

## Supplementary information: Exploring the amphibian exposome in an agricultural landscape using telemetry and passive sampling

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### Supplementary Methods

**Frog tissue analysis.** Tissue samples were thawed and homogenized with Na<sub>2</sub>SO<sub>4</sub> using a clean, solvent-rinsed mortar and pestle. Samples were spiked with d<sub>14</sub>trifluralin, ring-<sup>13</sup>C<sub>12</sub>-*p,p'*-DDE and phenoxy-<sup>13</sup>C<sub>6</sub>-*cis*-permethrin as recovery surrogates and extracted with dichloromethane (DCM) using pressurized liquid extraction. Sample extracts were then dried over Na<sub>2</sub>SO<sub>4</sub>, reduced and 10% by volume of each raw extract was allowed to evaporate to a constant mass for gravimetric lipid determination. A majority of the lipid was removed using gel permeation chromatography followed by 6% deactivated Florisil previously activated at 550 °C for 16 h. Prior to analysis, samples were reduced to 0.2 mL, and a deuterated internal standard was added to each extract. Sample extracts were analyzed on an Agilent 7890 GC coupled to an Agilent 7000 MS/MS operating in EI mode. Data was collected in multiple reaction monitoring (MRM) mode with each compound having 1 quantifier MRM and at least 1 qualifier MRM. Method detection limits (MDLs) for all compounds ranged from 0.5 to 4.2 µg/kg wet weight (Smalling et al. 2013).

**Pesticide quality control measures.** All sample glassware was hand-washed and rinsed with tap water followed by acetone and hexane prior to use. All solvents and other reagents were American Chemical Society (ACS) grade or better. Pesticide standard materials were donated by the USEPA National Pesticide Repository. Purities ranged from 95 to 99%. Performance-based quality assurance and quality control included the parallel analysis of procedural blanks, matrix spikes, and replicates in 10% of the samples analyzed. PSD cleaning and field blanks did not contain detectable levels of pesticides. PSD cleaning and field blanks as well as laboratory procedural blanks run with each batch of tissue samples did not contain detectable levels of pesticides. Means ( $\pm$  standard deviation) of  $d_{14}$ -trifluralin, ring- $^{13}C_4$ -fipronil, ring- $^{13}C_{12-p,p'}$ -DDE and phenoxy- $^{13}C_6$ -cis-permethrin added prior to the extraction of the PSDs as recovery surrogates were  $90 \pm 11\%$ ,  $100 \pm 13\%$ ,  $99 \pm 9\%$  and  $97 \pm 6\%$ , respectively. Means ( $\pm$  standard deviation) of  $d_{14}$ -trifluralin, ring- $^{13}C_{12-p,p'}$ -DDE and phenoxy- $^{13}C_6$ -cis-permethrin added prior to tissue sample extraction as recovery surrogates were  $93 \pm 16\%$ ,  $93 \pm 15\%$ , and  $95 \pm 15\%$ , respectively. Matrix spikes were analyzed in 10% tissue samples and the recoveries ranged from 66% to 129% (median of 102%), 70% – 126% (median of 99%) and 65% to 108% (median of 84%), respectively. PSDs and tissue for pesticide analysis were stored frozen at  $-20\text{ }^{\circ}C$  and held for no longer than 6 mo prior to extraction.

<b>Site</b>	<b>Year</b>	<b>Females</b>	<b>Males</b>
Cerro Gordo	2015	11	8
Worth	2015	8	11
Cerro Gordo	2016	8	9
Worth	2016	14	3

**Table S1.** Numbers and sexes of 72 radio tracked northern leopard frogs in Cerro Gordo and Worth counties, Iowa, USA 2015-2016.

