Operation of a Remote PIT Tag Antenna Array in the Little Colorado River

Summary of results through Fall 2011

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U.S. Department of the Interior
U.S. Geological Survey

- **How can native and nonnative fishes best be monitored while minimizing impacts from capture and handling.**

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Number of times fish were PIT tagged and/or recaptured in LCR

Species Code	134.2 kHz only	400 kHz only	134.2 and 400 kHz	Total
missing		1		1
BBH	2			2
BHS	6,898	5,461	34	12,393
CCF	11	1		12
CRP	153	1		154
FMS	5,975	5,591	1,082	12,648
FRH	1	12		13
HBC	26,809	29,359	9,548	65,716
RBS		35	8	43
Total	39,849	40,461	10,672	90,982

Year	134.2 kHz only	400 kHz only	134.2 and 400 kHz	Total
1989	-	523	30	553
1990	-	518	44	562
1991	-	4,913	482	5,395
1992	-	6,521	962	7,483
1993	-	8,185	984	9,169
1994	-	5,481	600	6,081
1995	-	3,267	776	4,043
1996	-	357	82	439
1997	-	263	90	353
1998	-	497	72	569
1999	-	596	150	746
2000	-	1,285	100	1,385
2001	-	4,469	756	5,225
2002	-	3,209	1,676	4,885
2003	2,425	345	840	3,610
2004	1,997	25	744	2,766
2005	2,257	2	366	2,625
2006	4,391	1	672	5,064
2007	6,466	-	478	6,944
2008	7,122	2	338	7,462
2009	10,011	1	260	10,272
2010**	5,180	1	170	5,351
Total	39,849	40,461	10,672	90,982

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NEVADA
Lake Mead
Colorado
Grand Canyon
Kaibab Plateau
Colorado Plateau
Painted Desert
Chuska Mts
Antenna
Aubrey Cliffs
Humphreys pk
3851
Flagstaff
Little Colorado
Black Mts
Bullhead City
Lake Havasu City
Prescott
Verde
Mogollon Rim
Salt River
CALIFORNIA
Sonoran Desert
Phoenix
Mesa
Gila Mts
Gila
Yuma
Casa Grande
Mt Graham
Oro Valley
Galiuro Mts
Tucson
San Pedro
Sierra Vista
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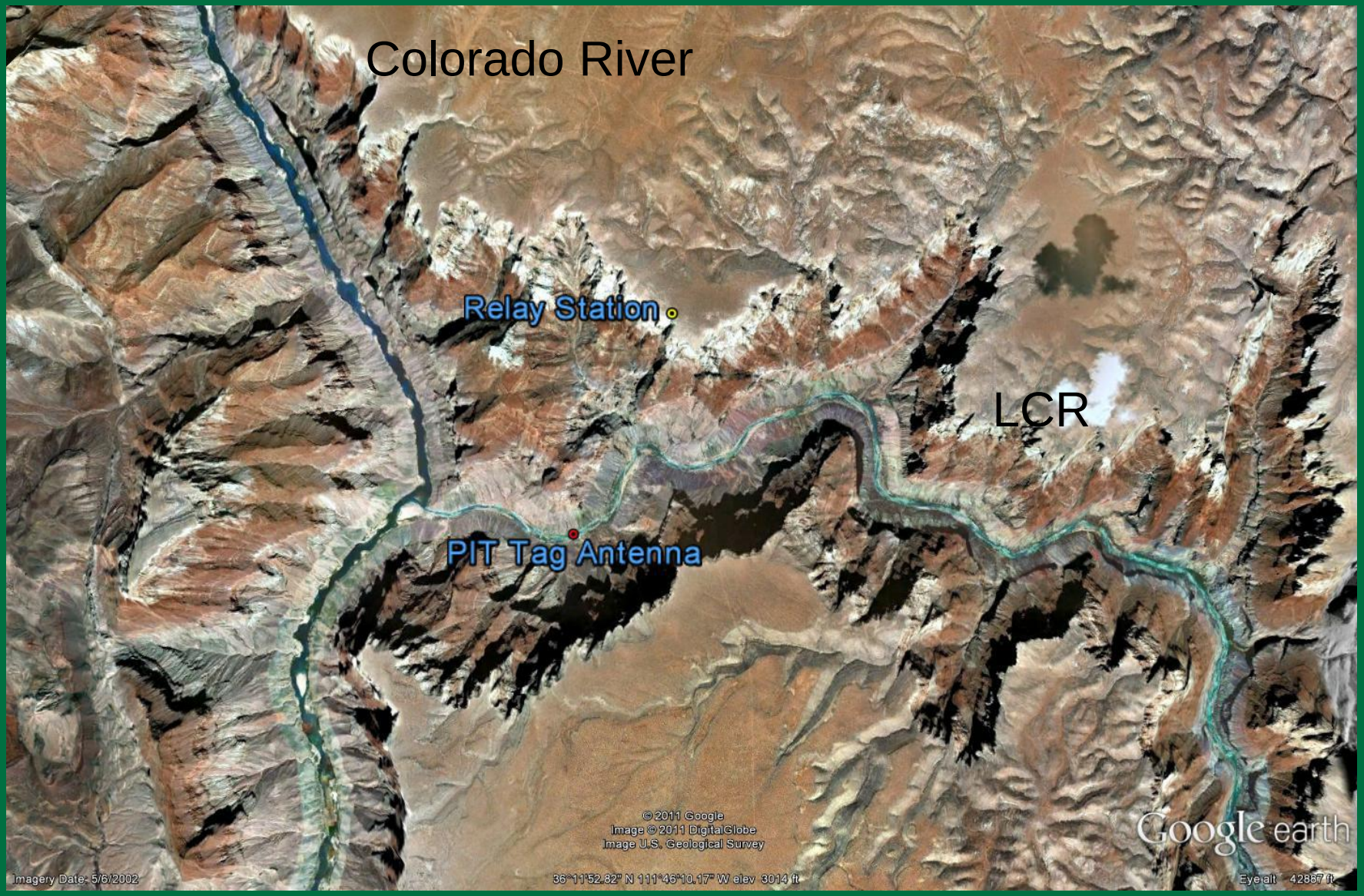
MEXICO
NEW MEXICO


