

IDAHO DEPARTMENT OF FISH AND GAME

Steven M. Huffaker, Director

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Completion Report



HELLS CANYON BIGHORN SHEEP

Study I: Hells Canyon Bighorn Sheep Restoration

July 1, 2005 to June 30, 2006

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south to Brownlee Reservoir. It is bounded on the east by the hydrologic divide between the Salmon and Snake rivers near Riggins, Idaho, south to Brownlee Creek on the Payette National Forest, Idaho, and extends just west of the Eagle Cap Wilderness, Wallowa-Whitman National Forest, Oregon. Major drainages include the Snake, Grande Ronde, Imnaha, and lower Salmon rivers. There are currently 16 bighorn sheep populations, or herds, established in the project area (Figure 1). Over 1.3 million acres (24%) of the project area is potential bighorn sheep habitat, 68% of which is publicly owned, primarily managed by the U.S. Forest Service (USFS). Other public land managers are the states of Oregon, Idaho, and Washington and the Bureau of Land Management (BLM).

Capture, Radio Collar, and Sampling

Eighty-eight bighorn sheep were captured, sampled, and released in 8 populations, and 74 of these were also radio-collared. Capture was by helicopter net-gun (70) or corral trap (18).

Pharyngeal swab samples collected at capture were submitted to the CVTC for culture of *Pasteurella* and *Mannheimia* spp. bacteria. Blood serum samples were collected for testing for exposure to respiratory viruses and submitted to the Idaho State Bureau of Animal Health Laboratory. Blood and serum were also collected for evaluation of trace element levels at the University of Idaho Holm Research Laboratory. Fecal samples and ear swabs were collected and submitted to the Washington Animal Disease and Diagnostic Laboratory for analysis of internal and external parasites. Body condition was estimated through palpation at the withers, ribs, and rump on a score of 1 (emaciated) to 5 (obese).

Sampling results

Results of health sampling were similar to those from previous years (1997-2004). Fecal lungworm larvae levels remain low to absent. No lungworm larvae were detected in 3 populations: Asotin, Lostine, and Sheep Mountain. Mean intensity in other populations ranged from 3 to 12 larvae per gram of feces with a range of 1 to 49 (Table 1).

Positive titers to 4 respiratory viruses were detected in 2006, indicating possible exposure. Positive titers to Parainfluenza-3 Virus (PI-3) were detected in all populations sampled. Titer prevalence ranged from 36-80%, and median positive titers from 8-96. A small number of individuals also had titers to Bovine Respiratory Syncytial Virus (BRSV), 4 sheep in 3 populations; Bovine Viral Diarrhea Virus (BVDV), 7 sheep in 2 populations; and Ovine Progressive Pneumonia (OPP), 8 sheep in 4 populations (Table 2).

Pasteurella or *Mannheimia* were detected in 63 of 88 pharyngeal swab samples (Table 2). Lack of detection of *Pasteurella* or *Mannheimia* may have been a result of sampling or handling rather than an absence of the bacteria in the sheep (Wild and Miller 1991). *Pasteurella trehalosi* was most frequently detected, followed by *Mannheimia* spp. *Pasteurella multocida*, considered potentially virulent (Weiser et al. 2003), was detected infrequently in 5 populations. Beta-hemolytic isolates, indicating presence of the potentially virulent leukotoxin-A gene (Fisher et al. 1999) were present in all populations except Asotin and Lostine (Table 2).

Survival and Movements

Adult Survival

Ninety-two radio-collared bighorn sheep (73 ewes, 19 rams) were monitored in 10 herds from 1 June 2005 to 31 May 2006. Eleven radio-collared adult bighorn sheep (7 ewes, 4 rams) died during this period. Two pneumonia-caused mortalities were documented, one in the Muir Creek population and one in the Upper Hells Canyon population, both in Oregon. The most common causes of mortality were pneumonia (females) or human-caused (harvest) in males (Figure 2). Annual survival of radio-collared ewes averaged 0.93 and ram survival averaged 0.75. Annual survival of ewes in 7 herds with 7 to 14 radio-collared females in each herd, ranged from a low in Muir Creek of 71% to 100% in the Black Butte, Redbird, and Wenaha herds (Table 4).

