

Development of a Monitoring Plan for Lowland Leopard Frogs and Colorado River Toads



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Long term goals of the MSCP

- **Determine distribution**
- **Protect existing occupied habitat**
- **Determine feasibility of establishing in unoccupied habitat**

Near term goals of the MSCP

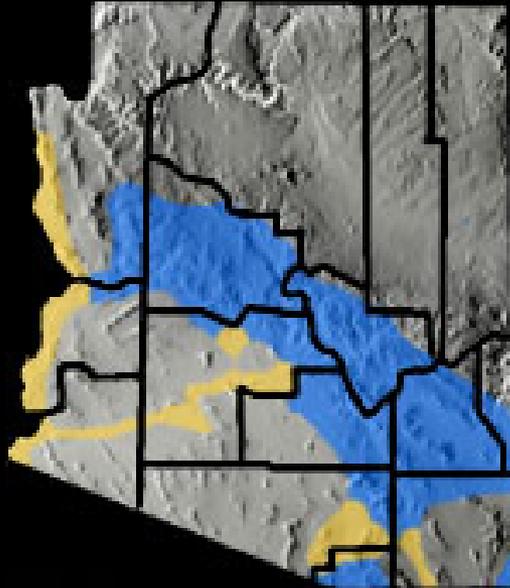
- **Develop repeatable methods for monitoring**

Lowland Leopard Frog

Spring breeder

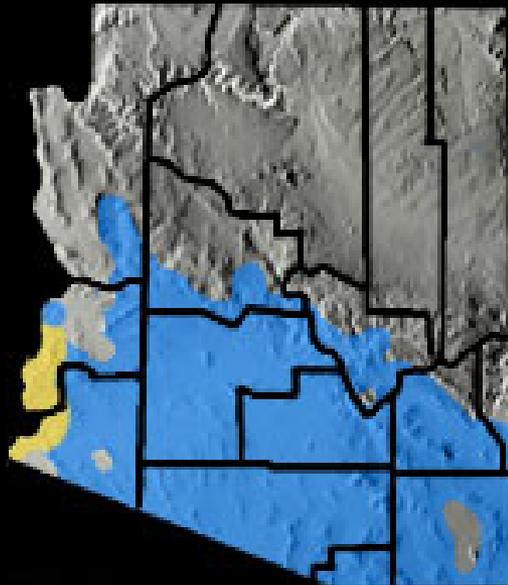
Variety of habitats with
semi-permanent water

