

Agreement P15AC01599

Final Report FY18

Date: 13 Nov 2019

Submitted to: PWR\_Agreements@nps.gov

From: Caren Goldberg, Washington State University (caren.goldberg@wsu.edu)

We received 77 samples during FY18. All samples were extracted and analyzed for requested species. Additionally, we analyzed samples from the previous batch for western toads and signal crayfish. eDNA filters were extracted and DNA preserved using a Qiashredder/DNeasy protocol (Goldberg et al. 2011). The assay for California red-legged frogs (*Rana draytoni*) is published in Halstead et al. (2018), the assay for American bullfrogs (*R. catesbeianus*) is from Strickler et al. (2015), the assay for foothill yellow-legged frogs (*R. boylei*) is from Bedwell et al. (accepted), and the assays for the western pond turtle (*Emys marmorata*) and western toad (*Anaxyrus boreas*) are currently unpublished. We used the Wilcox et al. (2013) BRK2 assay for brook trout.

Results are as follows:

Samples collected 27 April 2017

Sample	LabID	Western toad	Signal crayfish
SH-42617-B-ACK1	B-ACK1	0	0
SH-42617-S-ACK-1	S-ACK1	0	0

Samples from Fall 2017. Numbers are indices of eDNA quantity that are comparable only within species (not between species).

Field ID	Target Species	LICA	EMMA	RADR	RABO	SAFO
CV-051917-B01	LICA, WPT	0	0			
CV-051917-S-01	LICA, WPT	0	0			
SH-50817-S-BC1	LICA, WPT	0	0.084853			
SH-50817-B-BC1	LICA, WPT	0	0			
KB-50817-S-BC2	LICA, WPT	0	0			
KB-50817-B-BC1	LICA, WPT	0	0			
SH-42417-S-M-1	LICA, RADR	0		0		
SH-42417-B-M1	LICA, RADR	0.253315		0		
SH-42717-S-B1	LICA, RADR	0		0		
SH-42717-B-B1	LICA, RADR	0		0		
SH-50717-S-J1	LICA, RABO, WPT	0	0		0	
SH-50717-B-J1	LICA, RABO, WPT	0	0		0	
SH-50717-S-J2	LICA, RABO, WPT	0	0		0	
SH-50717-B-J2	LICA, RABO, WPT	0	0		0	
KB-50817-S-J3	LICA, RABO, WPT	0	0		0	

KB-50817-B-J3	LICA, RABO, WPT	0	0		0	
KB-50817-S-J4	LICA, RABO, WPT	0	0		0	
KB-50817-B-J4	LICA, RABO, WPT	0	0		0	
SH-50817-S-J5	LICA, RABO, WPT	0	0		0	
SH-50817-B-J5	LICA, RABO, WPT	0	0		0	
KB-52317-B3	LICA, RABO, WPT	0	0		0	
SH-52317-B-2	LICA, RABO, WPT	0	0		0	
SH-52317-S-2	LICA, RABO, WPT	0	0.069411		0	
SH-52317-S-1	LICA, RABO, WPT	0.083274	0.014182		0	
SH-52317-B-1	LICA, RABO, WPT	0	0		0	
KB-52317-S3	LICA, RABO, WPT	0.089071	0.029421		2.623939	
KB-52417-S4	LICA, RABO, WPT	0.231853	0.03911		0.825015	
KB-52417-B4	LICA, RABO, WPT	0	0		0	
KB-52417-S5	LICA, RABO, WPT	0	0.049631		4.533632	
KB-52417-B5	LICA, RABO, WPT	0	0		0	
SH-42517-B-A1	LICA, RABO, WPT	0	0		0	
SH-42517-S-A1	LICA, RABO, WPT	0	0		0	
Crane 01	LICA, RABO, WPT	0	0		0	
Crane 02	LICA, RABO, WPT	0	0		0	
Crane B	LICA, RABO, WPT	0	0		0	
Moss 01	LICA, RABO, WPT	0	0.035483		0	
Moss B	LICA, RABO, WPT	0	0		0	
Birtch 01	LICA, RADR	7.124424		0		
Birtch 02	LICA, RADR	16.59026		0		
Birtch 03	LICA, RADR	11.54696		0		
Birtch 04	LICA, RADR	6.78368		0		
Birtch 05	LICA, RADR	11.84768		0		
Birtch 06	LICA, RADR	5.937951		0		
Birtch 07	LICA, RADR	54.7013		0		
Birtch 08	LICA, RADR	80.76035		0		
Birtch Blank	LICA, RADR	0		0		
705710-01	SAFO					0
705710-02	SAFO					0
070571-03	SAFO					0
070571-04	SAFO					0
070571-01	SAFO					0
070571-02	SAFO					0
705710-03	SAFO					0
705710-04	SAFO					0
Cathedral-01	LICA, RADR	0		0.041165		
Cathedral-02	LICA, RADR	0		0		

Cathedra-03	LICA, RADR	0	0	
Cathedral-04	LICA, MIDO, RADR	0	0.044248	
Yellow-01	LICA, RADR	0	0	
Yellow-02	LICA, RADR	0	0	
Mirror-01	LICA, RADR	0	0	
Mirror-02	LICA, RADR	0	0	
Mirror-03	LICA, RADR	0	0	
Mirror-04	LICA, MIDO, RADR	0	0	
Camp6-01	LICA, RADR	0	0.324496	
Camp6-02	LICA, RADR	0	0	
Camp6-03	LICA, RADR	0	0.084482	
Camp6-04	LICA, RADR	0	0.040846	
AHW-01	LICA, RADR	0	0	
AHW-02	LICA, RADR	0	0	
Merced Bl	LICA, MIDO, RADR	0	0	
Merced -01	LICA, MIDO, RADR	0	0	
Merced-02	LICA, MIDO, RADR	0	0	
Merced-03	LICA, MIDO, RADR	0	0	
Valley-BL-01	LICA, RADR	0	0	
Valley-BL-02	LICA, RADR	0	0	
Merced-91617	LICA, MIDO, RADR	0	0	

#### Literature:

- Bedwell, M. E. and C. S. Goldberg. Accepted. Spatial and temporal patterns of environmental DNA detection to inform sampling protocols in lentic and lotic systems. *Ecology & Evolution*.
- Goldberg, C. S., D. S. Pilliod, R. S. Arkle, and L. P. Waits. 2011. Molecular detection of cryptic vertebrates in stream water: a demonstration using Rocky Mountain tailed frogs and Idaho giant salamanders. *PLoS ONE* 6:e22746.
- Halstead, B. J., P. M. Kleeman, C. S. Goldberg, M. Bedwell, R. B. Douglas, and D. W. Ulrich. 2018. Occurrence of California red-legged frogs (*Rana draytonii*) and northern red-legged frogs (*R. aurora*) in timberlands of Mendocino County, California, examined with environmental DNA. *Northwestern Naturalist* 99:9-20.
- Strickler, K. M., A. K. Fremier, and C. S. Goldberg. 2015. Quantifying the effects of UV, temperature, and pH on degradation rates of eDNA in aquatic microcosms. *Biological Conservation* 183:85-92, special issue on environmental DNA.
- Wilcox TM, McKelvey KS, Young MK, Jane SF, Lowe WH, Whiteley AR, Schwartz MK (2013) Robust detection of rare species using environmental DNA: the importance of primer specificity. *PLoS One* 8:e59520.