



Colorado River fish monitoring in Grand Canyon, Arizona: 2002-2012 humpback chub, *Gila cypha*, aggregations.



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



William R. Persons¹ and
David R. VanHaverbeke²

¹U.S.G.S. Grand Canyon Monitoring and Research
Center

²U.S. Fish and Wildlife Service



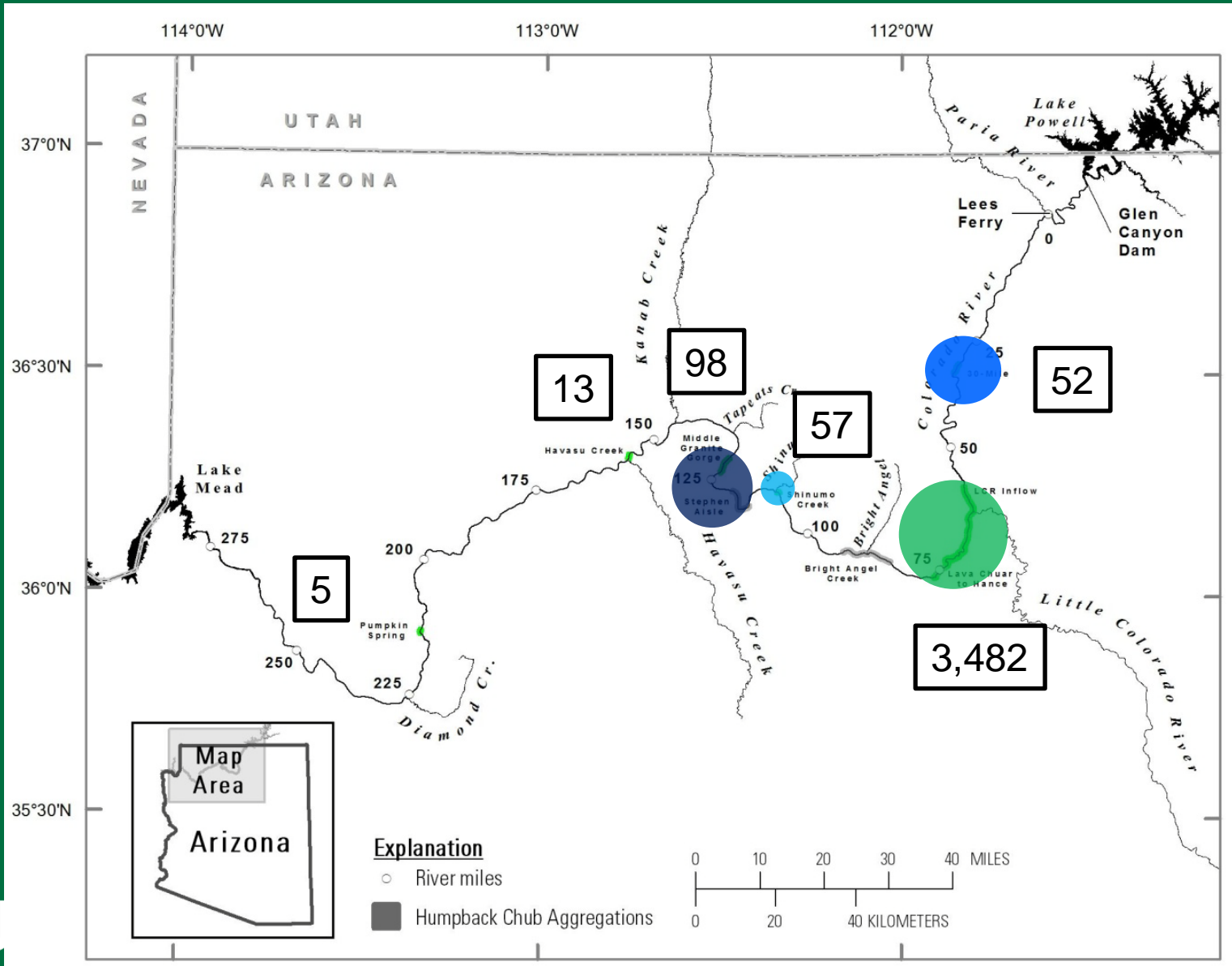
Aggregation:

“a consistent and disjunct group of fish with no significant exchange of individuals with other aggregations, as indicated by recapture of PIT-tagged juveniles and adults and movement of radio-tagged adults” (Valdez and Ryel, 1995).