Thought to be extirpated
from Lower Colorado River
since 1974



 **Known Range**
 **Former Range**





■ Known Range
■ Area of decline

Colorado River Toad

Sonoran Desert Toad,
(*Bufo*) *Incilius alvarius*

Monsoon breeder

Ephemeral water

Locally extirpated from
lower Colorado River



Five techniques

Visual Encounter Survey

Call-Response

Digital audio recorders

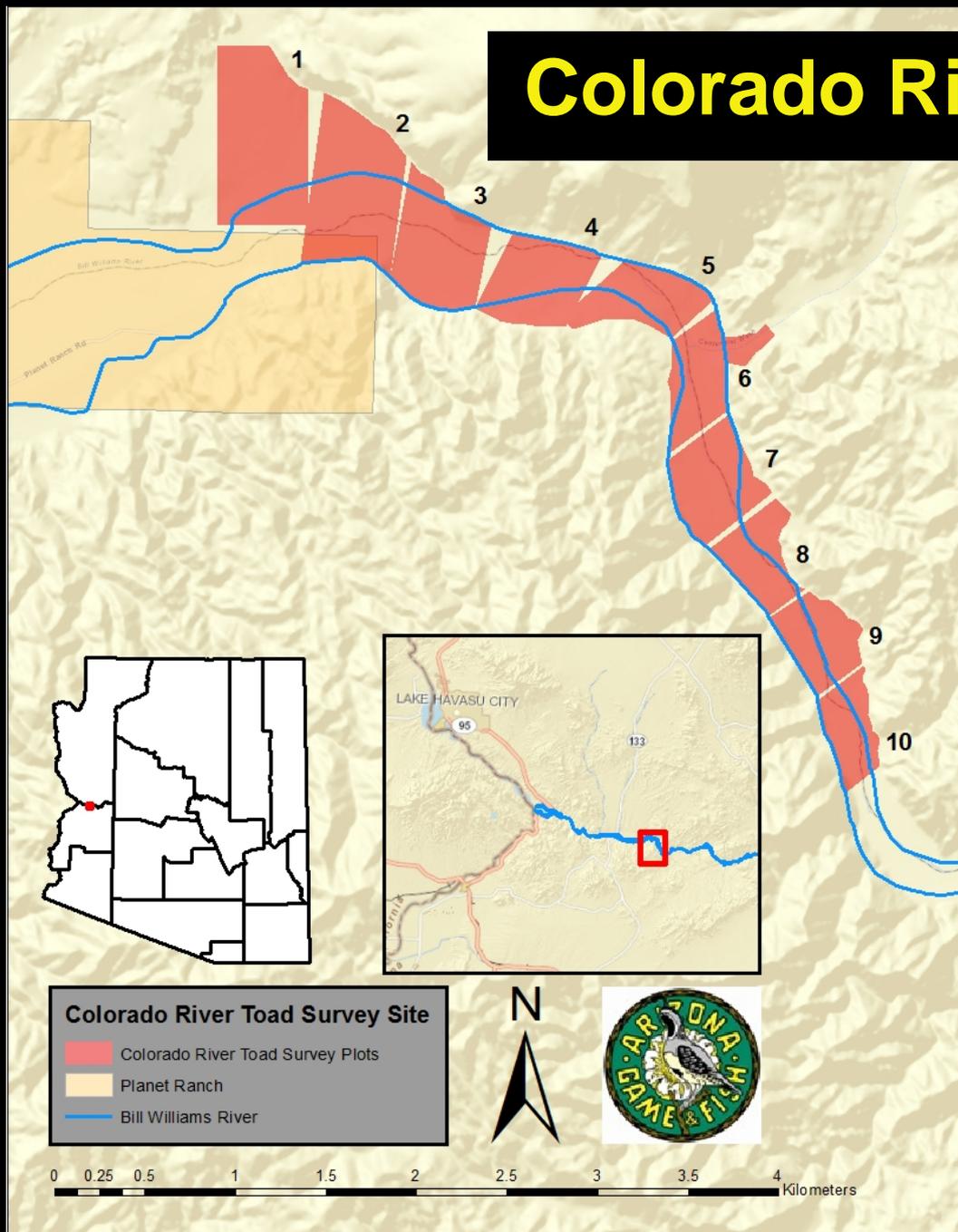
Funnel traps

eDNA

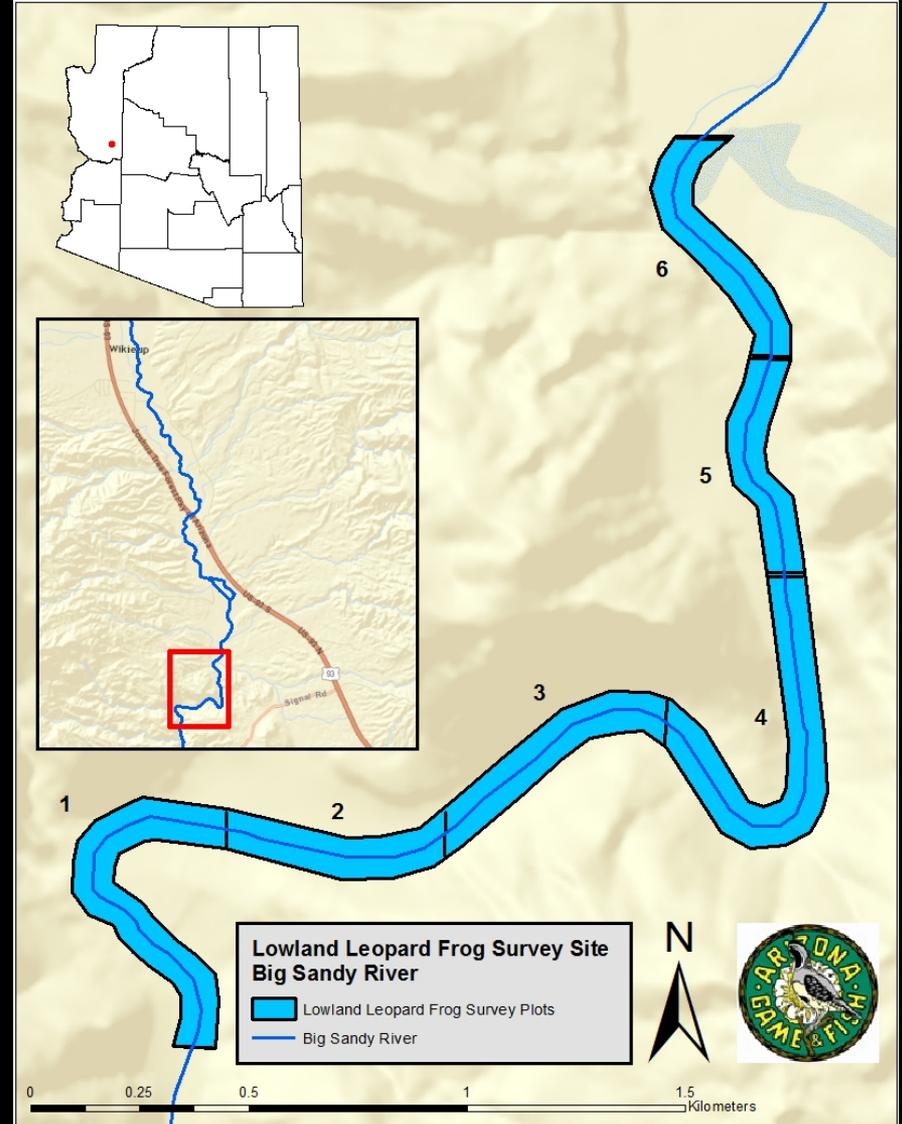
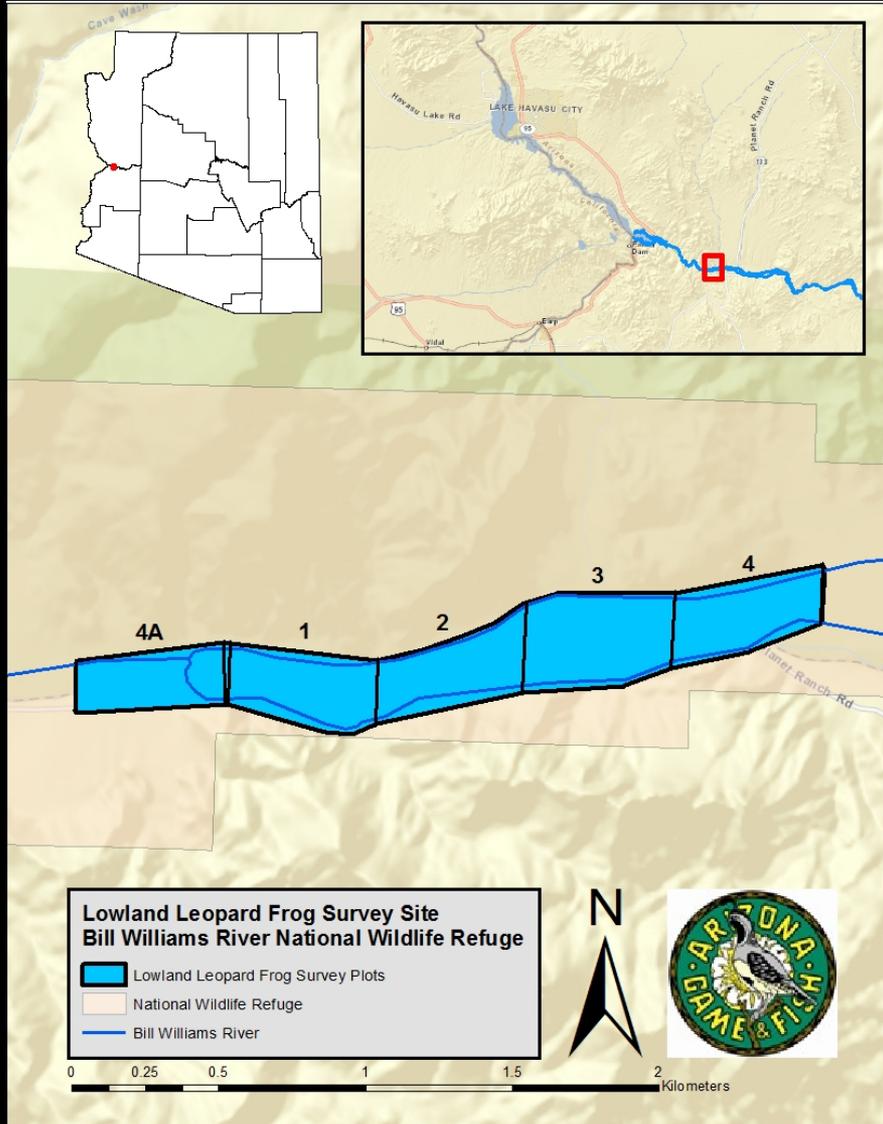
Four 2-week sampling sessions



