

SUPPLEMENTAL INFORMATION

**SNAKES, FENCES AND TEMPERATURE EXTREMES:
SUBSURFACE ARTIFICIAL REFUGIA PROVIDE ESCAPE FROM HEAT**

***CHLOE R. HOWARTH, LINDSAY WHITEHEAD, SHAYLEEN N. GRAY, JULIA M. BURKART,
VALERIE E. LAW, CHRISTINE A. BISHOP, AND KARL W. LARSEN***

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TABLE S1. Detailed occupancy patterns for snakes (Western Rattlesnake, Great Basin Gopher Snake, Western Yellow-Bellied Racer) using artificial refugia on the Osoyoos Indian Reserve in British Columbia, Canada, summarized by year and species. Units are degrees Celsius (°C) for all temperature metrics.

Metric	Year	Species	Min	Max	Median	Mean ± SD	N
Duration (min)	2020	Rattlesnake	1	2393	373.0	481.7 ± 467.8	49
		Gopher Snake	<1	907	125.0	288.2 ± 359.8	11
		Racer	1	43	4.0	16.0 ± 23.4	3
	2021	Rattlesnake	<1	5752	348.0	469.7 ± 716.1	80
		Gopher Snake	<1	334	5.0	34.8 ± 75.0	27
		Racer	<1	45	1.0	6.9 ± 14.6	10
	2022	Rattlesnake	<1	4036	212.0	484.0 ± 716.8	242
		Gopher Snake	<1	7379	22.5	504.2 ± 1449.2	26
		Racer	<1	41	1.0	7.6 ± 14.2	8
	2023	Rattlesnake	<1	3487	23.5	280.4 ± 554.6	312
		Gopher Snake	<1	534	3.5	53.1 ± 113.4	34
		Racer	<1	11	0.0	2.4 ± 4.8	5
Ambient temperature at time of entrance	2020	Rattlesnake	13.6	40.6	25.1	25.6 ± 4.7	49
		Gopher Snake	14.6	33.1	25.6	25.1 ± 5.9	11
		Racer	29.1	29.1	29.1	29.1 ± 0.0	3
	2021	Rattlesnake	12.5	46.0	25.5	25.7 ± 6.1	80
		Gopher Snake	15.5	32.0	21.0	22.5 ± 4.1	27
		Racer	15.5	31.0	21.8	23.3 ± 5.5	10
	2022	Rattlesnake	11.6	45.1	25.6	26.9 ± 5.7	242
		Gopher Snake	12.6	32.6	24.1	24.3 ± 4.8	26
		Racer	20.5	31.6	24.4	25.0 ± 3.7	8
	2023	Rattlesnake	13.0	48.0	25.5	26.6 ± 7.1	312
		Gopher Snake	13.5	42.5	23.5	25.1 ± 6.9	34
		Racer	13.0	35.5	24.5	23.8 ± 8.1	5
Ambient temperature at time of exit	2020	Rattlesnake	17.6	39.6	26.1	27.4 ± 5.3	49
		Gopher Snake	14.6	35.6	25.6	25.7 ± 7.4	11
		Racer	29.1	29.1	29.1	29.1 ± 0.0	3
	2021	Rattlesnake	14.5	46.0	28.5	28.6 ± 6.9	80
		Gopher Snake	15.5	31.5	22.5	22.9 ± 4.1	27
		Racer	15.5	31.0	21.8	23.3 ± 5.5	10
	2022	Rattlesnake	12.6	45.1	27.9	28.7 ± 7.3	242
		Gopher Snake	14.6	43.1	24.6	25.3 ± 6.3	26
		Racer	20.5	31.6	24.4	25.0 ± 3.7	8
	2023	Rattlesnake	13.0	48.0	26.5	27.8 ± 7.6	312