Colorado River
Relay Station
LCR
PIT Tag Antenna
© 2011 Google
Image © 2011 DigitalGlobe
Image U.S. Geological Survey
Google earth
Imagery Date: 5/6/2002
36°11'52.82" N 111°46'10.17" W elev 3014 ft
Eye alt 42887 ft

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Multiplexer (MUX) 2009-2011

- Multiplexer system installed May 2, 2009
  - (Multiplex = combining many signals into a single transmission circuit or channel) = MUX
  - 2009: Six 20’ x 2’ antennas
  - 2011: Four 20’ x 2’ + Four 10’ x 2’

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Antenna Array 2011

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May 2011 Maintenance and Installation

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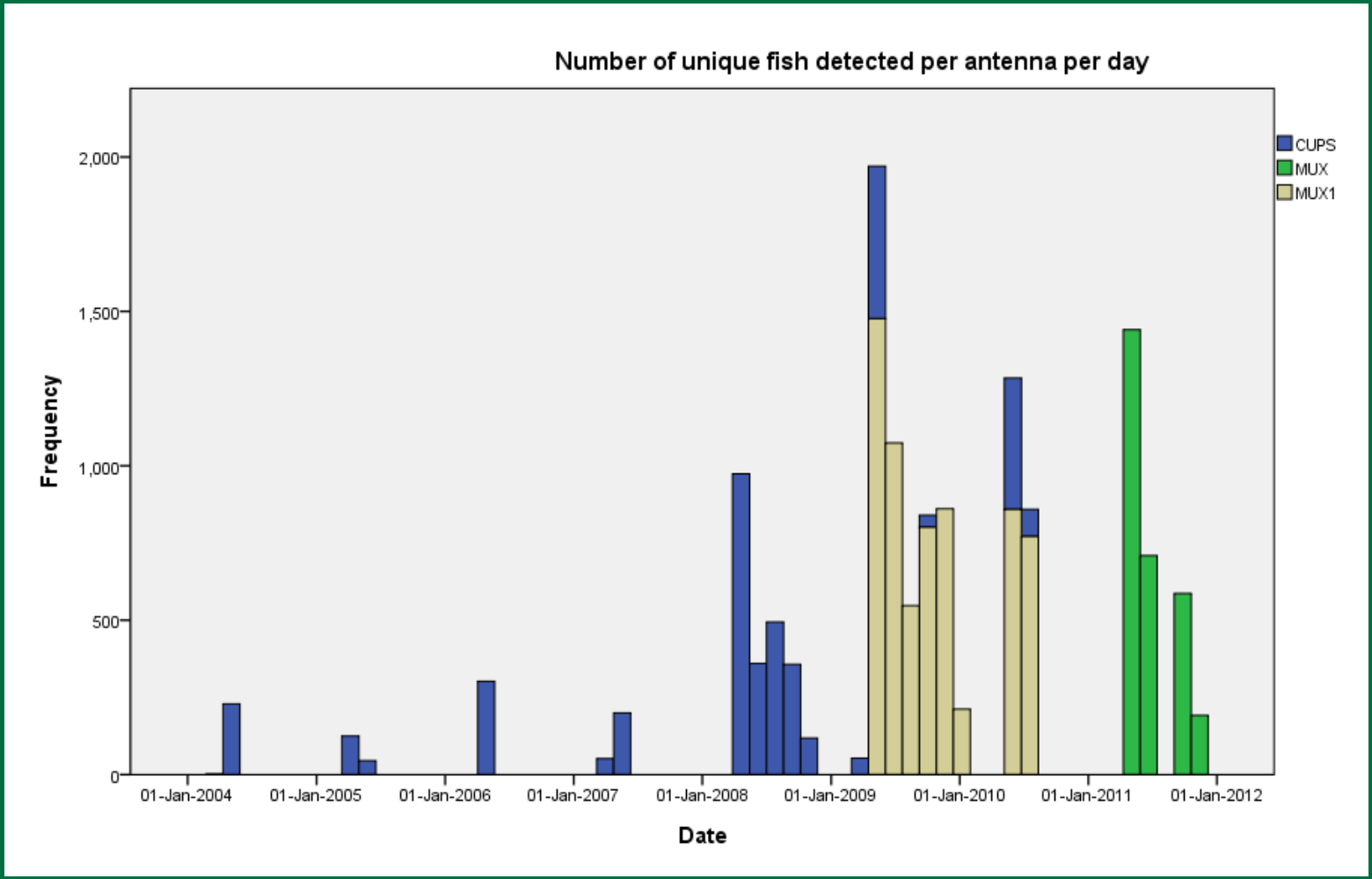
May 2011 base flow ~212 cfs

May 2011 base flow ~212 cfs

28 July 2011 ~ 800 cfs


Number of unique fish detected per antenna per day
Frequency
2,000
1,500
1,000
500
0
01-Jan-2004
01-Jan-2005
01-Jan-2006
01-Jan-2007
01-Jan-2008
01-Jan-2009
01-Jan-2010
01-Jan-2011
01-Jan-2012
Date
CUPS
MUX
MUX1