Colorado River Toad

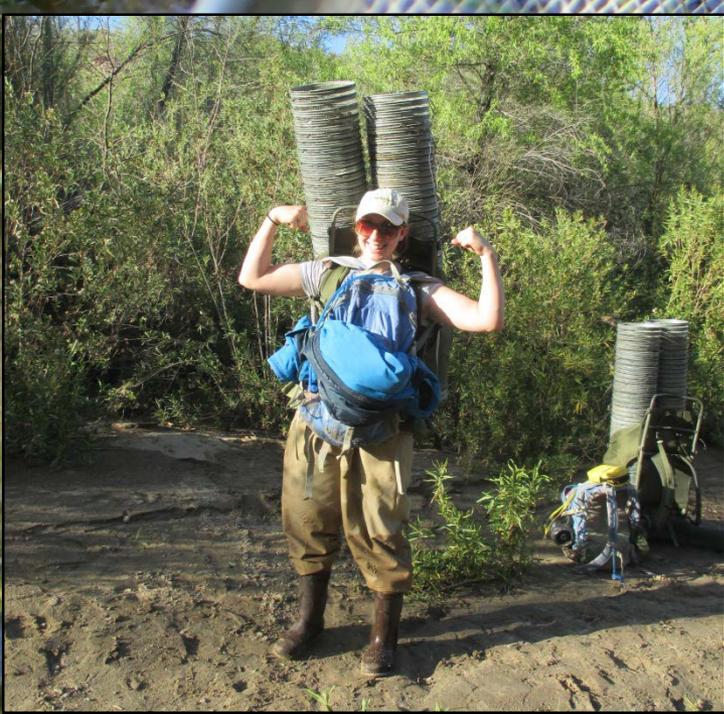


Lowland Leopard Frog

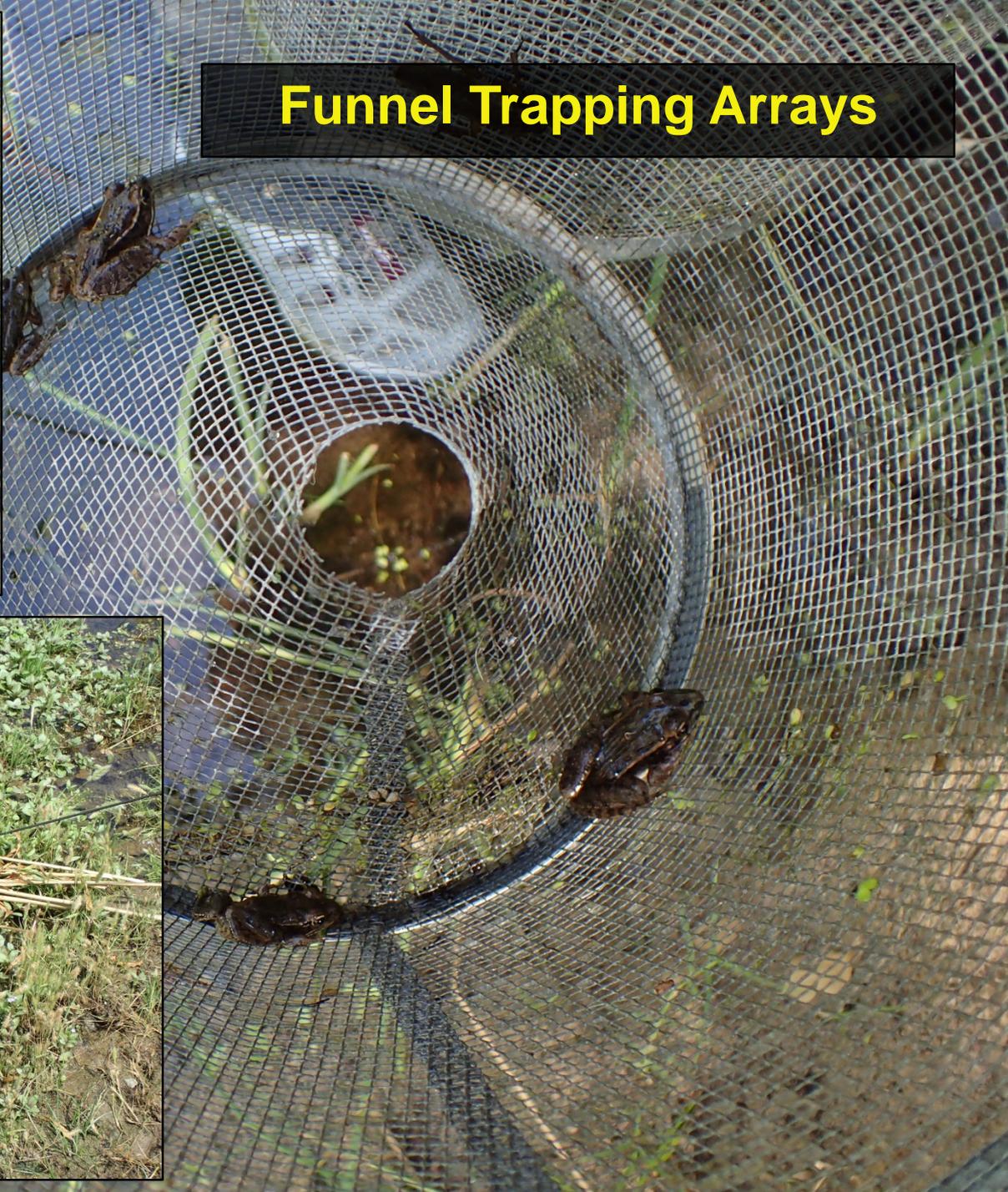


Digital Automated Recorders

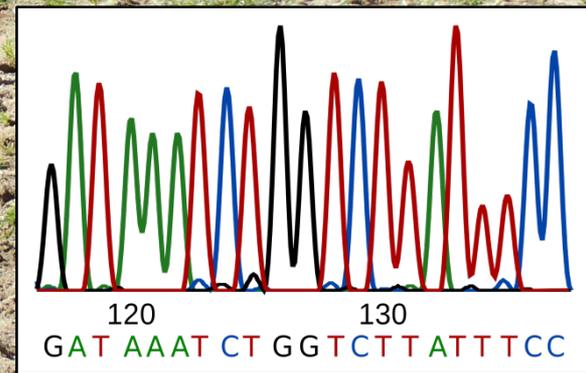