Lamb Survival

Lamb survival was highly variable among herds. Nine intact dead lambs were recovered between 21 June and 26 August 2005 in the Redbird, Black Butte, Imnaha, and Lower Hells Canyon herds. Seven were diagnosed with pneumonia by the Washington Animal Disease and Diagnostic Laboratory, and 2 were non-diagnostic. Summer lamb survival in the 3 herds where lambs were diagnosed with pneumonia was 50% or less (Table 5), and recruitment in these herds ranged from 0 to 28 lambs/100 ewes (Table 6). Pneumonia-caused lamb mortality was suspected in another 5 herds where summer survival was 14% or less and recruitment was 0 to 20 lambs/100 ewes (Table 6), although no dead lambs were recovered.

Population Monitoring

Hells Canyon bighorn sheep were surveyed by the states of Oregon, Idaho, and Washington from a helicopter (Robinson 44 and Hughes 500) and on the ground in 2005-2006. Approximately 870 bighorn sheep are estimated to occur in 16 herds or populations within the project area (Table 6), similar to the estimate of 875 bighorn sheep in 2004-2005. Population dynamics continues to differ considerably among herds (Appendix A). In 2005, the Asotin, Washington, and Bear Creek, Oregon, populations increased; the Black Butte, Washington, and Upper Hells Canyon, Oregon, populations declined; and other populations remained stable or changed slightly.

Disease Research and Management

Collaborative research projects were initiated in 2005-2006 between the Hells Canyon Initiative bighorn sheep restoration project and the CVTC, and WSU School of Veterinary Medicine to incorporate field data from Hells Canyon bighorn sheep and laboratory analysis and experiments to better understand causes of pneumonia in bighorn sheep. The projects with CVTC are scheduled to continue for 5 years and those with WSU for 2 years. The initial focus of the work is to use culture and molecular techniques to detect and evaluate potentially pathogenic bacteria and viruses from healthy and pneumonic adults and lambs in Hells Canyon. The goal is to identify organisms responsible for causing disease in bighorn sheep in Hells Canyon and other free-ranging populations.

In order to reduce the potential for contact between bighorn sheep and domestic sheep and goats, bighorn sheep removal and watch zones were delineated in Hells Canyon (Figures 3 and 4). This should allow managers to act quickly and consistently to resolve potential problems and minimize the potential for disease transfer from domestic sheep and goats to wild sheep.

Public Information and Outreach

An interpretive display on the Foundation for North American Wild Sheep (FNAWS) and the Hells Canyon Bighorn Sheep Initiative was completed in the newly-created Jack O'Connor Hunting Heritage Center in Lewiston.

Articles on the Hells Canyon Initiative appeared regularly in the FNAWS National and Chapter publications in 2005-2006, and the Initiative had an informational booth at the National FNAWS convention in Reno, Nevada, and at the Idaho and Oregon FNAWS chapter banquets. In June, Washington FNAWS sponsored the fourth annual meeting of the Washington, Oregon, and Idaho FNAWS chapters in Hells Canyon.

Harvest

A total of 278 rams have been harvested by 293 draw permit holders and auction or lottery tag holders in the project area since the first season in 1978 (Table 7), including 11 rams in 2005. Success rate has exceeded 90%. Hunting is by controlled permit and limited to rams only in all 3 states. Oregon and Washington permit the taking of any ram, while Idaho requires a $\frac{3}{4}$ curl or greater or an age of at least 4 years. Washington herds must have at least 8 mature rams, of which 2 are at least 6 years old or $\frac{3}{4}$ curl (WDFW 1995). In Idaho, permits can be issued for no more than 20% of mature ($\frac{3}{4}$ curl or greater) rams (IDFG 1990). In Oregon, the number of tags authorized for a hunt is based on the number of mature rams available in the unit area and the size of the hunt area (ODFW 2003). Nez Perce tribal members have treaty rights to hunt in all 3 states within the project area. The number of bighorn sheep harvested by tribal hunting is unknown. The Nez Perce tribe received authorization to issue a tag in the Redbird, Idaho, population in 2005 but did not exercise this option. In 2005, the first Blue Mountain lottery tag winner in Washington harvested a ram in the Tucannon herd. Over 50 rams greater than 180 Boone and Crockett points have been taken by tag holders in the Hells Canyon area.