ID #	Site	Year	Sex	Mass (g)	Start Date	End Date	# Locations	Proportion of locations					Home Range	Fate
								W	G	A	F	D		
0	CG	'15	M	38	6/3	6/25	20	40	50	10	0	0	28,316	Lost
1	W	'15	F	24	6/24	7/9	15	40	60	0	0	0	-	Dead
4	CG	'15	M	20	6/24	8/10	31	35	39	26	0	0	45,783	Captured
6	W	'15	F	24	6/10	7/5	22	9	91	0	0	0	2,445	Dead
6.2	CG	'15	M	ND	7/10	7/16	7	14	71	14	0	0	-	Lost
13	CG	'15	M	47	6/3	7/23	19	0	95	5	0	0	-	Lost
15	W	'15	M	22	5/18	6/23	35	31	69	0	0	0	15,011	Captured
15.2	W	'15	M	37	7/5	8/10	35	6	89	6	0	0	11,743	Captured
23	W	'15	M	22	5/18	6/23	20	15	70	5	10	0	3,053	Lost
26	W	'15	M	24	5/18	6/22	30	70	30	0	0	0	3,062	Captured
26.2	CG	'15	F	ND	7/10	8/10	28	4	96	0	0	0	4,225	Captured
29	CG	'15	F	36	5/18	5/28	9	33	67	0	0	0	-	Dead
29.2	CG	'15	M	24	6/24	7/14	19	16	84	0	0	0	-	Lost
31	CG	'15	F	43	5/18	6/24	29	34	52	14	0	0	112,648	Captured
31.2	W	'15	F	42	7/5	8/10	34	9	76	6	9	0	15,957	Captured
34	CG	'15	F	45	5/18	6/30	35	17	77	6	0	0	7,279	Captured
34.2	CG	'15	F	21	7/10	8/8	20	5	80	15	0	0	26,492	Lost
40	W	'15	M	23	5/18	6/6	15	33	67	0	0	0	-	Lost

46	W	'15	M	22	5/18	6/23	34	53	47	0	0	0	17,168	Captured
46.2	CG	'15	F	21	7/5	8/11	20	50	45	5	0	0	11,905	Captured
49	W	'15	M	22	5/18	6/14	26	19	77	4	0	0	13,961	Lost
53	CG	'15	M	41	5/18	6/6	16	38	56	6	0	0	-	Lost
56	W	'15	M	22	5/18	8/11	20	30	70	0	0	0	26,696	Captured
59	W	'15	F	25	5/18	5/28	11	64	36	0	0	0	-	Lost
61	W	'15	F	24	5/18	6/8	12	58	42	0	0	0	-	Dead
61.2	CG	'15	F	23	6/24	7/15	21	43	57	0	0	0	2,351	Lost
64	CG	'15	F	29	5/18	6/6	19	42	58	0	0	0	-	Lost
68	CG	'15	F	32	5/18	7/1	21	43	52	5	0	0	2,351	Captured
68.2	W	'15	M	36	7/10	7/24	15	27	73	0	0	0	-	Lost
73	CG	'15	F	48	5/18	6/6	20	65	35	0	0	0	1,715	Dead
73.2	W	'15	M	22	6/24	8/7	41	56	41	0	2	0	14,469	Captured
78	CG	'15	M	49	5/18	6/26	37	32	59	8	0	0	3,273	Captured
78.2	W	'15	F	45	7/5	8/10	36	0	36	53	11	0	13,160	Dead
80	CG	'15	M	38	5/18	7/23	34	62	35	3	0	0	24,375	Dead
83	CG	'15	F	29	5/18	5/21	2	50	50	0	0	0	-	Dead
83.2	W	'15	F	36	6/24	8/10	45	44	42	13	0	0	3,135	Dead
85	W	'15	M	29	5/18	6/20	29	21	69	7	3	0	21,637	Captured
85.2	W	'15	F	26	6/24	8/8	44	7	93	0	0	0	3,811	Lost
0.2	W	'16	F	48	5/30	6/15	15	20	80	0	0	0	-	Captured
0.3	W	'16	F	35	6/18	6/22	5	80	20	0	0	0	-	Lost

1.2	CG	'16	M	39	5/30	6/21	18	28	67	6	0	0	-	Lost
4.2	W	'16	F	40	5/30	7/4	30	100	0	0	0	0	3,756	Dead
4.3	W	'16	F	39	7/15	7/20	6	50	50	0	0	0	-	Dead
4.4	W	'16	F	46	7/15	8/8	25	16	84	0	0	0	6,218	Captured
13.2	W	'16	M	45	5/30	7/4	30	90	10	0	0	0	30,535	Dead
13.3	W	'16	F	37	7/15	8/8	18	17	11	72	0	0	-	Captured
15.3	CG	'16	F	34	6/22	7/14	17	0	94	6	0	0	-	Dead
18	W	'16	F	43	5/30	8/8	47	30	64	0	0	6	188,581	Captured
26.3	W	'16	F	40	7/15	8/8	25	16	84	0	0	0	981	Captured
31.3	CG	'16	M	33	5/30	6/15	15	40	60	0	0	0	-	Captured
31.4	CG	'16	F	28	6/22	7/20	23	4	83	13	0	0	48,784	Dead
40.2	W	'16	F	49	5/30	6/8	9	33	67	0	0	0	-	Lost
42	W	'16	M	45	5/30	8/8	66	94	6	0	0	0	2,640	Captured
45	W	'16	F	28	5/30	6/15	15	53	47	0	0	0	-	Captured
45.2	W	'16	M	31	6/18	8/8	49	14	84	2	0	0	70,017	Captured
46.3	CG	'16	F	44	6/6	6/21	12	17	83	0	0	0	-	Lost
48	W	'16	F	32	5/30	8/8	39	8	72	21	0	0	91,824	Captured
50	W	'16	F	28	5/30	6/21	20	90	10	0	0	0	6,423	Lost
53.2	W	'16	F	37	5/30	6/3	5	0	100	0	0	0	-	Lost
56.2	CG	'16	M	34	6/1	6/15	12	83	17	0	0	0	-	Dead
60	CG	'16	M	45	5/30	6/15	12	42	58	0	0	0	-	Dead
60.2	CG	'16	F	28	6/22	7/11	14	0	64	36	0	0	-	Dead