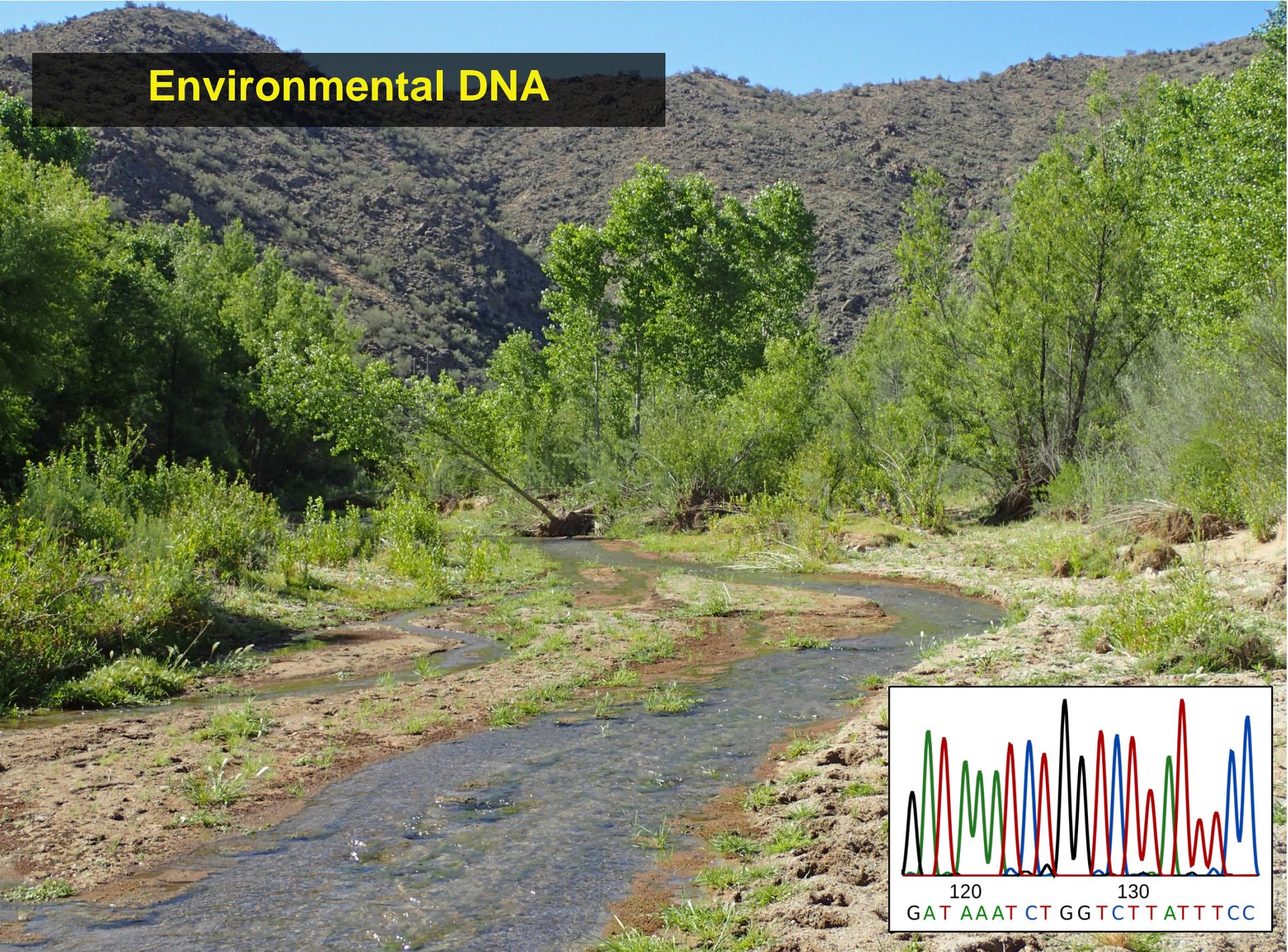




Funnel Trapping Arrays



Environmental DNA





Results: Toads

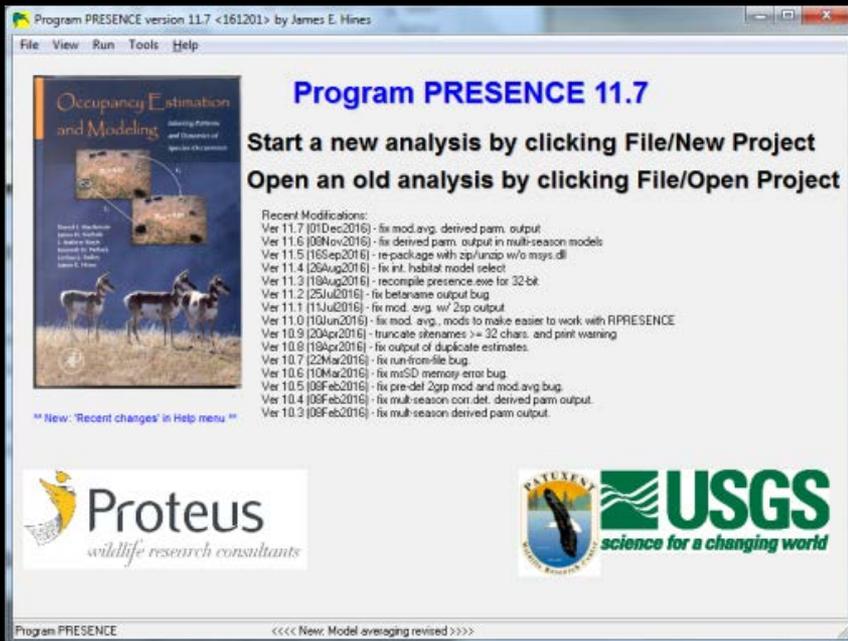
108 visual surveys (2 hr each), with call-response