Restoration Committee

The Hells Canyon Bighorn Sheep Initiative is conducted by the Hells Canyon Bighorn Sheep Restoration Committee. The committee is comprised of state, federal, tribal, and private organizations, of which each provide an administrative (A) and technical (T) committee member. Organizations and committee members in 2006 are:

Idaho Department of Fish and Game

- Dale E. Toweill, Wildlife Program Coordinator (A)
- Frances Cassirer, Tri-State Coordinator/Wildlife Research Biologist (T)

Oregon Department of Fish and Wildlife

- Don Whitaker, Program Coordinator (A)
- Vic Coggins, District Wildlife Biologist (T)

Washington Department of Fish and Wildlife

- Donny Martorello, Big Game Program Manager (A)
- Paul Wik, Wildlife Biologist (T)

USDA Forest Service

- Bob Rock, Natural Resources Staff, Wallowa-Whitman National Forest (A)
- Tim Schommer, Forest Biologist, Wallowa-Whitman National Forest (T)

USDI Bureau of Land Management

- John Augsburger, Wildlife Biologist, Idaho State Office(A)
- Craig Johnson, Wildlife Biologist, Salmon-Clearwater Resource Area (T)

Foundation for North American Wild Sheep

- Raymond Lee, President/CEO (A)
- Lloyd Oldenburg and Rick Brigham, Members (T)

Nez Perce Tribe

- Loren Kronemann, Wildlife Biologist (A)
- Marcie Carter, Wildlife Biologist (T)

Literature Cited

- FISHER, M. A., G. C. WEISER, D. L. HUNTER, AND A. C. S. WARD. 1999. Use of a polymerase chain reaction method to detect the leukotoxin gene *lktA* in biogroup and biovariant isolates of *Pasteurella haemolytica* and *P. trehalosi*. *American Journal of Veterinary Research* 60:1402-1406.
- HELLS CANYON BIGHORN SHEEP RESTORATION COMMITTEE. 1997. Restoration of Bighorn Sheep to Hells Canyon: The Hells Canyon Initiative. Technical Bulletin 97-14, Bureau of Land Management.
- HELLS CANYON BIGHORN SHEEP RESTORATION COMMITTEE. 2004. The Hells Canyon Initiative: Hells Canyon bighorn sheep restoration plan. Idaho Department of Fish and Game, Lewiston, USA.
- IDAHO DEPARTMENT OF FISH AND GAME. 1990. Bighorn Sheep Management Plan, 1991 - 1995. Bureau of Wildlife, Idaho Department of Fish and Game, Boise, USA.
- OREGON DEPARTMENT OF FISH AND WILDLIFE. 2003. Oregon's bighorn sheep and Rocky Mountain goat plan. Salem, Oregon, USA.
- WASHINGTON DEPARTMENT OF FISH AND WILDLIFE. 1995. Washington state management plan for bighorn sheep. Wildlife Management Program, Washington Department of Fish and Wildlife, Olympia, USA.
- WEISER, G. C., W. J. DELONG, J. L. PAZ, B. SHAFI, W. J. PRICE, AND A. C. S. WARD. 2003. Characterization of *Pasteurella multocida* associated with pneumonia in bighorn sheep. *Journal of Wildlife Diseases* 39:536-544.
- WILD, M. A., AND M. W. MILLER. 1991. Detecting nonhemolytic *Pasteurella haemolytica* infections in healthy Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*): Influences of sample site and handling. *Journal of Wildlife Diseases* 27:53-60.

