Evaluating assessment programs for humpback chub in the Grand Canyon

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Background

- Glenn Canyon dam completed in 1964.
- Humpback chub were listed on the federal list of endangered species in 1967.
- Monitoring program based on mark-recapture methods.
- Complicated life-history ontogeny & movement between CR and LCR.

Method used to assess chub abundance

Age-Structured Mark-Recapture analysis (ASMR, Coggins et al. 2006)

- A combination of VPA and SCA methods to jointly estimate abundance and age-specific capture probabilities.
    - VPA to reconstruct untagged population
    - SCA to predicted fate of tagged individuals
- Assumptions include:
  - M is known
  - no aging error
- **Historical estimates of abundance are extremely precise; so what is the problem?**

Expensive monitoring programs for HBC, or glorified rafting trips for biologists?

Overarching project objective

- Examine how estimates of uncertainty in HBC abundance would change if monitoring efforts were reduced such that capture probabilities were reduced by as much as 50% over the current levels.

- Two steps to achieve this objective:

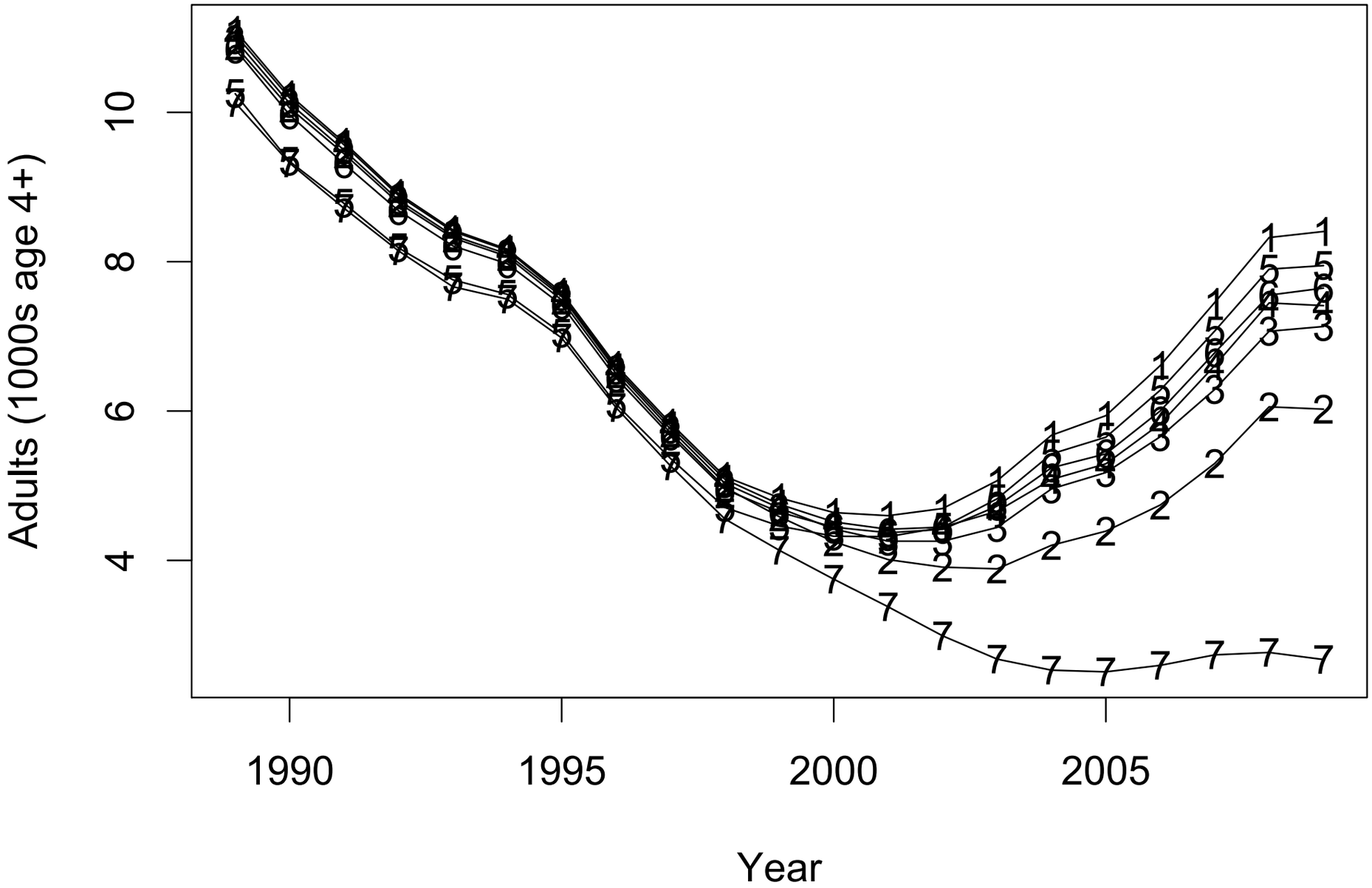
1. Use historical sampling data to establish appropriate spatial and temporal sampling coverage that is consistent with the current program.

2. Develop an IBM model to simulate mark-recapture data from reduced sampling efforts to quantify changes in estimates of uncertainty.