1993 Aggregations

Aggregation	Abundance	95% C.I.
30-Mile	52	24-136
Little Colorado River Inflow	3,482	2,682-4,281
Lava Chuar to Hance	-	
Bright Angel Creek Inflow	-	
Shinumo Creek Inflow	57	31-149
Stephen Aisle	-	
Middle Granite Gorge	98	74-153
Havasus Creek Inflow	13	5 - 70
Pumpkin Spring	5	4-16

Aggregations 1993



METHODS (1): Generate pooled capture probabilities estimates

Years	Marks	Captures	Recaptures	p1 mark rate	p2 recap rate
2002 - 2003	31	46	3	0.065	0.097
2003 - 2004	46	29	2	0.069	0.043
2010 - 2011	168	141	8	0.057	0.048
2011 - 2012	141	99	5	0.051	0.035
Pooled	386	315	18	0.057	0.047

Data from 2002-2012 consecutive years (2002-2004 Ackerman 2008).

METHODS (2): Generate abundance estimates

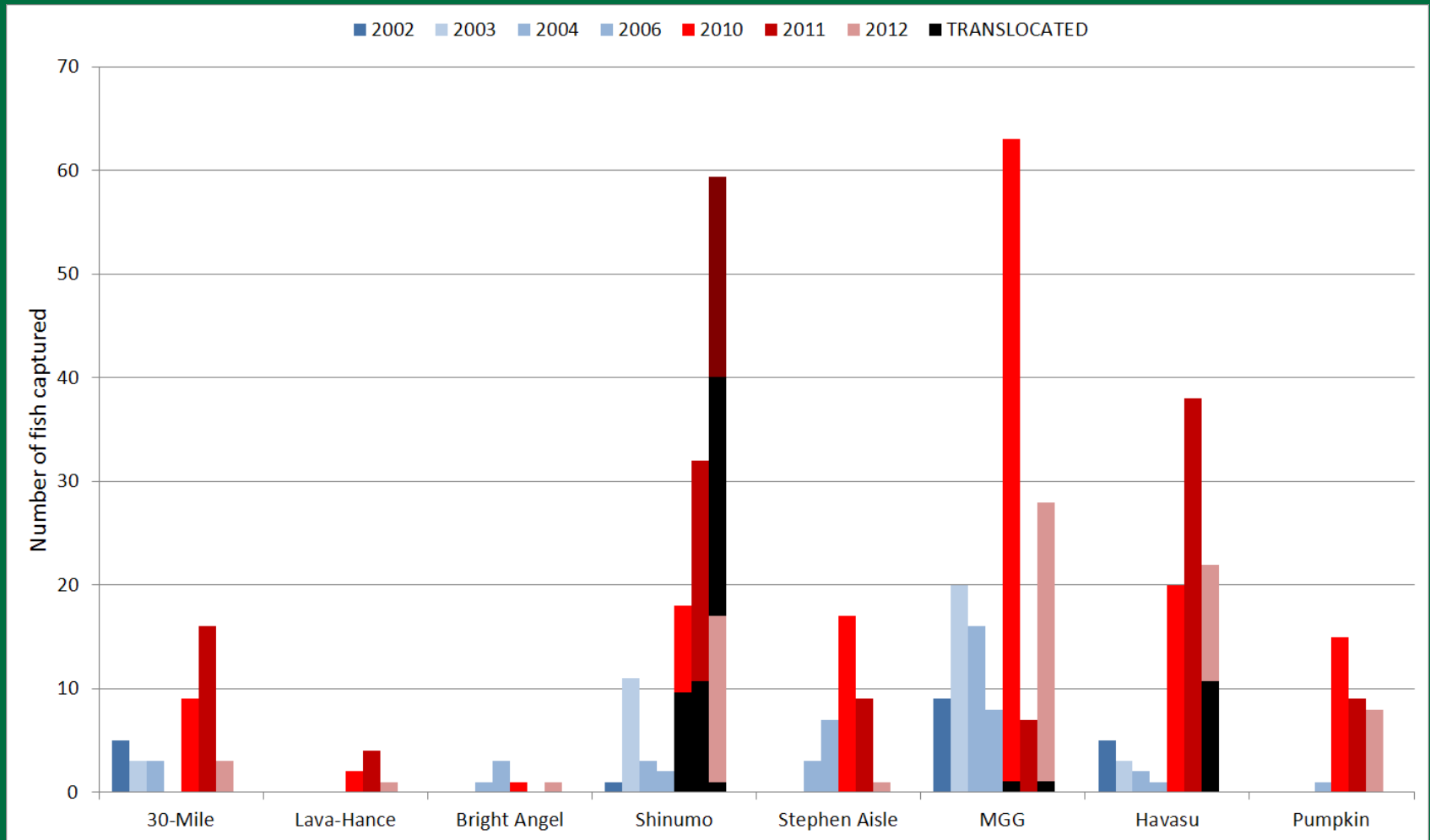
$$\text{Abundance} = \text{Catch} / p$$

$$16 / 0.0507 = 280$$

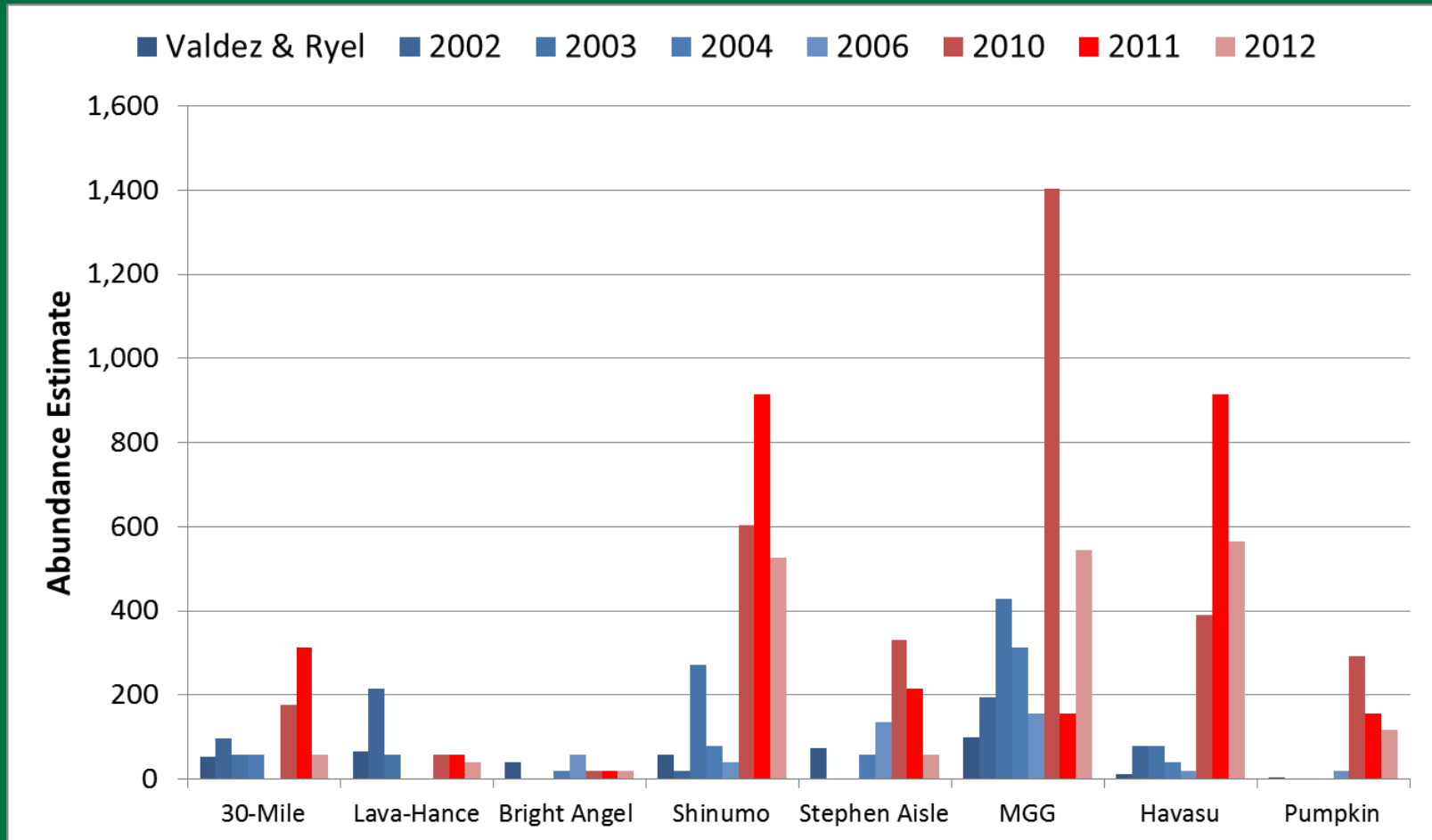
$$16 / 0.0407 = 343$$

$$\text{Average} = (280 + 343)/2 = 312$$

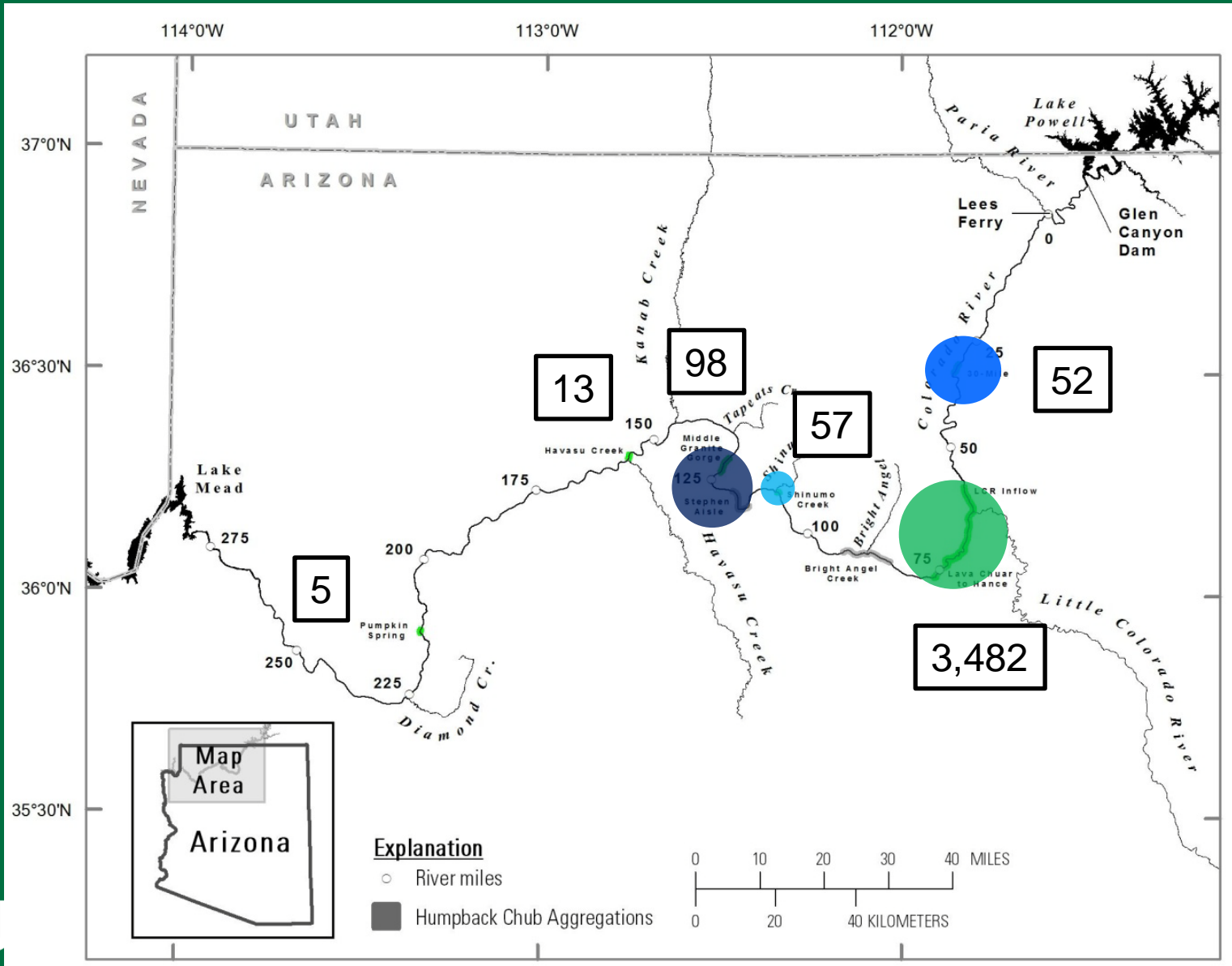
Catches of humpback chub 2002-2012.