Hells Canyon Bighorn Sheep Project Area

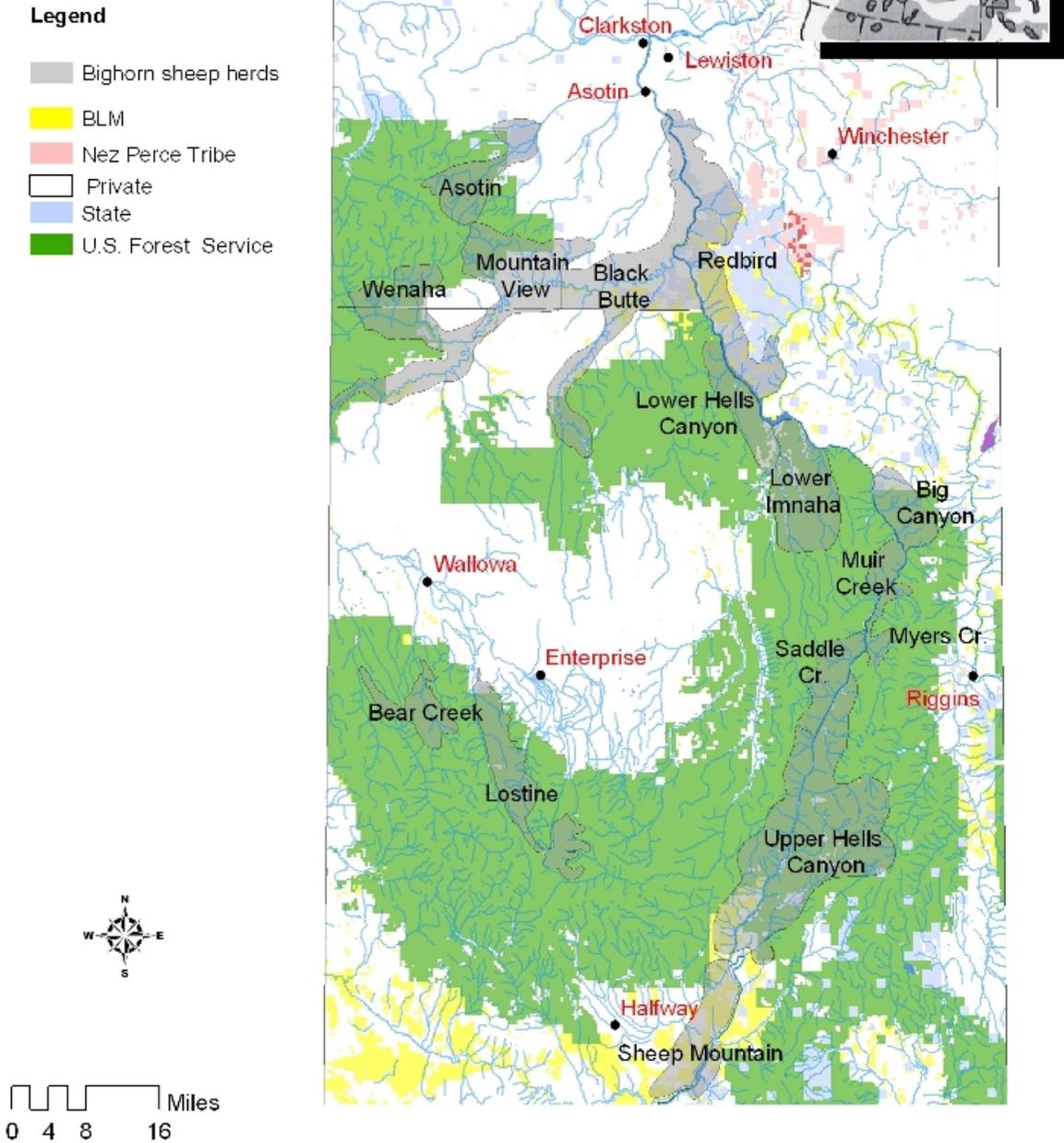


Figure 1. Hells Canyon Initiative Project Area.