		Gopher Snake	13.5	46.0	24.3	26.4 ± 8.1	34
		Racer	13.0	35.5	24.5	23.8 ± 8.1	5
Refugia temperature at time of entrance	2020	Rattlesnake	20.0	33.8	27.8	28.0 ± 3.3	49
		Gopher Snake	20.9	35.4	28.3	28.0 ± 4.0	11
		Racer	30.9	31.4	31.4	31.2 ± 0.3	3
	2021	Rattlesnake	15.8	31.0	27.7	27.1 ± 2.8	80
		Gopher Snake	14.3	28.8	17.3	18.8 ± 3.5	27
		Racer	16.4	22.8	18.6	18.8 ± 2.0	10
	2022	Rattlesnake	15.1	32.0	28.0	27.4 ± 2.5	233
		Gopher Snake	16.4	30.9	24.6	24.1 ± 4.0	26
		Racer	18.0	27.4	20.6	21.2 ± 3.4	8
	2023	Rattlesnake	19.9	33.5	27.5	27.4 ± 2.6	312
		Gopher Snake	15.6	31.6	22.4	23.1 ± 3.9	34
		Racer	18.3	22.6	19.9	19.9 ± 1.7	5
Refugia temperature at time of exit	2020	Rattlesnake	19.0	36.4	28.3	28.2 ± 4.8	49
		Gopher Snake	20.9	35.9	26.4	29.0 ± 5.2	11
		Racer	30.9	31.4	31.4	31.2 ± 0.3	3
	2021	Rattlesnake	15.8	31.9	28.0	27.3 ± 3.0	80
		Gopher Snake	14.3	28.8	17.3	19.0 ± 3.5	27
		Racer	16.4	22.8	18.6	18.8 ± 2.0	10
	2022	Rattlesnake	12.7	32.0	27.7	27.5 ± 2.8	226
		Gopher Snake	15.5	31.4	24.6	24.2 ± 4.3	26
		Racer	18.0	27.4	20.6	21.2 ± 3.4	8
	2023	Rattlesnake	19.9	33.5	27.8	27.6 ± 2.7	312
		Gopher Snake	15.6	31.6	23.3	23.4 ± 4.1	34
		Racer	18.3	22.6	19.9	19.9 ± 1.7	5
Temperature difference (entrance vs. exit)	2020	Rattlesnake	-15.5	8.5	0.0	-1.8 ± 4.9	49
		Gopher Snake	-11.0	12.5	0.0	-0.6 ± 6.1	11
		Racer	0.0	0.0	0.0	0.0 ± 0.0	3
	2021	Rattlesnake	-23.5	14.5	0.0	-3.0 ± 6.9	80
		Gopher Snake	-8.0	0.5	0.0	-0.4 ± 1.6	27
		Racer	0.0	0.0	0.0	0.0 ± 0.0	10
	2022	Rattlesnake	-23.5	17.5	0.0	-1.8 ± 6.5	242
		Gopher Snake	-14.5	10.0	0.0	-1.0 ± 5.2	26
		Racer	0.0	0.0	0.0	0.0 ± 0.0	8
	2023	Rattlesnake	-25.0	19.0	0.0	-1.2 ± 5.4	312
		Gopher Snake	-14.5	5.5	0.0	-1.3 ± 4.0	34
		Racer	0.0	0.0	0.0	0.0 ± 0.0	5
Entrance date (Julian date)	2020	Rattlesnake	179.0	254.0	233.0	226.8 ± 17.4	49
		Gopher Snake	176.0	215.0	214.0	206.6 ± 12.3	11