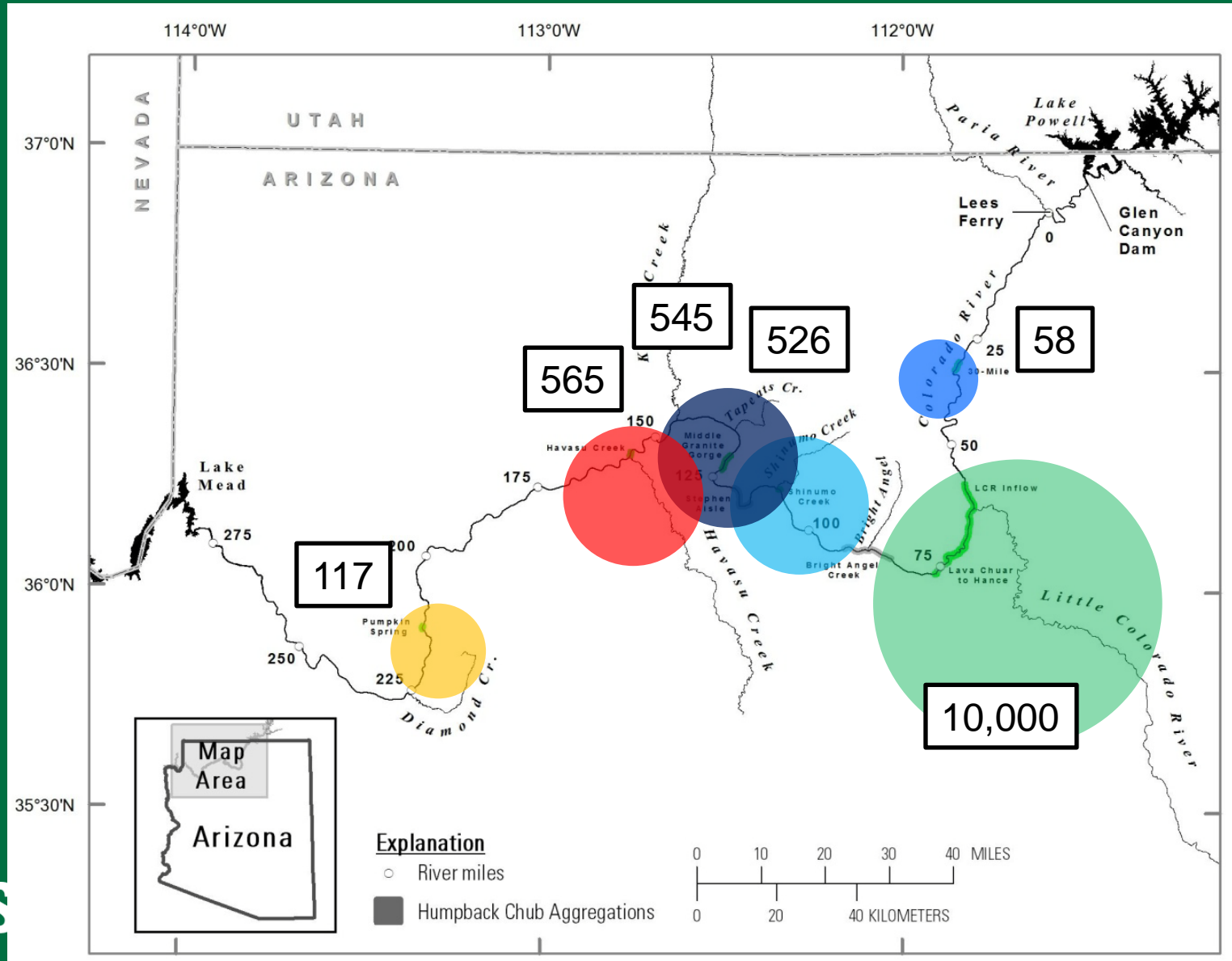
Abundance estimates 1993-2012.