60.3	CG	'16	M	36	7/15	8/8	22	18	82	0	0	0	6,481	Captured
70	CG	'16	M	31	5/30	6/2	4	0	100	0	0	0	-	Dead
73.3	CG	'16	F	27	5/30	7/17	30	3	93	3	0	0	246,661	Lost
78.3	CG	'16	M	25	5/30	8/9	13	38	54	8	0	0	-	Captured
79	CG	'16	F	40	5/30	7/10	27	19	74	4	0	4	116,546	Lost
80.2	W	'16	F	36	7/15	8/7	21	76	24	0	0	0	1,817	Dead
89	CG	'16	M	24	5/30	6/28	24	83	17	0	0	0	3,740	Dead
89.2	CG	'16	F	31	7/15	8/8	19	0	68	21	11	0	-	Captured
92	CG	'16	M	30	5/30	6/26	18	0	67	28	0	6	-	Lost
94	CG	'16	F	43	7/15	7/20	6	33	67	0	0	0	-	Lost

**Table S2.** Summary of 72 radio tracked northern leopard frogs in Iowa, USA 2015-2016. Sites: CG = Cerro Gordo, W = Worth; year, 2015 ('15) or 2016 ('16); mass at first capture; # of locations; proportion of locations occurring in each habitat type: W = wetland, G = grassland, A = Agriculture, F = Forest, and D = Developed; home range estimate (only individuals with  $\geq 20$  locations;  $m^2$ ); and fate (dead = transmitter was found in environment, lost = could not be relocated, and captured = individual captured and euthanized for tissue analysis). ND = not detected.

<b>Location</b>	<b>ID #</b>	<b>Date</b>	<b>Atrazine</b>	<b>Azoxystrobin</b>	<b>Bifenthrin</b>	<b>Chlorpyrifos</b>	<b>Cyhalothrin</b>	<b>Fluxapyroxad</b>	<b>Metolachlor</b>	<b>Permethrin</b>	<b>Propiconazole</b>	<b>Pyraclostrobin</b>	<b>Tebuconazole</b>	<b>Trifloxystrobin</b>	<b># of Pesticides</b>
CG	60.3	7/30/2016	10.7	21.4	4.80	10.6	ND	2.23	32.8	ND	7.86	ND	5.71	ND	8
CG	60.3	8/8/2016	ND	9.91	2.46	54.9	ND	ND	ND	9.18	ND	ND	ND	ND	4
CG	89.2	7/30/2016	54.4	16.3	4.24	8.42	ND	ND	3.10	6.76	5.98	ND	2.86	ND	8
CG	89.2	8/8/2016	ND	26.0	ND	8.82	2.50	ND	ND	5.62	2.30	ND	ND	ND	5
W	26.3	7/30/2016	6.88	33.0	8.10	61.0	7.44	7.22	3.68	41.9	5.34	49.3	5.71	16.9	12
W	26.3	8/8/2016	ND	10.9	11.2	38.4	3.04	2.60	ND	ND	ND	ND	ND	5.36	6
W	18	7/3/2016	5.76	ND	ND	ND	ND	ND	2.80	ND	ND	ND	ND	ND	2
W	18	7/30/2016	ND	21.1	5.60	128	7.61	33.2	6.64	55.4	4.64	103	12.9	6.88	11
W	18	8/8/2016	ND	9.10	5.38	24.7	ND	2.53	ND	6.58	ND	ND	ND	ND	5
W	4.4	7/30/2016	4.98	35.9	3.74	55.1	5.46	10.7	4.78	3.92	10.3	60.6	7.07	9.17	12
W	4.4	8/8/2016	ND	23.5	13.4	44.3	4.12	3.03	ND	ND	3.42	ND	ND	15.6	7
W	13.2	7/30/2016	23.6	23.9	5.72	13.7	2.86	6.89	56.2	7.86	ND	28.1	ND	5.73	10
W	13.2	8/8/2016	ND	15.5	10.9	25.8	2.86	ND	ND	14.6	ND	ND	ND	2.04	6
W	42	7/3/2016	11.1	ND	ND	ND	ND	ND	ND	7.74	ND	ND	ND	ND	2
W	42	7/17/2016	43.1	13.7	ND	2.98	ND	2.65	75.3	5.20	3.48	ND	ND	1.25	8
W	42	7/30/2016	23.3	38.9	8.42	51.0	5.06	18.2	28.8	ND	8.54	84.4	18.0	15.8	11
W	42	8/8/2016	3.24	20.5	9.26	29.4	2.38	3.41	2.48	ND	3.70	39.0	4.20	4.26	11
W	45.2	7/3/2016	189	ND	ND	ND	ND	ND	15.8	ND	ND	ND	ND	ND	2