		Racer	236.0	238.0	236.0	236.7 ± 1.2	3
		Rattlesnake	120.0	234.0	192.0	194.9 ± 24.6	80
	2021	Gopher Snake	119.0	195.0	135.0	140.6 ± 17.7	27
		Racer	121.0	171.0	139.0	141.8 ± 15.8	10
		Rattlesnake	123.0	245.0	210.0	208.1 ± 18.1	242
	2022	Gopher Snake	119.0	241.0	193.5	184.8 ± 30.5	26
		Racer	148.0	251.0	158.0	176.1 ± 38.2	8
		Rattlesnake	121.0	262.0	197.0	195.3 ± 21.5	312
	2023	Gopher Snake	121.0	255.0	153.5	162.4 ± 35.0	34
		Racer	130.0	142.0	133.0	134.4 ± 5.1	5
		Rattlesnake	179.0	254.0	233.0	227.1 ± 17.5	49
	2020	Gopher Snake	176.0	215.0	214.0	206.6 ± 12.4	11
		Racer	236.0	238.0	236.0	236.7 ± 1.2	3
		Rattlesnake	120.0	234.0	192.0	195.1 ± 24.5	80
	2021	Gopher Snake	119.0	195.0	135.0	140.6 ± 17.7	27
		Racer	121.0	171.0	139.0	141.8 ± 15.8	10
Exit date (Julian date)		Rattlesnake	124.0	245.0	210.5	208.4 ± 18.1	242
	2022	Gopher Snake	119.0	241.0	193.5	185.1 ± 30.6	26
		Racer	148.0	251.0	158.0	176.1 ± 38.2	8
		Rattlesnake	121.0	262.0	197.0	195.5 ± 21.6	312
	2023	Gopher Snake	121.0	255.0	153.5	162.4 ± 35.0	34
		Racer	130.0	142.0	133.0	134.4 ± 5.1	5
		Rattlesnake	17:59	12:00	11:00	16:39	49
	2020	Gopher Snake	20:43	22:00	19:05	06:30	11
		Racer	13:11	18:01	14:47	07:19	3
		Rattlesnake	12:19	19:07	12:05	15:35	80
	2021	Gopher Snake	11:28	05:27	18:20	04:14	27
		Racer	16:09	08:52	17:50	09:31	10
Entrance time (hh:mm)		Rattlesnake	07:00	10:23	02:08	22:54	242
	2022	Gopher Snake	23:00	10:50	00:49	14:24	26
		Racer	12:36	11:44	15:01	15:56	8
		Rattlesnake	18:53	18:18	19:30	01:06	312
	2023	Gopher Snake	18:35	09:58	03:21	23:45	34
		Racer	12:12	21:33	18:36	02:00	5
		Rattlesnake	17:59	12:00	11:00	16:39	49
	2020	Gopher Snake	20:43	22:00	19:05	06:30	11
		Racer	13:11	18:01	14:47	07:19	3
		Rattlesnake	12:19	19:07	12:05	15:35	80
	2021	Gopher Snake	11:28	05:27	18:20	04:14	27
		Racer	16:09	08:52	17:50	09:31	10
Exit time (hh:mm)		Rattlesnake	17:59	12:00	11:00	16:39	49
	2020	Gopher Snake	20:43	22:00	19:05	06:30	11
		Racer	13:11	18:01	14:47	07:19	3
		Rattlesnake	12:19	19:07	12:05	15:35	80
	2021	Gopher Snake	11:28	05:27	18:20	04:14	27
		Racer	16:09	08:52	17:50	09:31	10

	Rattlesnake	07:00	10:23	02:08	22:54	242
2022	Gopher Snake	23:00	10:50	00:49	14:24	26
	Racer	12:36	11:44	15:01	15:56	8
	Rattlesnake	18:53	18:18	19:30	01:06	312
2023	Gopher Snake	18:35	09:58	03:21	23:45	34
	Racer	12:12	21:33	18:36	02:00	5



FIGURE S1. Construction photos of refugia installed along snake exclusion fencing on the Osoyoos Indian Reserve in June 2020 and May 2022. **(A)** Newly completed refugium, where the refugium chamber (bucket) is located under the pile of rocks/sticks, and entrance tunnels are located under the three piles of rocks (two along the fence, one facing away perpendicular to the fence); **(B)** Entrance tunnel camouflaged/stabilized by rocks along snake exclusion fencing; **(C)** Refugium installation in process, where the chamber (bucket) is dug to sit flush with the surrounding ground; **(D)** Foil insulation and Bushnell® Natureview affixed to the underside of a refugium lid. (Photographed by Chloe R. Howarth).