Aggregations 1993



2012 Aggregations



Location of tagging and recapture, humpback chub 1989-2012.

		Location recaptured											
Location tagged	Number Marked	30M	LCR	LCR reach	LCH	BAC	SHI	STE	MGG	HAV	PUM	Total	FIDELITY
30M	61	36	2	2	-	-	-	-	-	-	-	40	59%
LCR	38,502	3	33,841	2,720	73	3	4	2	4	3	-	36,656	88%
LCR reach	4,698	1	1,934	1,870	16	1	1	-	1	2	-	3,826	40%
LCH	271	-	47	22	10	-	-	-	-	-	-	79	4%
BAC	22	-	1	-	-	-	-	-	-	-	-	1	-
SHI	1,001	-	-	-	-	-	71	1	2	-	-	74	7%
STE	76	-	1	1	-	-	-	1	2	-	-	5	1%
MGG	314	-	-	1	-	-	1	1	87	1	-	92	28%
HAV	617	-	4	-	-	-	-	-	-	14	-	18	2%
PUM	27	-	-	-	-	-	-	-	-	-	2	2	7%
Total	45,589	40	35,831	4,616	99	5	77	5	96	23	2	40,799	

Location of tagging and recapture, humpback chub 1989-2012.

		Location recaptured											
Location tagged	Number Marked	30M	LCR	LCR reach	LCH	BAC	SHI	STE	MGG	HAV	PUM	Total	FIDELITY
30M	61	36	2	2	-	-	-	-	-	-	-	40	59%
LCR	38,502	3	33,841	2,720	73	3	4	2	4	3	-	36,656	88%
LCR reach	4,698	1	1,934	1,870	16	1	1	-	1	2	-	3,826	40%
LCH	271	-	47	22	10	-	-	-	-	-	-	79	4%
BAC	22	-	1	-	-	-	-	-	-	-	-	1	-
SHI	1,001	-	-	-	-	-	71	1	2	-	-	74	7%
STE	76	-	1	1	-	-	-	1	2	-	-	5	1%
MGG	314	-	-	1	-	-	1	1	87	1	-	92	28%
HAV	617	-	4	-	-	-	-	-	-	14	-	18	2%
PUM	27	-	-	-	-	-	-	-	-	-	2	2	7%
Total	45,589	40	35,831	4,616	99	5	77	5	96	23	2	40,799	

Increasing abundance:

- Warmer than normal water during 2004, 2005, 2011
- Translocations
 - Shinumo Creek
 - 902 fish 2009-2011
 - Havasu Creek
 - 543 fish 2011-12
- Mechanical trout removal at LCR confluence 2003-2006, 2009
- Good production from Little Colorado River

Future Directions:

- Increase sampling effort at areas outside of discrete aggregations during 2013-14.
- Humpback chub natal origins project 2013-14.
 - Otolith microchemistry, ultrasound.

