

Glen Canyon Dam Adaptive Management Program

1996 Glen Canyon Dam EIS Record of Decision
1996 Grand Canyon Protection Act
Created Grand Canyon Monitoring and Research Program
Mandated long-term monitoring

STRATEGIC SCIENCE QUESTION 1-8:

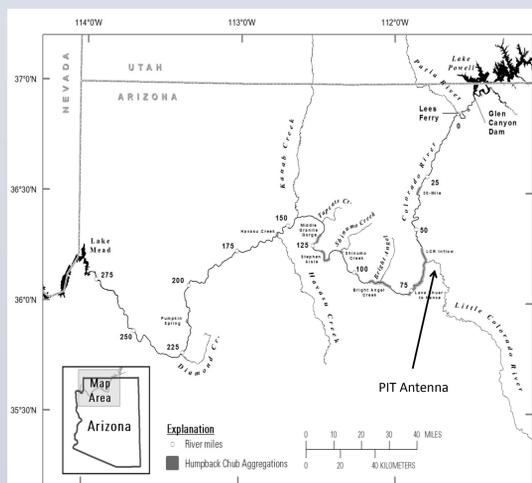
How can native and nonnative fish best be monitored while minimizing impacts from capture and handling or sampling?

Number of unique fish implanted with Passive Integrated Transponder (PIT) tags, Grand Canyon 1989-2013.

Species	Number PIT tagged
Black bullhead	30
Bluehead sucker	20,697
Brown trout	3,259
Channel catfish	112
Carp	1,771
Flannelmouth sucker	30,890
Humpback chub	53,026
Total	109,785

Recent advances in PIT tag technology allow unattended detection of PIT tagged fish using underwater antennas. Large numbers of native fish have been implanted with PIT tags, and most native fishes spawn in the Little Colorado River, providing an opportunity to detect fish during their spawning migrations.

Study site



Antennas are located approximately 2 km upstream from the confluence of the Little Colorado River and the mainstem Colorado River.



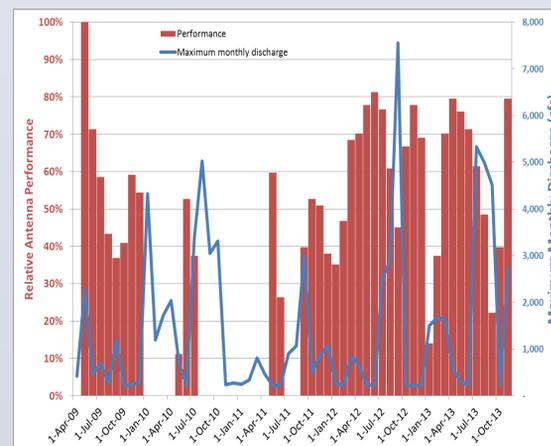
Photograph showing location of individual antennas in upstream array.



Solar panels used to power antenna system.

Results 2009- 2013

Antenna Performance and Little Colorado River Discharge

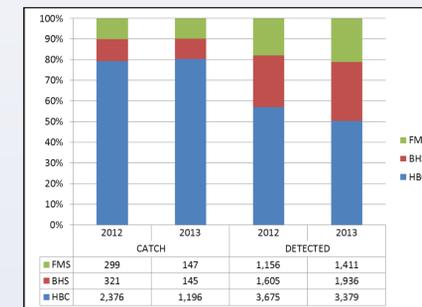


Relative performance and antenna array compared to 'optimum' at installation May, 2009 when 6 antennas were installed. Relative performance estimated as:

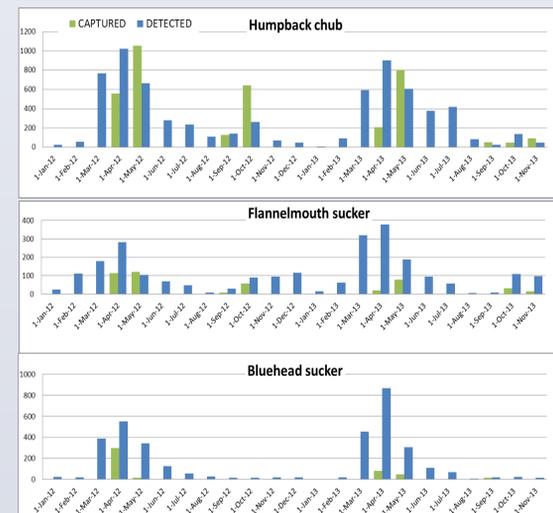
$$\frac{\sum(\text{Number of antennas active/day}) * \text{Number of days per month}}{\text{Maximum active in May 2009}}$$

Gaps in operations were due to high flow events damaging antennas and cables and inadequate power due to a lack of sunlight during winter. During May 2011 antennas were anchored more securely to prevent damage during moderate high flows and adjustments were made to maintain operation during winter months when sunlight was decreased.

Native fish detected by antennas and captured by hoop nets



Numbers of unique fish detected at antenna array and collected by hoop net as part of long term monitoring, Boulders camp, Jan 1, 2012 – Nov 30, 2013. Antenna detections may be more representative of species composition than hoop netting

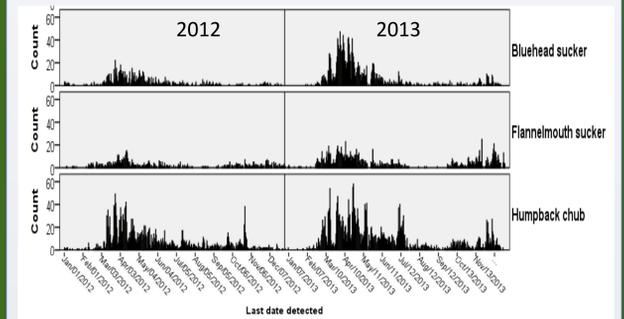


Numbers of unique fish detected at antennas and captured by hoop nets by month, Little Colorado River January 1, 2012 – November 30, 2013.



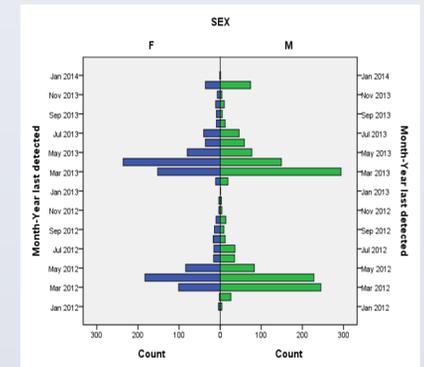
Little Colorado River antenna upstream array, May 2012, base flow approximately 213 ft³/sec..

Apparent timing of spawning runs



Number of unique fish detected, by last detection date, all antenna arrays, Little Colorado River, January 1, 2012 – December 31, 2013.

Male HBC ascend before females



Number of unique humpback chub detected by sex and month, Little Colorado River antenna array, January 1, 2012 December 31, 2013.

Conclusions

- Antenna arrays can be a cost effective method to detect PIT tagged fish in the Little Colorado River, although detection efficiency appears to be less than 40% (K. Pearson, personal communication).
- Communication with PIT tag reader allows for some remote maintenance and system tuning, thus reducing trips into the Canyon.

Future Directions

- Kristen Pearson, Colorado State University is working on a Masters Thesis evaluating detection efficiency and movement.
- Evaluate methods to reduce signal noise and improve detection efficiency.
- Incorporate data into stock assessment models.

Acknowledgements

USGS Columbia River Research Laboratory:

- Patrick Connolly, Ian Jezorek, Cari Mausling, Kyle Martin. GCMRC
- Tim Andrews, Glenn Bennett, Luke Avery, Tim Dealy, Dave Foster, Seth Felder, Ron Griffiths, Tom Gushue, Tom Sabol, Bob Tusso. Arizona Game and Fish Department
- John Luepke, Ed Jahrke, Mike Kuhna, Brian Clark, Aaron Bunch

PROVISIONAL DATA DO NOT CITE