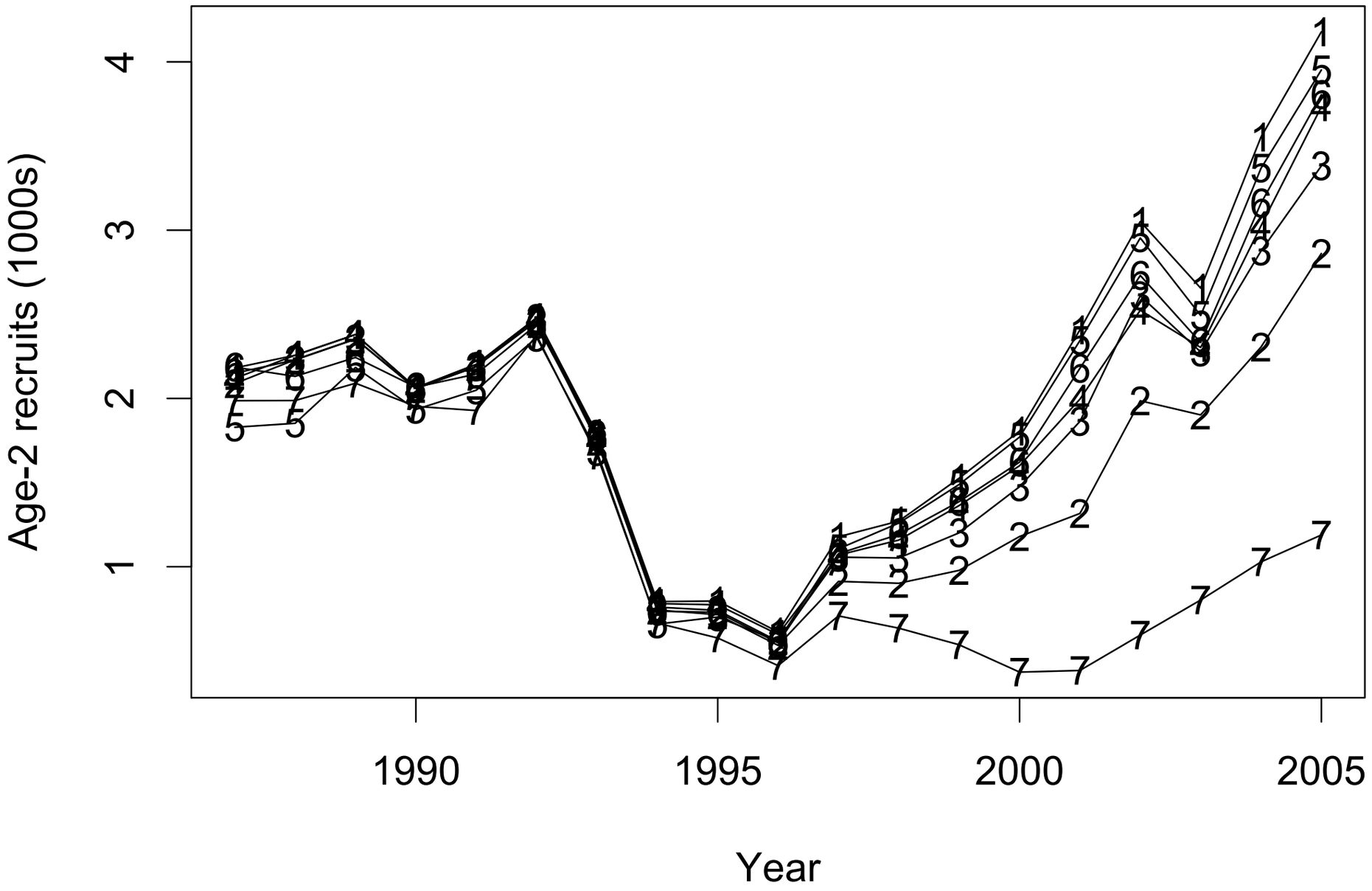
Scenarios

- **Scenario 1** represents the base line scenario where all available records between 1989 and 2009 are used to construct the ASMR input file.
- **Scenario 2** all September and October USFWS records have been removed (i.e., no fall sampling).
- **Scenario 3** all September USFWS records have been removed.
- **Scenario 4** all October USFWS records have been removed.
- **Scenario 5** all lower 1200 records have been removed.
- **Scenario 6** all April or first sampling trips of the spring have been removed, second trip or May trips have not been excluded.
- **Scenario 7** all USFWS lower 5 km samples have been removed from the spring sampling periods (lower 1200 spring trips have not been excluded).

Estimates of adult abundance



Estimates of age-2 recruits



Summary

- Historical data suggests non-random sampling is occurring:
  - Status quo: current population is at 78% of its 1989 abundance.
  - Temporal patterns: omit fall sampling, 57% depletion level.
  - Spatial patterns: omit lower 5km, 32% depletion level.
- Future changes (spatial or temporal) in sampling effort are likely to result in biased estimates of abundance.
- Reduced sampling frequency (e.g., every other year) may provide unbiased but less precise estimates of abundance.