W	45.2	7/17/2016	ND	ND	ND	ND	ND	ND	2.10	6.48	ND	ND	ND	ND	2
W	45.2	7/30/2016	ND	32.1	6.14	81.9	18.0	22.2	ND	4.18	9.72	57.7	3.57	47.5	10
W	45.2	8/8/2016	ND	7.78	7.66	37.0	2.32	5.49	ND	ND	ND	27.2	ND	2.85	7
W	48	7/3/2016	ND	ND	ND	ND	ND	ND	4.30	ND	ND	ND	ND	ND	1
W	48	7/17/2016	ND	ND	ND	2.34	ND	ND	2.48	3.20	ND	ND	ND	ND	3
W	48	7/30/2016	ND	20.7	4.26	65.1	5.56	15.0	9.48	30.1	3.06	47.7	ND	10.7	10
W	48	8/8/2016	ND	ND	7.78	24.6	2.80	ND	ND	ND	ND	11.7	ND	6.12	5

**Table S3.** Concentration of pesticides (ng/PSD) detected in silicone passive sampling devices (PSDs) deployed with radio tracked leopard frogs in Iowa, 2016. CG = Cerro Gordo, W = Worth. ND = not detected.

Site	Habitat	Date	Atrazine	Azoxystrobin	Bifenthrin	Chlorpyrifos	Cyhalothrin	Cyproconazole	Esfenvalerate	Fluxapyroxad	Flutriafol	Imidacloprid	Metolachlor	Permethrin	Propiconazole	Pyraclostrobin	Tebuconazole	Trifloxystrobin	Trifluralin
			H	F	I	I	I	F	I	F	F	I	H	I	F	F	F	F	H
CG	A	7/30/2015	2.40	3.54	2.22	5.71	ND	ND	ND	ND	ND	ND	3.44	ND	3.83	37.1	8.19	5.47	ND
CG	A	8/13/2015	ND	ND	3.54	116	12.0	ND	41.1	ND	ND	ND	2.06	ND	3.01	ND	ND	ND	ND
CG	A	7/3/2016	9.56	ND	ND	ND	ND	ND	ND	ND	ND	ND	504	ND	5.68	ND	ND	ND	15.7
CG	A	7/17/2016	6.92	37.7	ND	8.14	ND	ND	ND	ND	ND	ND	9.76	ND	19.2	ND	ND	ND	2.28
CG	A	7/17/2016	6.52	49.1	ND	6.98	3.66	ND	ND	11.8	ND	ND	429	ND	28.8	ND	ND	ND	7.70
CG	A	7/30/2016	3.70	28.1	ND	4.94	ND	ND	ND	ND	ND	ND	ND	ND	8.98	ND	ND	ND	ND
CG	A	7/30/2016	7.80	25.0	2.06	21.9	ND	ND	ND	8.84	ND	ND	271	ND	17.9	ND	ND	ND	5.0
CG	A	8/9/2016	ND	85.8	ND	3.72	ND	ND	ND	7.98	ND	ND	ND	ND	37.8	ND	ND	ND	ND
CG	A	8/9/2016	ND	234	3.24	1219	66.5	ND	ND	5.36	ND	ND	18.5	ND	287	ND	ND	6.66	3.74
CG	G	7/30/2015	1.90	13.4	2.38	3.42	ND	8.04	ND	ND	12.2	ND	4.16	ND	13.3	57.0	17.8	3.60	ND
CG	G	7/30/2015	ND	8.39	2.86	3.68	ND	ND	ND	ND	ND	ND	2.98	ND	4.78	ND	3.42	ND	ND
CG	G	8/13/2015	ND	ND	ND	28.9	ND	1.90	3.79	ND	ND	ND	ND	ND	ND	ND	8.52	ND	ND
CG	G	8/13/2015	ND	ND	ND	60.8	ND	ND	3.45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CG	G	7/3/2016	8.44	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.04	ND	ND	ND	ND	ND	ND
CG	G	7/17/2016	ND	44.5	ND	3.86	ND	ND	ND	ND	ND	ND	4.14	26.8	14.7	ND	ND	ND	ND
CG	G	7/30/2016	ND	32.8	2.22	11.2	ND	ND	ND	ND	ND	ND	ND	ND	16.3	ND	ND	ND	ND