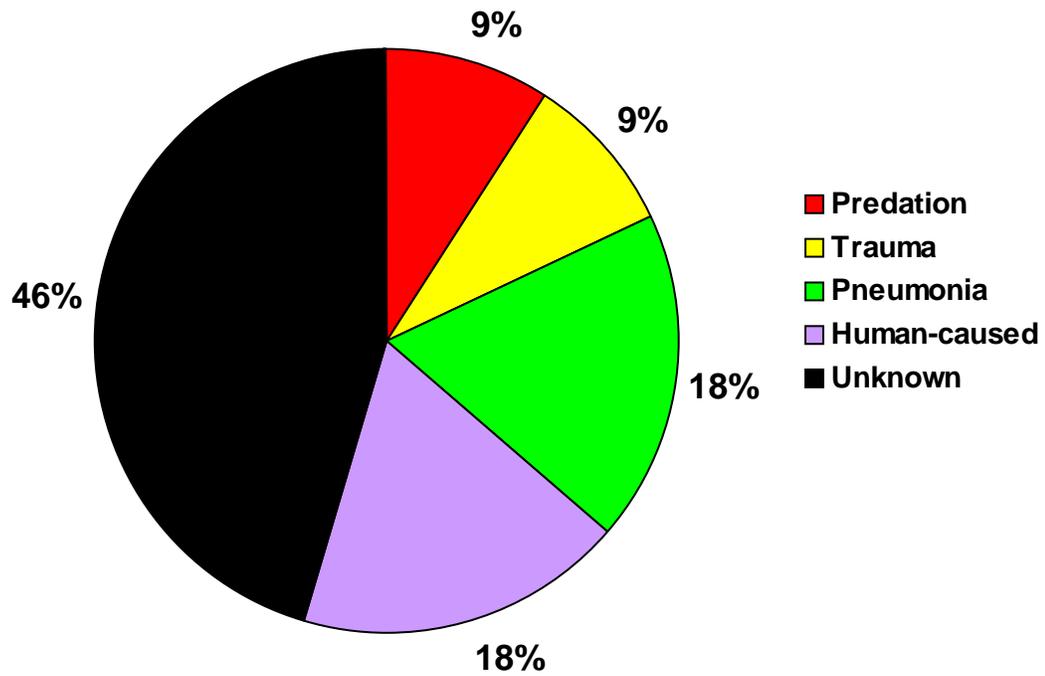


Figure 2. Causes of mortality of 11 adult radio-collared bighorn sheep in Hells Canyon, 1 June 2005 to 31 May 2006. The cause of death could not be determined for 5 mortalities, 3 scavenged and 2 intact. The most frequent known causes of mortality were pneumonia and human-caused. Cougar predation accounted for 9% of adult mortality.

