Wyoming Game and Fish Department
Bighorn Mountains Enhanced Elk Brucellosis Surveillance Program
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Summary

In the Bighorn Mountains, Wyoming Game and Fish Department (WGFD) documented two brucellosis seropositive hunter-harvested elk in 2012. In 2013, surveillance efforts were increased to better understand the extent and distribution of brucellosis seropositive elk within Bighorn Mountain Elk Hunt Areas (HAs) 33-41, 45, 47-49, and 120. Primary objectives of the enhanced elk surveillance program are to increase hunter contacts and increase in the number of testable blood and tissue samples. From 2013 to 2016, seven brucellosis seropositive hunter-harvested elk were documented.

During the 2017 hunting season in the Bighorn Mountains, WGFD dedicated five At-will Employee Contract (AWEC) technicians and a permanent brucellosis-habitat biologist specifically to monitor brucellosis seroprevalence and distribution in the Bighorn Mountains. The WGFD Wildlife Health Laboratory (WHL) and Cody and Sheridan regional personnel contacted a minimum of 2,032 elk hunters, distributed 6,373 blood sample kits (kits), and collected 777 blood samples (92% useable; 458 mail and 319 non-mail sources) and 44 lymphatic tissue samples. Blood samples were most frequently collected at check stations and drop-off coolers. No seropositive elk were detected during this sampling effort.

Since 2011, the number of useable blood and tissue samples increased and was likely a function of communication, participation, and training among WGFD personnel, hunters, and key stakeholders. Through extensive coordination with WHL and sponsors, WGFD developed a raffle to incentivize and improve brucellosis hunter sample returns statewide, which will commence with the 2018 hunting season.

Introduction

Brucellosis, a zoonotic disease caused by the bacteria *Brucella abortus*, is endemic in elk and bison of the Greater Yellowstone Ecosystem (GYE). In elk, the disease typically causes abortion from February to mid-June (peaking from March to mid-May) and is transmitted primarily through contact of animals with infected aborted fetuses, placentas, bodily fluids, or milk and ingestion of the bacteria. In the GYE, spillover transmissions from elk to livestock have increased over the last 20 years causing economic hardship for affected producers, debate over appropriate management actions, and need for more seroprevalence and genetic data. To understand the prevalence and distribution of brucellosis, particularly in non-feedground elk herds, WGFD annually provides about 10,000 blood sampling kits (kits) to limited quota elk license holders in targeted surveillance HAs around Wyoming. In the Bighorn Mountains, brucellosis seropositive elk were documented in two hunter-harvested elk in 2012. Beginning in 2013, the WGFD increased surveillance efforts through additional funding and personnel to better understand the seroprevalence, and document culture positive elk; seven seropositive elk were documented through 2016. Primary objectives of the Bighorn Mountains enhanced surveillance program are to increase elk hunter contacts in an attempt to increase in the number of testable blood and supramammary and iliac lymphatic tissue samples.

Study Area & Methods

The Bighorn Mountains lie within the north-central portion of Wyoming and are comprised by HAs 33-41, 45, 47-49, and 120 of the North Bighorn, Medicine Lodge, and South Bighorn Elk Herd Units in the Sheridan, Cody, and Casper Regions (Figure 1). In 2017, elk hunting seasons ranged from 15 August 2017 to 15 January 2018. Among all HAs, there were at least 9,478 limited quota elk license holders who reported hunting in the Bighorn Mountains in 2017.