6,100 trap hours (2014 only)

153 audio recording hours

11 eDNA samples

	Minnow Traps	VES	Session 1 VES (call responses)	eDNA	DAR	Minnow Traps	VES	Session 2 VES (call responses)
Site 1	1	1	1	1	1	1	1	1
Site 2	1	1	1	1	0	1	1	1
Site 3	0	1	0	1	1	1	1	1
Site 4	1	1	0	1	.	0	1	1
Site 5	1	1	1	1	0	1	1	1
Site 6	0	1	1	1	1	1	1	1
Site 7	0	1	0	1	0	1	1	1
Site 8	0	0	0	0	0	1	0	0
Site 9	1	0	1	1	0	0	1	0
Site 10	0	0	1	1	0	0	1	1



Model	AIC	deltaAIC	AIC weight	Model Likelihood	no.Par.
$\psi, \theta(s), p(m)$	115.72	0.00	0.83	1.00	10
$\psi, \theta(\cdot), p(m)$	120.82	5.10	0.06	0.08	7
$\psi, \theta(\cdot), p(s)$	121.12	5.40	0.06	0.07	6
$\psi, \theta(\cdot), p(ms)$	122.28	6.56	0.03	0.04	22
$\psi, \theta(s), p(\cdot)$	124.56	8.84	0.01	0.01	6
$\psi, \theta(s), p(s)$	126.38	10.66	0.00	0.00	9
$\psi, \theta(s), p(ms)$	127.70	11.98	0.00	0.00	25
$\psi, \theta(\cdot), p(\cdot)$	132.19	16.47	0.00	0.00	3

Detection probability **varies by method** (and not survey session).

Colorado River Toad 2014					
	P	Labor cost	Equipment/ analysis cost	CCDP total	CCDP recurring
VES	0.28 ± 0.09	4064	470	0.62	0.69
CR	0.20 ± 0.08	2711	250	0.72	0.73
Traps	0	1597	1280	0	0
DAR	0.32 ± 0.10	1414	6990	0.38	2.26
eDNA	1.00 ± 0	41	1928	5.1	5.19
Colorado River Toad 2015					
VES	1.00	7258	470	1.3	1.38
CR	0.00	2421	250	0	0
Traps	0.00	0	1280	0	0
DAR	0.00	1538	6990	0	0

Monitoring recommendation

eDNA is very effective, but relies on surface water

For short-term sampling, VES is cost-effective

For long-term monitoring, DARs may be the best value.



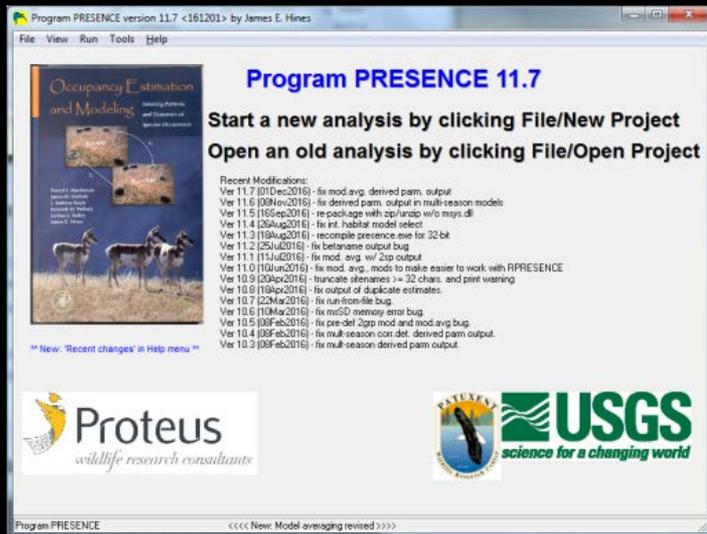
Results: Frogs

52 visual surveys (2 hr each),
with call-response

89,000 trap hours

131 hours of audio recordings

160 eDNA samples



Model	AIC	deltaAIC	AIC weight	Model Likelihood	no. Par.
$\psi, \theta(\cdot), p(m)$	243.49	0.00	0.96	1.00	7
$\psi, \theta(s), p(m)$	249.86	6.37	0.04	0.04	12
$\psi, \theta(\cdot), p(ms)$	273.30	29.81	0.00	0.00	32
$\psi, \theta(s), p(ms)$	275.50	32.01	0.00	0.00	37
$\psi, \theta(\cdot), p(s)$	300.76	57.27	0.00	0.00	8
$\psi, \theta(s), p(s)$	303.19	59.70	0.00	0.00	13
$\psi, \theta(\cdot), p(\cdot)$	306.28	62.79	0.00	0.00	3
$\psi, \theta(s), p(\cdot)$	306.35	62.86	0.00	0.00	8

Detection probability varies by method (and not survey session).