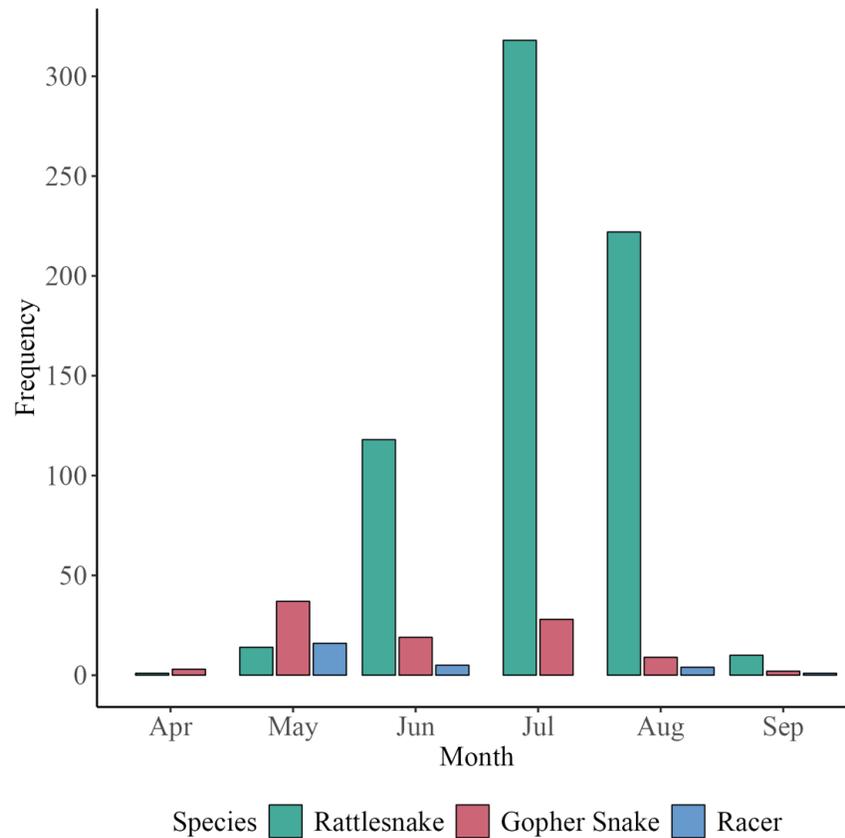


FIGURE S2. Temporal patterns of use, where observations across all years (2020-2023) are grouped by month, for snakes using artificial refugia structures on the Osoyoos Indian Reserve in British Columbia, Canada. Species: Rattlesnake = Western Rattlesnake (*Crotalus oreganus*); Gopher snake = Great Basin Gopher Snake (*Pituophis catenifer deserticola*); Racer = Western Yellow-Bellied Racer (*Coluber constrictor*). Note that data were only collected during the snakes active season; overwintering in hibernacula typically occurs between October and April.