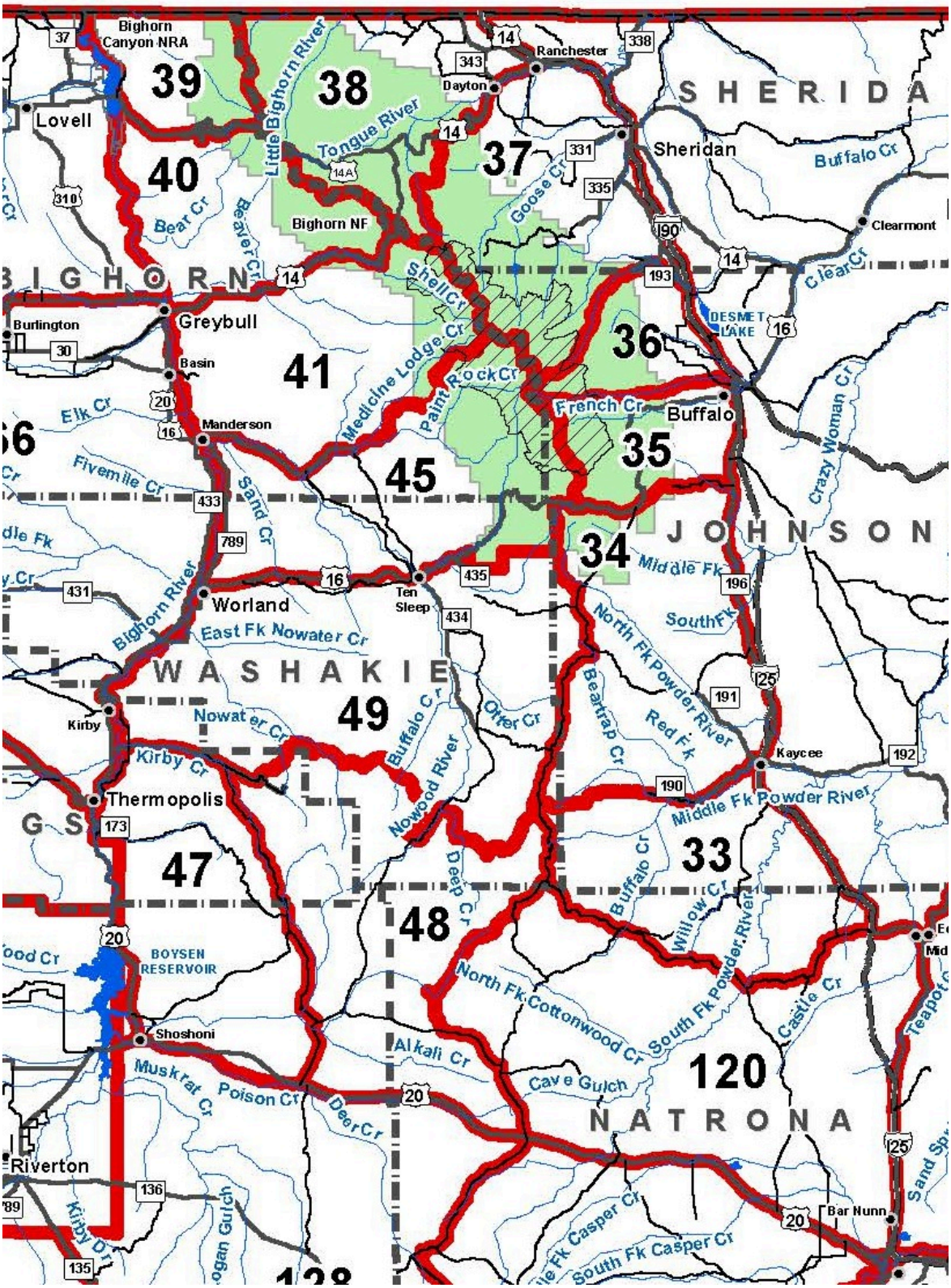

Figure 1. Elk hunt areas, Bighorn Mountains, WY, 2017.

In 2017, four AWEC technicians (two each in Sheridan Region and Cody Region), and a Cody Region permanent, brucellosis-habitat biologist position collected blood samples to monitor brucellosis seroprevalence and distribution. One WHL AWEC technician provided sample testing and database management (Table 1). To increase public awareness of brucellosis, Cody and Sheridan Wildlife Division personnel discussed brucellosis ecology and harvest data with hunters, landowners, outfitters, merchants, veterinarians, and other publics prior to and throughout the hunting season. About 6,373 kits were assembled and distributed to hunters, landowners, outfitters, and license selling agents (6,049 by mail and 324 handed out in field) by WHL, Cody and Sheridan personnel (Table 2).