Hells Canyon Bighorn Sheep Management Zones 2006

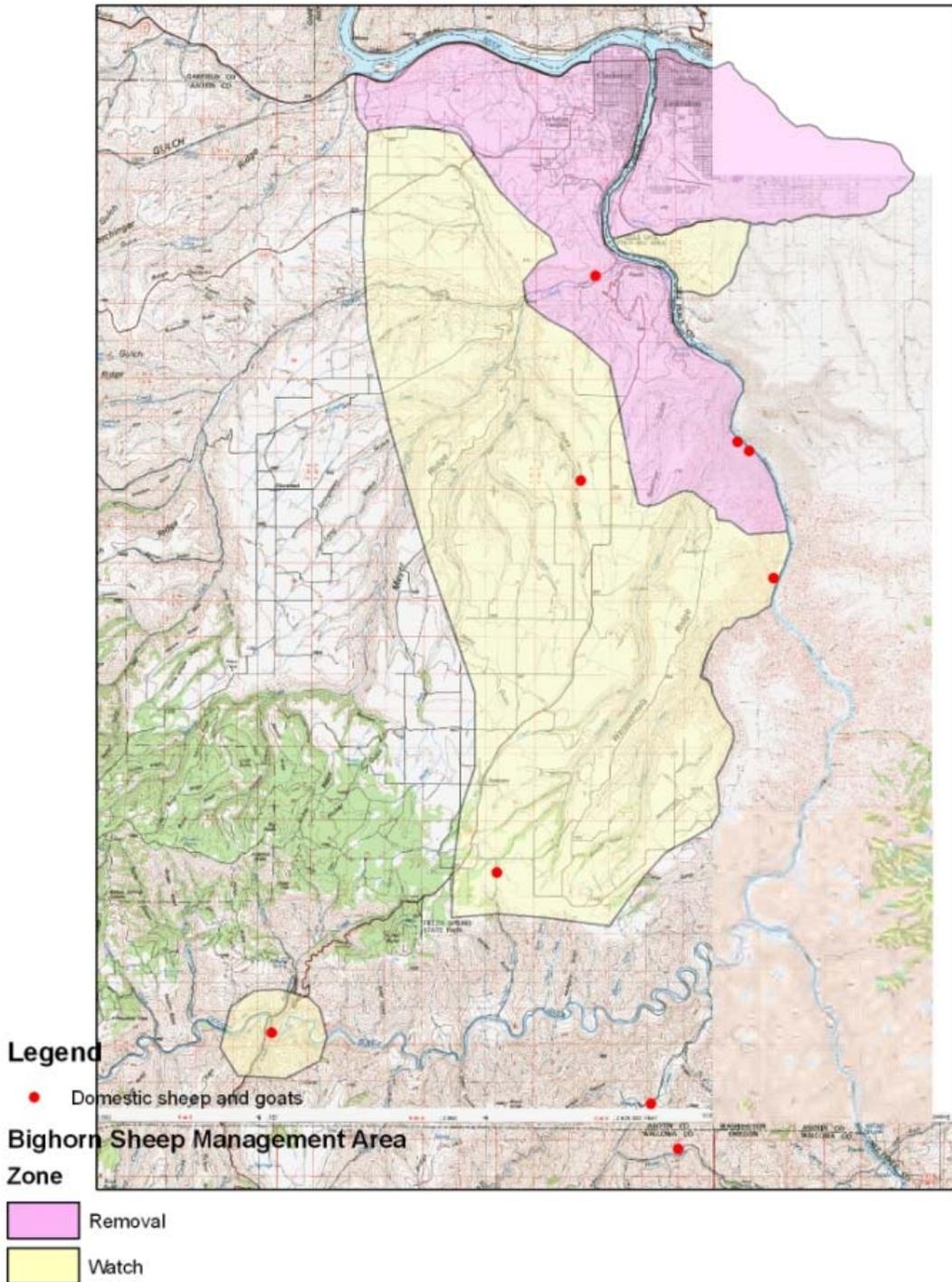
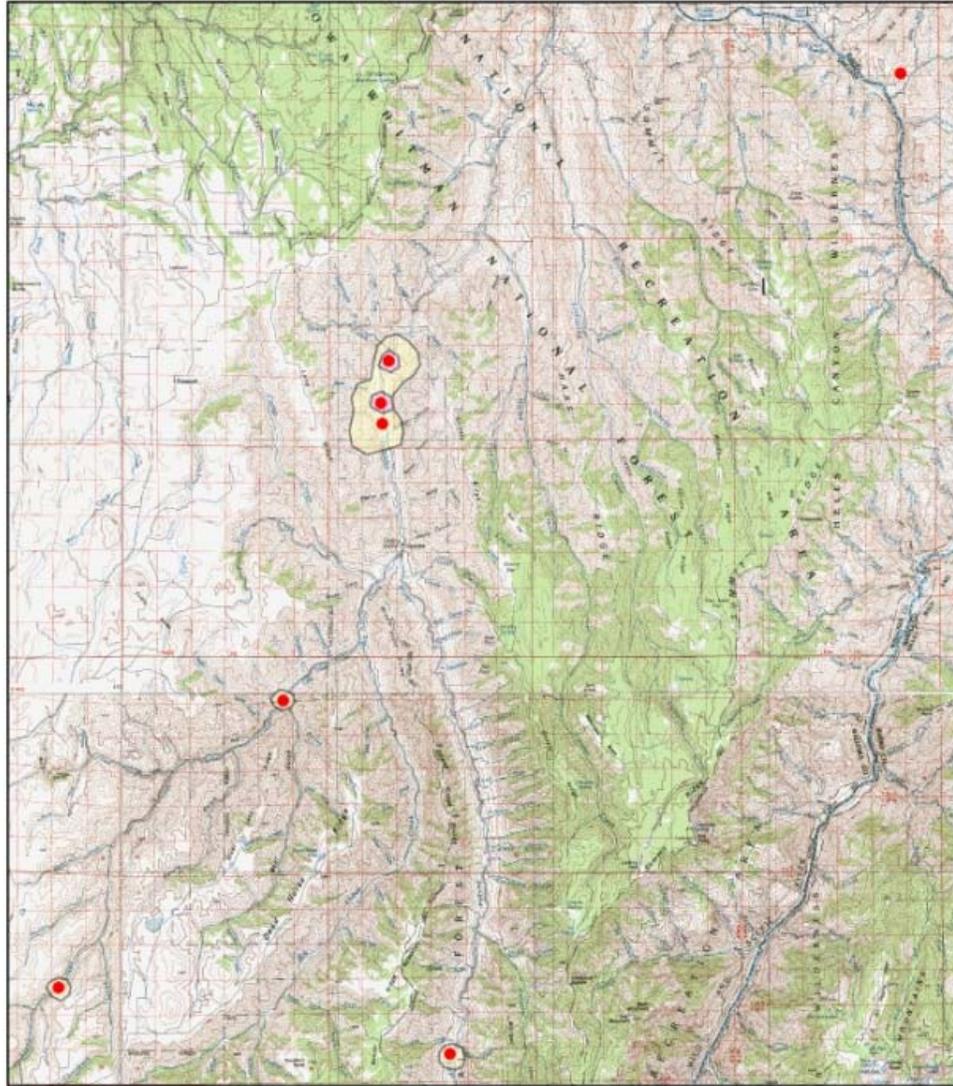