CG	G	8/9/2016	ND	25.1	ND	37.2	ND	ND	ND	ND	ND	ND	ND	ND	21.4	ND	ND	ND	ND
CG	W	7/30/2015	2.24	5.46	ND	4.72	ND	3.14	ND	ND	6.28	ND	2.36	ND	6.50	72.1	11.0	8.06	ND
CG	W	8/13/2015	ND	3.31	3.78	157	ND	ND	60.6	ND	ND	ND	2.48	ND	ND	ND	ND	ND	ND
CG	W	7/3/2016	29.4	ND	ND	9.12	ND	ND	ND	ND	ND	ND	14.6	ND	2.02	ND	ND	ND	ND
CG	W	8/9/2016	4.08	94.6	ND	141	ND	ND	ND	6.98	ND	ND	2.18	ND	33.9	ND	ND	ND	ND
CG	W	8/9/2016	8.86	35.3	ND	7.04	ND	ND	ND	ND	ND	ND	ND	ND	15.1	ND	ND	ND	ND
W	A	7/3/2016	480	ND	ND	ND	ND	ND	ND	ND	ND	ND	19.8	ND	ND	ND	ND	ND	ND
W	A	7/17/2016	62.9	20.3	ND	6.04	ND	ND	ND	ND	ND	ND	4.06	ND	6.16	ND	ND	ND	ND
W	A	7/30/2016	61.3	37.2	5.68	75.8	7.06	ND	ND	13.5	ND	ND	4.02	ND	21.2	66.3	19.3	27.0	ND
W	A	8/9/2016	15.8	31.2	14.8	102	4.08	ND	ND	3.40	ND	ND	ND	ND	11.7	ND	ND	14.6	ND
W	G	7/30/2015	ND	ND	3.00	4.31	ND	ND	ND	ND	2.73	5.84	3.04	ND	ND	ND	ND	ND	ND
W	G	7/30/2015	5.88	14.4	5.31	5.94	ND	ND	ND	ND	ND	ND	6.28	ND	19.1	84.9	17.1	7.40	ND
W	G	8/13/2015	ND	ND	6.70	31.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
W	G	8/13/2015	ND	ND	4.87	33.0	1.98	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
W	G	7/3/2016	2.98	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.09	ND	ND	ND	ND	ND	ND
W	G	7/17/2016	2.28	38.7	ND	ND	ND	ND	ND	ND	ND	ND	2.26	ND	14.8	ND	ND	ND	ND
W	G	7/30/2016	ND	35.1	2.34	40.2	7.20	ND	ND	26.1	ND	ND	ND	ND	16.2	80.7	18.40	24.2	ND
W	G	8/9/2016	ND	23.6	6.92	53.8	4.60	ND	ND	ND	ND	ND	ND	ND	16.0	ND	ND	24.8	ND
W	W	7/30/2015	7.10	14.3	2.02	6.62	ND	ND	ND	ND	ND	ND	7.64	ND	13.6	51.5	12.7	6.20	ND
W	W	7/30/2015	4.20	ND	ND	4.16	ND	ND	ND	ND	ND	ND	4.14	ND	3.52	15.1	6.06	ND	ND
W	W	8/13/2015	ND	ND	2.18	17.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
W	W	8/13/2015	ND	ND	1.89	24.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	15.9	ND	ND