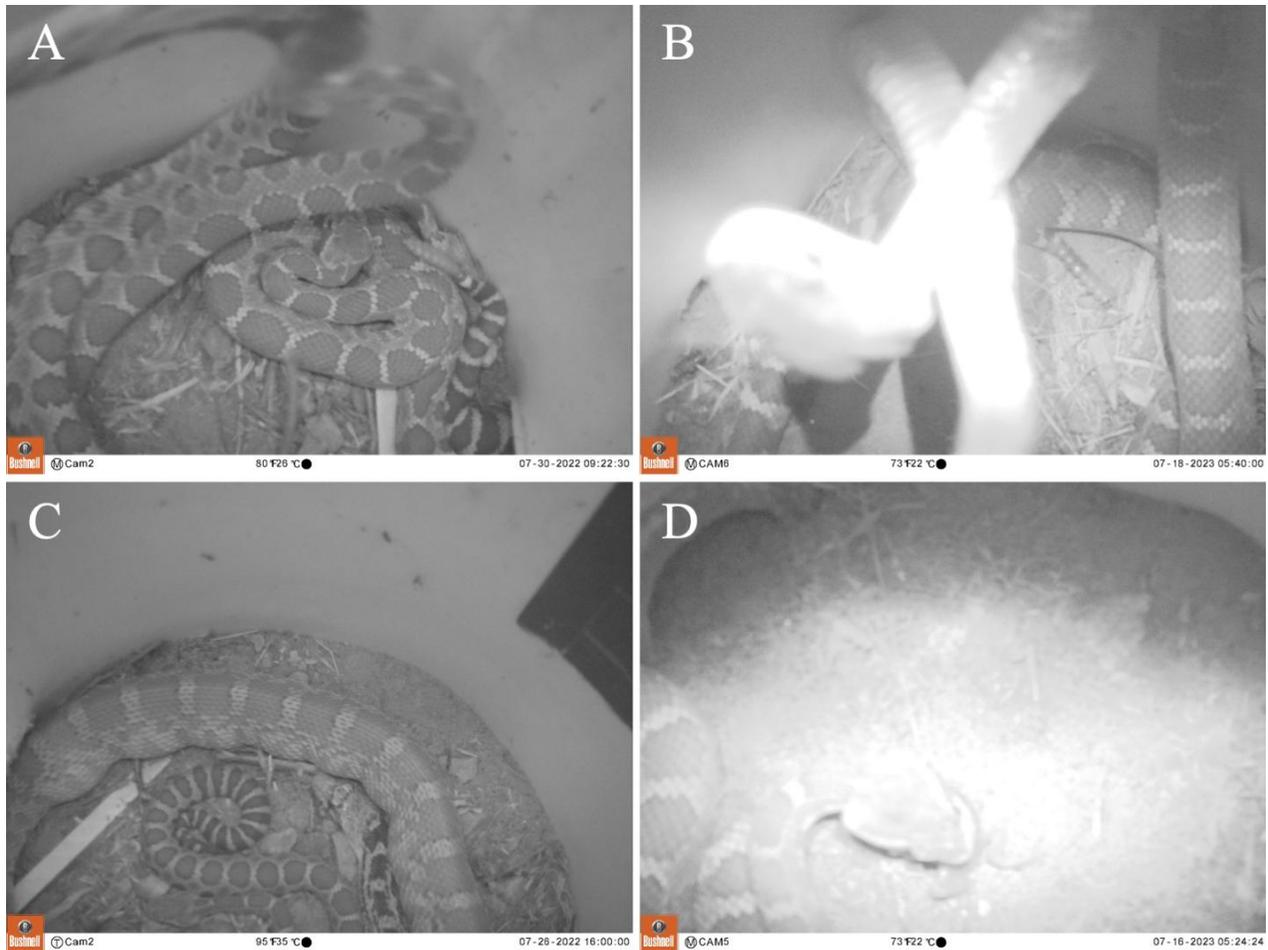


FIGURE S3. Behaviors observed inside refugia structures on the Osoyoos Indian Reserve in British Columbia, Canada. (A) Combat between two Western Rattlesnakes (*Crotalus oreganus*), with at least one additional Western Rattlesnake present in the refugium; (B) Combat between two Western Rattlesnakes (separate occurrence); (C) Great Basin Gopher Snake (*Pituophis catenifer deserticola*) digesting a meal of bird eggs, with a juvenile Western Rattlesnake also present; (D) Western Rattlesnake consuming a Great Basin Spadefoot (*Spea intermontana*). All images were captured by Bushnell® Natureview cameras affixed to the underside of refugia lids.