Figure 3. Removal and watch zones for bighorn sheep in northern Hells Canyon relative to known locations of domestic sheep and goats.

Hells Canyon Bighorn Sheep Management Zones 2006



Legend

• Domestic sheep and goats

Bighorn Sheep Management Area

Zone

■ Removal
■ Watch

Figure 4. Removal and watch zones for bighorn sheep in southern Hells Canyon relative to known locations of domestic sheep and goats.

Table 1. Fecal lungworm (*Protostrongylus* spp.) larvae infection prevalence and intensity (larvae per gram) in 267 bighorn sheep sampled at capture in 8 populations in Hells Canyon, 1997-2006.

Population	Year	Prevalence	Mean intensity	Range
Asotin	2003	0/13	0.00	0
	2006	0/9	0.00	0
Black Butte	1997	10/13	20.17	6 - 48
	2000	6/6	24.50	6 - 40
	2003	8/10	5.90	2 - 16
	2006	4/14	12.75	1 - 45
Imnaha	2000	10/21	12.00	1 - 176
	2006	1/10	3.00	3
Lostine	2000	0/15	0.00	0
	2001	0/14	0.00	0
	2002	0/13	0.00	0
	2003	0/7	0.00	0
	2004	0/10	0.00	0
	2005	0/15	0.00	0
	2006	0/12	0.00	0
Mountain View	2006	5/7	2.60	1 - 4
Redbird	1997	8/11	13.64	5 - 33
	2000	2/3	10.70	4 - 28
	2003	12/12	9.30	2 - 22
	2006	5/8	5.80	1 - 10
Sheep Mountain	2006	0/10	0.00	0
Wenaha	1997	6/12	8.00	8 - 30
	2000	15/15	9.80	3 - 22
	2006	3/10	7.70	6 - 9
Average		0.13	8.00	0 - 176

Table 2. Prevalence of titers to respiratory viruses and *Anaplasma* spp. in adult bighorn sheep in 8 Hells Canyon populations at capture, 1997-2006. Number positive in parentheses.