W	W	7/3/2016	120	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.5	ND	ND	ND	ND	ND	ND
W	W	7/3/2016	6.38	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.70	ND	ND	ND	ND	ND	ND
W	W	7/17/2016	71.5	30.6	ND	ND	ND	ND	ND	11.2	ND	ND	122	ND	19.3	ND	ND	ND	ND
W	W	7/17/2016	45.4	33.0	ND	5.18	ND	ND	ND	5.46	ND	ND	67.8	ND	17.7	ND	ND	ND	ND
W	W	7/30/2016	24.5	37.2	ND	5.98	ND	ND	ND	20.3	ND	ND	45.8	ND	15.3	141	50.3	8.04	ND
W	W	7/30/2016	38.3	96.4	3.80	41.9	3.44	ND	ND	44.6	ND	ND	154	ND	47.1	311	127	27.6	ND
W	W	8/9/2016	11.2	39.0	ND	41.4	ND	ND	ND	12.2	ND	ND	5.72	ND	14.9	ND	26.7	5.40	ND
W	W	8/9/2016	ND	41.8	5.14	29.0	ND	ND	ND	5.28	ND	ND	ND	ND	9.94	ND	12.1	10.7	ND

**Table S4.** Concentration of pesticides detected (ng/PSD) in silicone passive sampling devices (PSDs) placed from June-August in 2015 and 2016. Under pesticide names, H=Herbicide, I=Insecticide, and F=Fungicide; Site: CG = Cerro Gordo and W = Worth; Habitat: W=Wetlands, A=Agriculture, and G=Grassland; ND = not detected.

<b>ID #</b>	<b>Date</b>	<b>Bifenthrin</b>	<b>Fenbuconazole</b>	<b><i>p,p'</i>-DDE</b>	<b>Tebuconazole</b>
C1W	5/24/2016	ND	7.30	ND	230
C2W	5/24/2016	ND	5.40	ND	71.8
C3W	5/24/2016	ND	12.6	ND	24.4
C4W	5/24/2016	ND	31.0	ND	23.2
C5W	5/24/2016	ND	41.9	ND	19.1
C1CG	5/24/2016	ND	ND	7.60	229
C2CG	5/24/2016	ND	ND	ND	34.6
C3CG	5/24/2016	ND	44.6	ND	ND
C4CG	5/24/2016	ND	ND	21.7	11.6
C5CG	5/24/2016	ND	ND	43.8	33.3
60.3	8/8/2016	ND	ND	ND	20.1
89.2	8/8/2016	1.40	ND	3.26	4.90
78.3	8/9/2016	ND	ND	28.0	ND
4.4	8/8/2016	2.09	ND	4.59	ND
13.3	8/8/2016	ND	ND	ND	ND
18	8/8/2016	ND	ND	ND	ND
26.3	8/8/2016	ND	ND	ND	ND
42	8/8/2016	ND	ND	21.1	ND

45.2	8/8/2016	ND	ND	ND	ND
48	8/8/2016	ND	ND	ND	ND

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**Table S5.** Pesticides detected (ng/g) in tissues of captured and euthanized northern leopard frogs in Iowa. ND = not detected.

Study Site Location	Construction Year	Wetland (ha)	Grass Buffer (ha)	Drainage (ha)	Surrounding land use (%)			
					Agriculture	Grassland	Wetland	Other
Cerro Gordo	2006	1.5	6.0	298	77.7	9.0	1.5	12.0
Worth	2008	2.4	9.8	287	51.7	22.1	16.8	9.4

**Table S6.** Study site information at the two study locations. Ha= hectares; Other = human developed or forest. Land-use was measured using a 1 km buffer around each wetland.

<b>ID #</b>	<b>CG F 15</b>	<b>CG M 15</b>	<b>CG F 16</b>	<b>CG M 16</b>	<b>W F 15</b>	<b>W M 15</b>	<b>W F 16</b>	<b>W M 16</b>
0	0	1	0	0	0	0	0	0
0.2	0	0	0	0	0	0	1	0
0.3	0	0	0	0	0	0	1	0
1	0	0	0	0	1	0	0	0
1.2	0	0	0	1	0	0	0	0
4	0	1	0	0	0	0	0	0
4.2	0	0	0	0	0	0	1	0
4.3	0	0	0	0	0	0	1	0
4.4	0	0	0	0	0	0	1	0
6	0	0	0	0	1	0	0	0
6.2	0	1	0	0	0	0	0	0
13	0	1	0	0	0	0	0	0
13.2	0	0	0	0	0	0	0	1
13.3	0	0	0	0	0	0	1	0
15	0	0	0	0	0	1	0	0
15.2	0	0	0	0	0	1	0	0
15.3	0	0	1	0	0	0	0	0
18	0	0	0	0	0	0	1	0
23	0	0	0	0	0	1	0	0
26	0	0	0	0	0	1	0	0
26.2	1	0	0	0	0	0	0	0