Table 1. Expenses for brucellosis technicians, 2017-2018.

		Labor[a]			**Vehicles**		
Technician Positions (N)	**Period Worked**	**Hours**	**Cost ($) /hour**	**Total Cost ($)**	**Miles**	**Cost ($) /mile**	**Total Cost ($)**
Cody (2)	Oct-Dec 2017	213	14.82	3,1566.66	4,741[b]	0.30	1,422.30
Sheridan (2)	Oct-Dec 2017	767	14.82	11,366.94	5,886	0.30	1,765.80
Wildlife Health Lab (1)	Jun 2017-Mar 2018	N/A	N/A	20,748.00	N/A	N/A	N/A
Total		**980**		**35,271.60**	**10,627**		**3,188.10**

[a] Cost for WHL Technician is amount budgeted

[b] Includes miles outside Bighorn Mountains during kit drop-off sampling throughout Cody Region

Kits consisted of a 15-ml sterile polypropylene conical tube, paper towel, instruction/data sheet, and a prepaid mailing label for return shipping. Kits were collected opportunistically at hunter field checks, game check stations, regional WGFD offices, and strategic drop-off locations (i.e., road junctions, convenience stores, check stations, processors) around the Cody and Sheridan Regions. Drop-off locations consisted of a 12”x18” instructional sign, conspicuously displayed, and a cooler. To potentially increase the number of useable samples, and reduce effort and cost of checking coolers, WGFD coordinated sample collections with land and business owners and managers, discussing the need to keep blood samples cool and the need to keep samples indoors and refrigerated. Coolers exposed to ambient weather conditions, kept indoors, or kept indoors within refrigerated units were typically checked daily, twice per week, or once per week, respectively. To understand efficiency of returns at non-mail sources, personnel categorized type and number of drop-off sites [WGFD permanent field personnel (13), WGFD office (2), check station (6), cooler (41), ranch (2), outfitter

(3), processor (3)], summarized data per individual site type (e.g., cooler, ranch, WGFD personnel), and calculated total and average return of kits per drop-off site type per day.

Uncontaminated and unfrozen blood samples were separated into red blood cells and serum using a centrifuge. To facilitate WHL sample testing, field personnel differentiated blood samples that would not separate based on smell (rumen, urine, and/or putrid), texture, or color/transparency (frozen, or frozen/thawed). Samples were transferred to cryovials, frozen, and shipped weekly to WHL. When available, supramammary and iliac lymphatic tissues were collected. Following discussions and agreement with a key landowner in HA 49, ranch personnel were trained to collect lymphatic tissue when WGFD personnel were not available. WGFD later checked these samples for quality. Lymphatic tissue samples were placed in a Whirlpack® (plastic bag), labeled with unique information, frozen, and returned to WHL in March 2018.

Results

During the 2017 hunting season, personnel contacted a minimum of 2,032 hunters and 52 key individuals during informal and formal conversations regarding brucellosis sampling and results. Of 41 drop-off locations with coolers, 13 were ranches or businesses with the potential to collect samples indoors. All 13 agreed to allow indoor drop-off coolers, and eight of these in refrigerated units. Of the 777 kits returned with blood, 92% were useable, with 458 and 319 samples received via mail and non-mail returns, respectively. For non-mail returns, coolers received the most kits with 161 samples and processors received the least (7). Per drop-off site (or per person in the case of field staff) per day, kits were collected most frequently at check stations (0.53 kits/check station/day) and least frequently by processors and field staff (0.03 kits/processor/day, 0.03 kits/person/day). All five (100%) lymphatic tissue samples collected by ranch personnel in HA 49 were usable.

Table 2. Average number of blood kits returned per drop-off site type per day (total), 2017-2018 hunting season, Bighorn Mountains WY.

