comparison

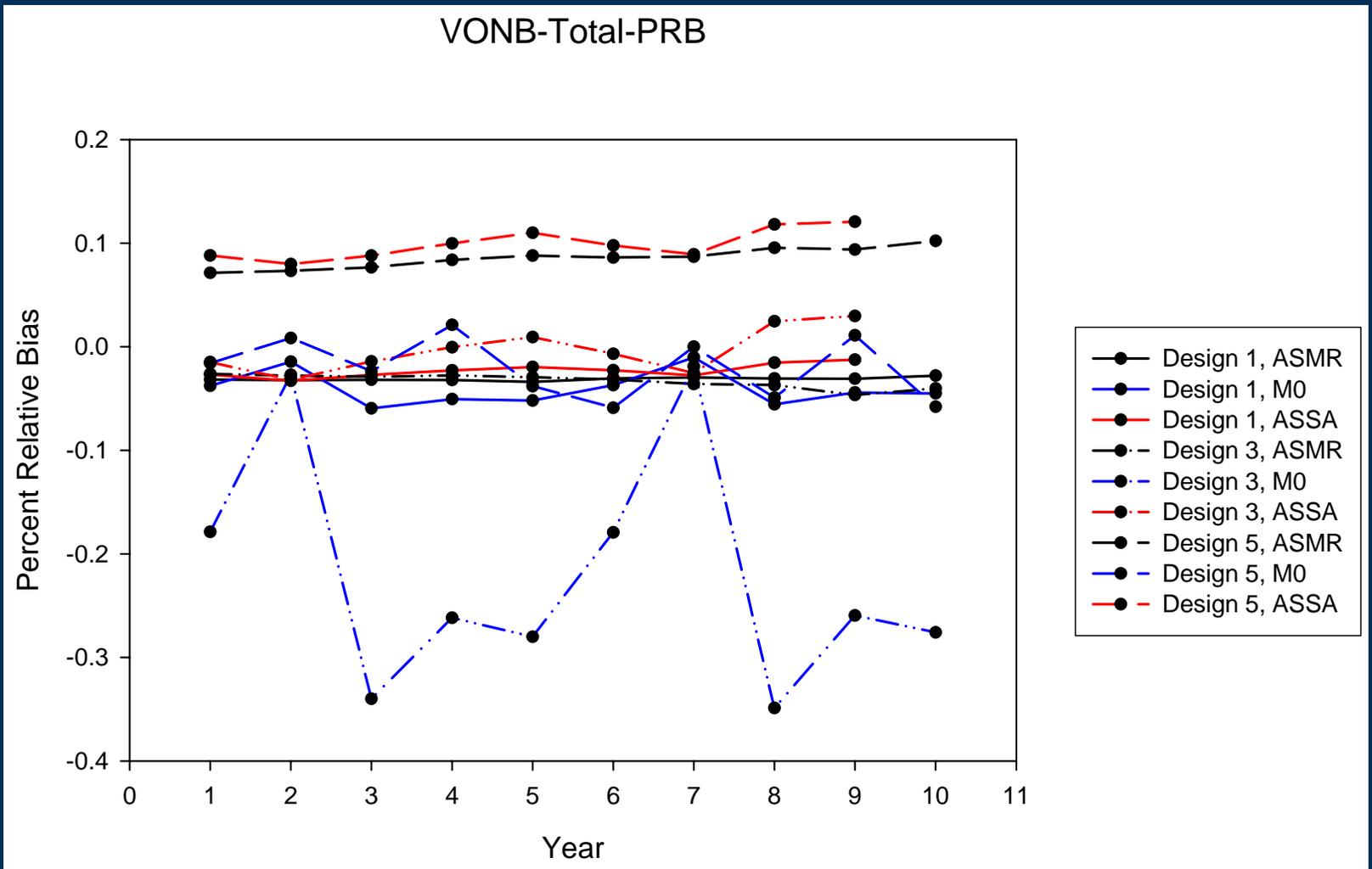
Otis and Wickham (2006) conclusions

- Accuracy (bias) and precision of ASMR was same or better than other models
- Consistency is valuable
- Sampling design of ASMR could be improved (also: Pollock 1982)
- Biology and cost were not considered

Sampling Designs Evaluated

- **Design 1: February, March, April**
- **Design 3: August, September, October**
- **Design 5: April, May, September, October (LCR only), July, August (COR only); (Current GCMRC/AMP sampling design)**

Spring sampling has least bias



Concurrent Sampling Justification

- Concurrent sampling design in spring has least bias
- Provides information for humpback chub Protocol Evaluation Panel in winter 2008
- 2007 approach requested and approved by USFWS Upper Colorado River Program
- Described in approved work plan for FY 07

Modifying Considerations

- Differing capture probabilities LCR vs. COR
- Seasonal movements
- Seasonal life history (spawning in spring)
- Handling effects
- Costs – limited to 2 concurrent samples in 2007

2007 Approach - Spring

- **Little Colorado River**
 - Continue existing protocol
 - Continue timing (April and May)
- **Colorado River – LCR reach**
 - Deploy trammel and hoop nets at approximately same time as LCR spring sampling – 2 trips
 - Collect blood samples for trammel/stress study
- **Colorado River – 8th year of canyon wide sampling of fish community**
 - Electrofishing

2007 Approach - Fall

- **Little Colorado River**
 - Continue protocol
 - Continue timing (August and September)
- **Colorado River** – canyon wide sampling of fish community
 - Electrofishing
- **Backwater seining**

Additional Concurrent Trips - 2007

- Sonic tags + Nonnative control
- Lower 1200 m LCR + PIT tag antennae