26.3	0	0	0	0	0	0	0	1	0
29	1	0	0	0	0	0	0	0	0
29.2	0	1	0	0	0	0	0	0	0
31	1	0	0	0	0	0	0	0	0
31.2	0	0	0	0	0	1	0	0	0
31.3	0	0	0	1	0	0	0	0	0
31.4	0	0	1	0	0	0	0	0	0
34	1	0	0	0	0	0	0	0	0
34.2	1	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	1	0	0
40.2	0	0	0	0	0	0	0	1	0
42	0	0	0	0	0	0	0	0	1
45	0	0	0	0	0	0	0	1	0
45.2	0	0	0	0	0	0	0	0	1
46	0	0	0	0	0	0	1	0	0
46.2	1	0	0	0	0	0	0	0	0
46.3	0	0	1	0	0	0	0	0	0
48	0	0	0	0	0	0	0	1	0
49	0	0	0	0	0	0	1	0	0
50	0	0	0	0	0	0	0	1	0
53	0	1	0	0	0	0	0	0	0
53.2	0	0	0	0	0	0	0	1	0

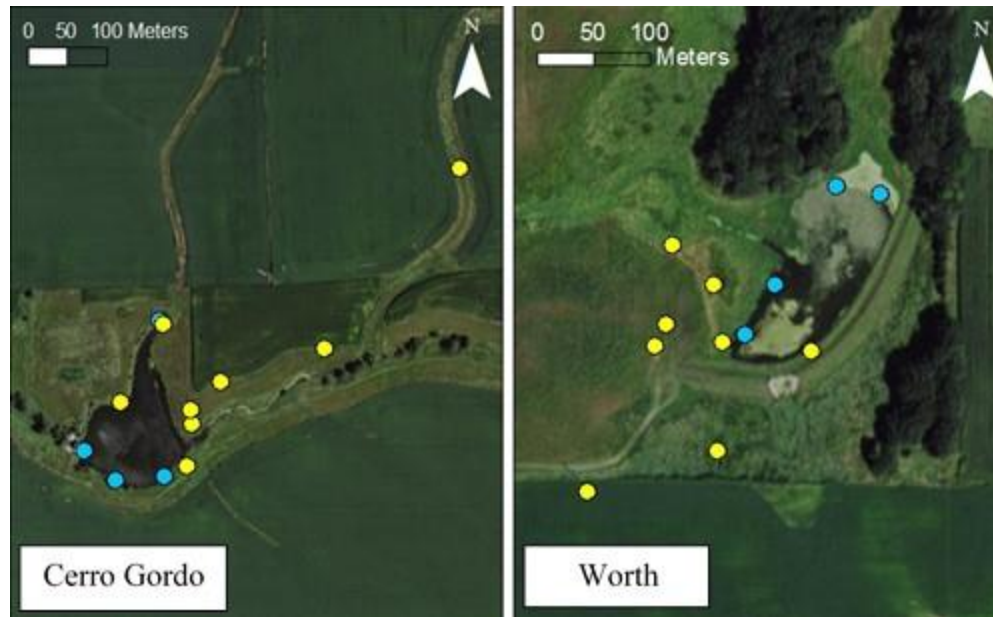
56	0	0	0	0	0	0	1	0	0
56.2	0	0	0	1	0	0	0	0	0
59	0	0	0	0	0	1	0	0	0
60	0	0	0	1	0	0	0	0	0
60.2	0	0	1	0	0	0	0	0	0
60.3	0	0	0	1	0	0	0	0	0
61	0	0	0	0	0	1	0	0	0
61.2	1	0	0	0	0	0	0	0	0
64	1	0	0	0	0	0	0	0	0
68	1	0	0	0	0	0	0	0	0
68.2	0	0	0	0	0	0	1	0	0
70	0	0	0	1	0	0	0	0	0
73	1	0	0	0	0	0	0	0	0
73.2	0	0	0	0	0	0	1	0	0
73.3	0	0	1	0	0	0	0	0	0
78	0	1	0	0	0	0	0	0	0
78.2	0	0	0	0	0	1	0	0	0
78.3	0	0	0	1	0	0	0	0	0
79	0	0	1	0	0	0	0	0	0
80	0	1	0	0	0	0	0	0	0
80.2	0	0	0	0	0	0	0	1	0
83	1	0	0	0	0	0	0	0	0