	Average Kits per Day (N)						
Year	**Check Station**	**Cooler**	**Outfitter**	**Ranch**	**WGFD Office**	**Field Staff**	**Processor**
2017	0.53 (65)	0.11 (161)	0.09 (28)	0.05 (12)	0.05 (11)	0.03 (65)	0.03 (7)

Since 2011, WGFD increased the number of kits distributed, blood and tissue samples collected, and number and proportion of useable samples. Since 2013, the percentage of kits returned relative to kits distributed and elk harvested was stable but relatively low (Table 3).

Table 3. Brucellosis hunter-harvest sampling summary for the 2011-2016 hunting seasons in Elk Hunt Areas 33-41, 45, 47-49 and 120 in the Bighorn Mountains, WY,.

	Total				% Return[b]		% Samples Useable (N)[c]	Seropositive Elk	
Year	Kits[a]	Harvest	Samples		Kits	Harvest		N	Hunt Area(s)[d]
			Blood	Tissue					
2011	2,829	3,057	241	UK	8.5	7.9	55.6 (134)	0	N/A
2012	2,885	3,785	244	UK	8.5	6.4	43.4 (106)	2	40
2013	7,626	3,364	736	48	9.7	21.9	67.0 (493)	2	40, Unk[e]
2014	7,350	3,880	812	27	11.0	20.1	71.2 (578)	3	39,40,41
2015	6,640	4,053	700	34	10.5	17.3	68.9 (482)	0	N/A
2016	7,606	4,247	724	64	9.5	17.0	74.2 (537)	2	40, 49
2017	6,373	3,577	777	44	12.2	21.7	91.7 (708)	0	N/A

[a] Total mailed plus estimated total distributed to hunters in field

[b]Percentage of blood samples returned relative to total kits distributed to hunters or elk harvested

[c]Number of useable blood samples (N) divided by number of blood samples returned

[d]Hunt area(s) where samples from seropositive elk were harvested

[e] Unk = Unknown; sample did not have HA information

Discussion

The relative increase and sustained numbers of useable blood and tissue samples after 2011 were likely facilitated by committed funding, educating and maintaining relationships with stakeholders on the importance of samples, and trained WGFD personnel. Despite not documenting brucellosis in 2017, repeated detection of seropositive female elk in HA 40 since 2012 suggests this area may be a potential source for brucellosis. Subsequent detection in surrounding HAs suggests the disease may have expanded from HA 40. Maintaining current efforts to monitor brucellosis surveillance in the Bighorn Mountains will help in the continuation of stakeholder education, participation, and collection, processing and testing of samples.

The increased number of useable samples was greatly facilitated by recent WHL's ability to accurately test frozen and/or contaminated samples, and the cooperation of land and business owners to keep coolers indoors or refrigerated. The willingness of businesses to allow indoor drop-off and storage of blood samples was likely facilitated by increased potential sales to hunters that dropped off samples at such businesses. The relatively high return of kits at check stations and coolers was likely a function of strategic timing and/or location, and particularly for coolers, persistent availability. Low return of kits at processors likely resulted from low submission of elk for processing (estimated <5% of those harvested based on processor check-in sheets), whereas low return for field personnel likely resulted from conflicting job duties and/or inconvenient timing of harvest. Similar to 2016, repeated success of non-WGFD personnel to accurately collect lymphatic tissue samples warrants future solicitation of sampling from willing license holders.

Statewide, approximately 10% to 15% of kits mailed to hunters are returned. Similarly from the Bighorn Mountains, the sustained low levels of samples returned relative to the kits deployed or elk harvested are likely functions of hunter education and motivation. To increase returns of useable samples, WGFD has collaborated with Rocky Mountain Elk Foundation, The Wyoming Chapter of The Wildlife Society, Maven, and Vortex to donate prizes for a raffle to be initiated during the 2018 hunting season. WGFD intends to sustain the raffle for at least three hunting seasons (2018 to 2020), to promote hunter return of sample kits.

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