Lowland Leopard Frog 2015-2016

	P	Labor cost	Equipment/ analysis cost	CCDP total	CCDP recurring
VES	0.92 ± 0.04	2903	470	2.7	3.2
CR	0.78 ± 0.06	967	250	6.4	8.1
Traps	0.72 ± 0.06	3865	1280	1.4	2.0
eDNA	0.95 ± 0.04	600	28,050	0.33	0.33
DAR	0.26 ± 0.06	1553	6990	0.30	1.7

Monitoring recommendation

eDNA had the highest detection probability, but also the highest cost (by far).

VES can be easily combined with CR, are very effective, and are much cheaper than eDNA.

DARs less effective because calls are quiet

Future Work

Spring 2017

Test implementation of
VES-CR for Lowland
Leopard Frogs

Summer 2017

Analyze results and
prepare final report





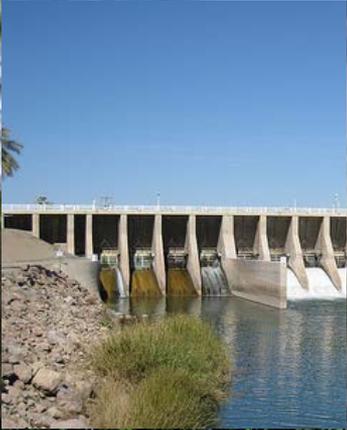
Acknowledgements

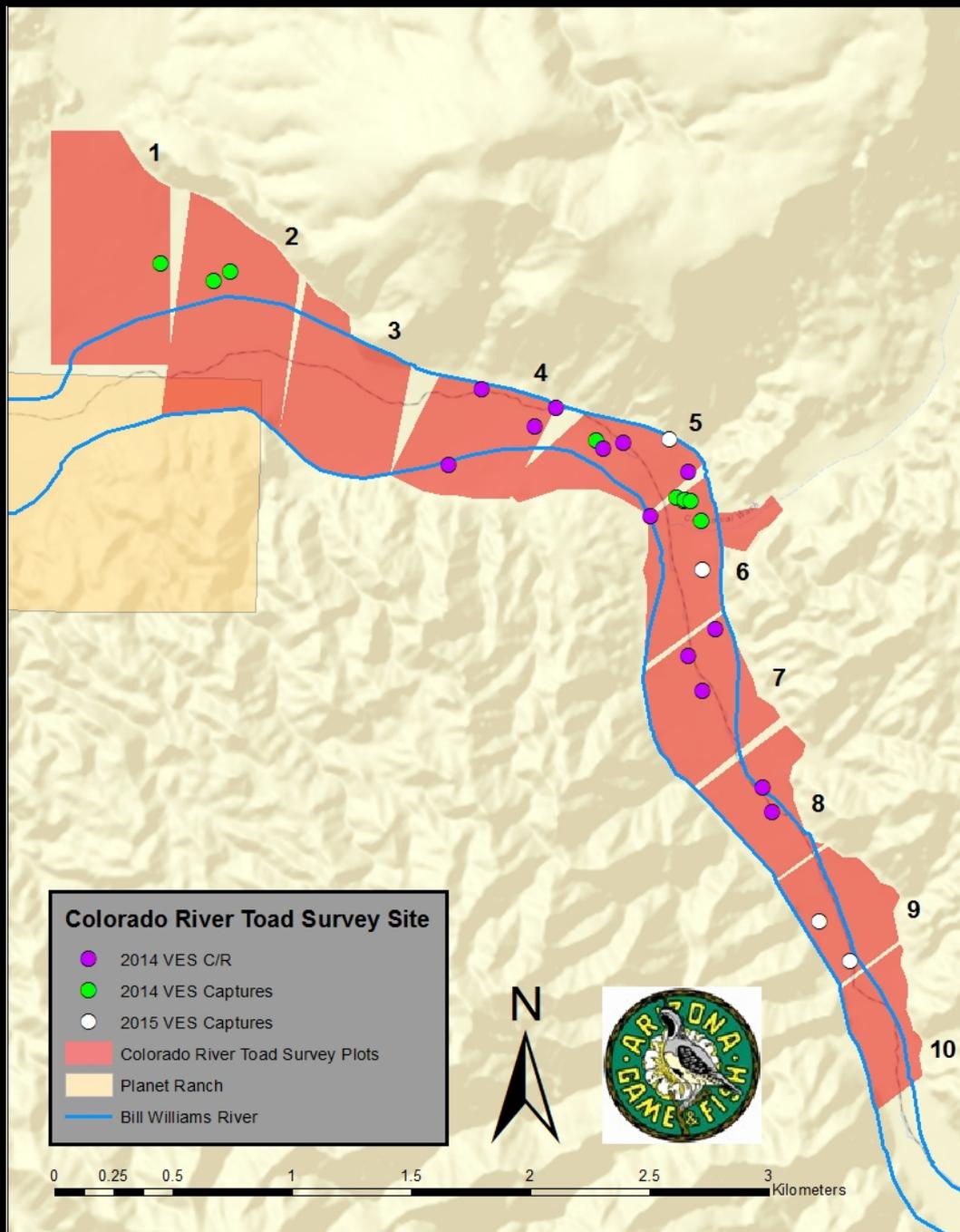
- **LCR - MSCP office** - Allen Calvert, Steve Farinella, Jeffery Hill, Sonja Kokos, Barb Raulston, Michelle Reilly, Carrie Ronning, Jeneal Smith,
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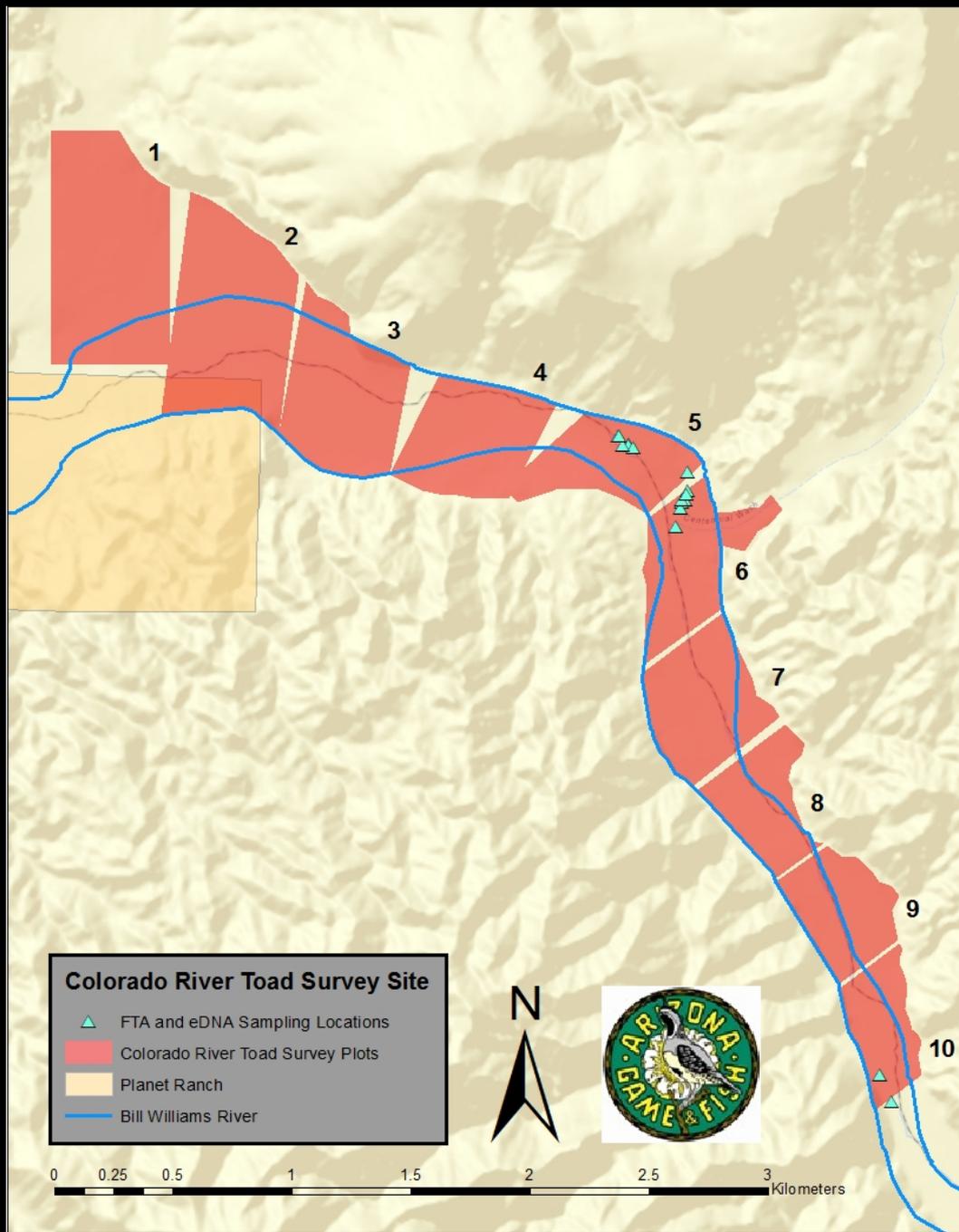


Reasons for decline

- Development/Habitat loss
- Invasive plants
- Introduced predators
fishes
crawfish
Bullfrogs
- Introduced competitors
Rio Grande Leopard
Frogs







Lowland Leopard Frog

- Not observed on main channel of the Lower Colorado River since 1974
- Lack of formal surveys and coordinated search effort



Spare photos