83.2	0	0	0	0	0	1	0	0	0
85	0	0	0	0	0	0	1	0	0
85.2	0	0	0	0	0	1	0	0	0
89	0	0	0	0	1	0	0	0	0
89.2	0	0	1	0	0	0	0	0	0
92	0	0	0	0	1	0	0	0	0
94	0	0	1	0	0	0	0	0	0
<b>Total</b>	<b>11</b>	<b>8</b>	<b>8</b>	<b>9</b>	<b>8</b>	<b>11</b>	<b>14</b>	<b>3</b>	

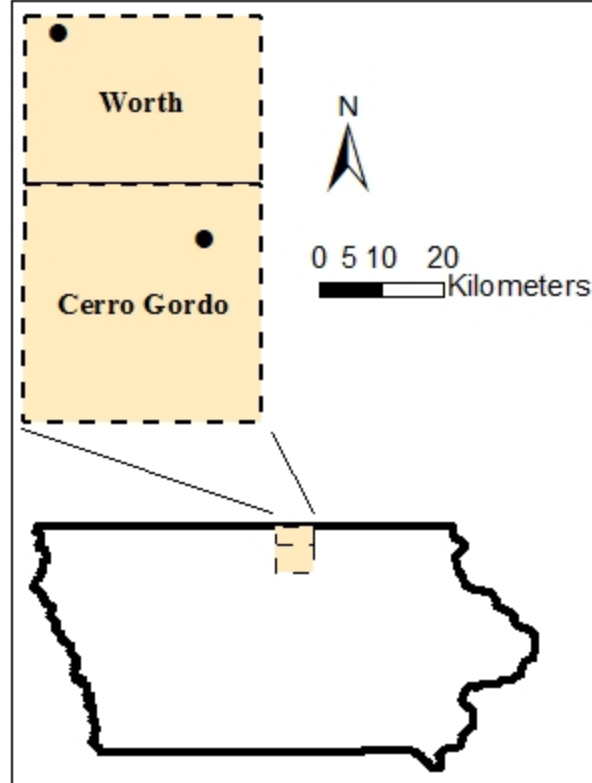
**Table S7.** Groups individual adult leopard frogs were assigned to for known fate analysis. Groups are organized by Site Sex Year. CG = Cerro Gordo, W = Worth, F=Female, M=Male, 15 = 2015, and 16 = 2016. “1” indicates frogs were in that group, with group totals in the last row.

<b>Model Name</b>	<b>k</b>	<b>Model Description</b>
S(.)	1	Survival is constant for all individuals
S(t)	86	Survival varies over time
S(Sex)	2	Survival varies by sex
S(Year)	2	Survival varies by study year
S(Site)	2	Survival varies by site
S(Group)	8	Survival varies by group
S(.+Habitat)	2	Survival is constant with an additive habitat effect
S(t+Habitat)	87	Survival varies over time with an additive habitat effect
S(Sex+Habitat)	3	Survival varies by sex with an additive habitat effect
S(Year+Habitat)	3	Survival varies by study year with an additive habitat effect
S(Site+Habitat)	3	Survival varies by site with an additive habitat effect
S(Group+Habitat)	9	Survival varies by group with an additive habitat effect

**Table S8.** Known fate models fit to data from radio telemetered leopard frogs in Iowa, k = number of parameters, S = survival, “.” = constant survival, t=time, Group = individual group assignment (see Appendix III), Habitat= Grassland, Wetland, Agriculture, Forest, or Developed, Year = 2015 or 2016.



**Figure S1.** Locations of PSDs in wetlands in 2015 and 2016. Blue dots represent PSDs placed overwinter while yellow dots represent PSDs placed in different habitats during the summer. This map was created using ArcGIS 10.3.1 software, <http://desktop.arcgis.com/en/arcmap/>



**Figure S2.** Location of two northern leopard frog radio telemetry study sites in Cerro Gordo and Worth counties, Iowa, USA. This map was created using ArcGIS 10.3.1 software, <http://desktop.arcgis.com/en/arcmap/>



**Figure S3.** White dots illustrate locations of a radio tracked frog (individual 45.2) and placement of PSD, 18 Jun – 8 Aug, 2016 (Worth County). This map was created using ArcGIS 10.3.1 software, <http://desktop.arcgis.com/en/arcmap/>.



**Figure S4.** PSDs being placed in wetlands to assess pesticide exposure of northern leopard frogs during aquatic hibernation from November 2015 – April 2016 in Iowa.