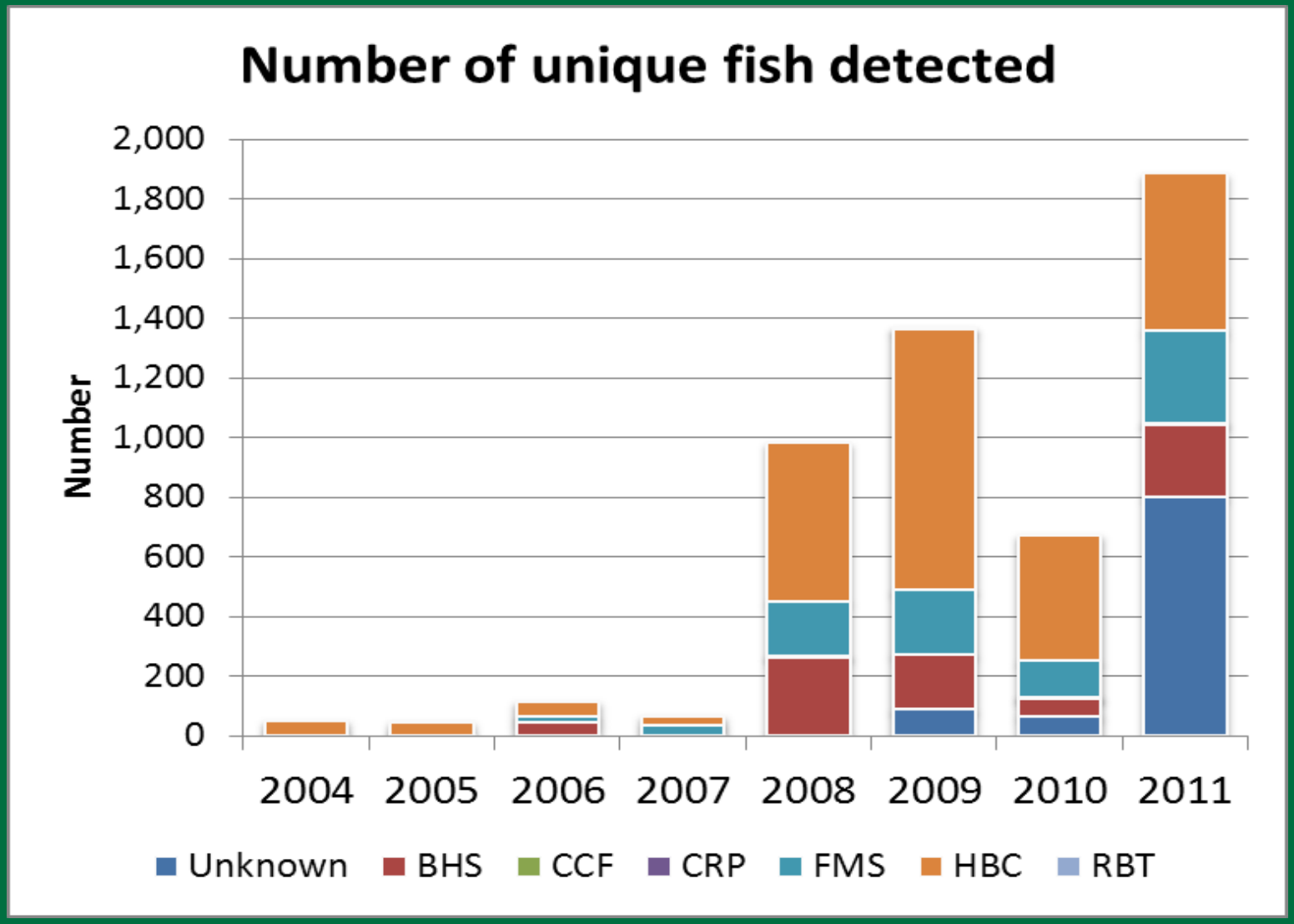
USGS

Number of unique fish detected, all PIT Antennas, LCR 2004-2011

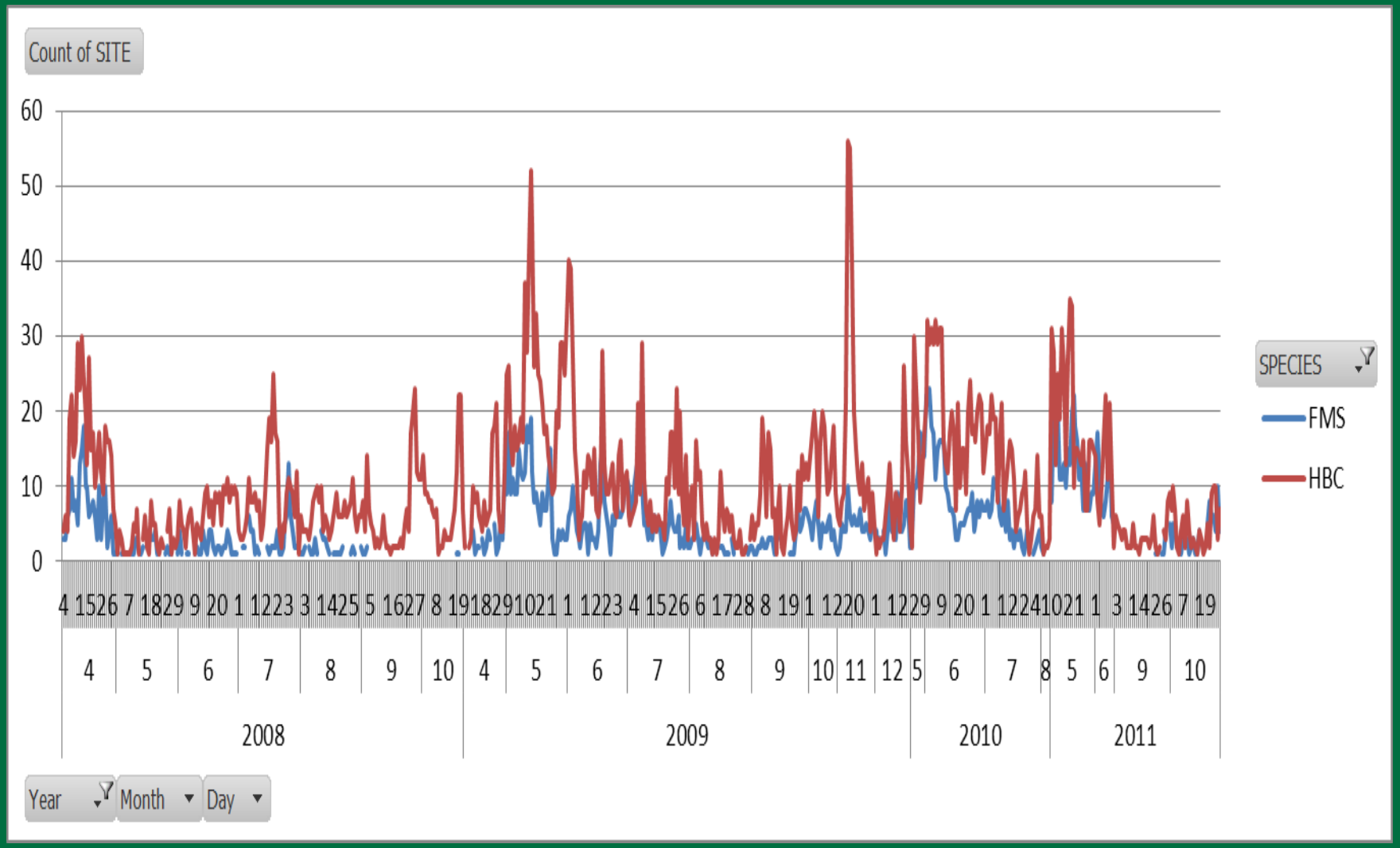
- **5,176 unique PIT tagged fish, 38,859 detections**

Species	Detected	(%)
Humpback chub	2,527	49
Unknown	964	19
Flannelmouth sucker	888	17
Bluehead sucker	788	15
Common carp	6	< 1
Channel catfish	2	< 1
Rainbow trout	1	< 1
Total	5,176	

USGS


Number of unique fish detected
Number
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2004
2005
2006
2007
2008
2009
2010
2011
Unknown
BHS
CCF
CRP
FMS
HBC
RBT

USGS


Count of SITE
60
50
40
30
20
10
0
4 15 26 7 18 29 9 20 1 12 23 3 14 25 5 16 27 8 19 18 29 10 21 1 12 23 4 15 26 6 17 28 8 19 1 12 20 1 12 29 9 20 1 12 24 10 21 1 3 14 26 7 19
4 5 6 7 8 9 10 4 5 6 7 8 9 10 11 12 5 6 7 8 5 6 9 10
2008
2009
2010
2011
SPECIES
FMS
HBC
Year
Month
Day

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- **WHAT WORKED**
  - **2009 - 2011 Power plant and MUX with lapses**
  - **Detected >5,600 unique fish**
  - **Modified antenna configuration to better span entire channel in 2011**
  - **Remote access relay station built and tested**
  - **Camera installed**
  - **Colorado Coop Unit / CSU Graduate student started 2011**
- **WHAT DID NOT WORK**
  - **Unable to install second downstream antenna array**

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Remote relay station 2011

Acknowledgements

- USGS CRRL: Patrick Connolly, Ian Jezorek, Cari Mausling,
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- CSU: Dana Winkelman, Kristen Pearson

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