Population	Year ^b	<i>n</i>	Pathogen ^a							<i>PI3</i> median + ^c	<i>PI3</i> + range
			Ana	BTV	BRSV	BVDV	EHDV	OPP	<i>PI3</i>		
Asotin	2002-03	13	0	0.08 (1)	0	0	0.08	0.15 (2)	0.38 (5)	8	
	Jan 2006	9		0	0.56 (5)	0	0	0	0.67 (6)	16	8 - 64
Black Butte	1997-98	12	0	0	0	0	0	0	0.25 (3)	64	
	1999-00	6	0.16 (1)	0	0.16 (1)	0	0	ND	1.00 (6)	32	8 - 64
	2002-03	10	0.50 (5)	0	0	0	2 (0.20)	0	0.9 (9)	12	
Imnaha	Jan 2006	14		0	0.07 (1)	0	0	0.14 (2)	0.36 (5)	32	32 - 64
	1999-00	21	0.38 (8)	0	0	0.14 (3)	0	0	0.86 (18)	24	8 - 64
	2002-03	6	0	0	0	0	1 (0.17)	0	1.00 (6)	8	8 - 16
Lostine	Jan 2006	11		0	0	0	0	0	0.73 (8)	32	16 - 64
	1998-99	15	0.47 (7)	0.07 (1)	0	0	0	1 (0.07)	0.87 (13)	16	8 - 16
	1999-00	21	0.38 (8)	0	0	0.05 (1)	1 (0.05)	0	0.67 (14)	32	4 - 64
Lostine	2000-01	11	0	0	0	0	0	0	0.09 (1)	16	16
	2001-02	25	0	0	0	0	0	0	0	0	0
	2002-03	10	0	0	0	0	0	0	0.90 (9)	4	4
	2003-04	15	0	0	0	0	0	0	0.47 (7)	12	8 - 32
	2004-05	15	0	0	0	0	0	0	0.87 (13)	32	16 - 64
	2006	19	0.10 (2)	0	0	0	0	0	0.60 (12)	32	8 - 64
Mountain View	Jan 2006	8		0	0.13 (1)	0	0	0	0.86 (7)	16	8 - 32
Redbird	1997-98	12	0	0	0	0.08 (1)	0	0	0.50 (6)	24	16 - 32
	1999-00	6	0.17 (1)	0	0	0.33 (2)	0	0	0.83 (5)	16	8 - 32
	2002-03	12	0	0.17 (1)	0	0	0	0	1.00 (12)	12	4 - 128

Table 2. Continued.

Population	Year ^b	<i>n</i>	Pathogen ^a							<i>PI3</i> median + ^c	<i>PI3</i> + range
			Ana	BTV	BRSV	BVDV	EHDV	OPP	<i>PI3</i>		
	Jan 2006	9		0	0.22 (2)	0.67 (6)	0	0.22 (2)	0.78 (7)	48	16 - 128
Sheep Mtn.	Jan 2006	10		0	0	0.1 (1)	0	0.20 (2)	0.80 (8)	96	8 - 256
Wenaha	1997-98	10	0.33 (3)	0	0	0	0	0	0.10 (1)	16	16
	1999-00	16	0.75 (12)	0	2 (0.13)	0	0	0	0.81 (13)	32	8 - 64
	2002-03	8	0	0.13 (1)	0	0	0	0	0.38 (3)	16	16
	2006	9		0	0	0	0.11 (1)	0.25 (2)	0.67 (6)	8	8 - 128
Total		333	0.18 (47)	0.01 (4)	0.04 (12)	0.04 (13)	0.02 (6)	0.03 (11)	0.68 (226)		

^a Pathogens: Ana = *Anaplasma* spp.; BTV = bluetongue virus; BRSV = bovine respiratory syncytial virus; BVDV = bovine viral diarrhea virus; EHDV = epizootic hemorrhagic disease virus; OPP = ovine progressive pneumonia; *PI3*, parainfluenza-3 virus.

^b Year = all samples collected December-March.

^c Median value of positive titers to parainfluenza-3 virus.

Table 3. Prevalence (% of bighorn sheep) of *Pasteurella* and *Mannheimia* species isolated from pharyngeal swabs, and proportion beta-hemolytic in 8 bighorn sheep populations in Hells Canyon, 1997-2006.

Population	Date	<i>n</i> sheep	<i>n</i> isolates	<i>P.</i> <i>trehalosi</i>	<i>Mannheimia</i> spp.	<i>P.</i> <i>multocida</i>	beta- hemolytic
Asotin	Mar 2003	13	15	1.00	0.08	0.00	0.00
	Jan 2006	9	15	1.00	0.11	0.00	0.00
Black Butte	Mar 1997	7	10	0.71	0.29	0.29	0.29
	Jan 2000	7	10	0.57	0.43	0.43	0.14
	Mar 2003	2	2	1.00	0.00	0.00	0.00
Imnaha	Jan 2006	10	18	0.70	0.30	0.10	0.22
	Jan 2000	21	38	0.95	0.38	0.00	0.38
	Mar 2003	5	9	0.80	0.80	0.20	0.80
Lostine	Jan 2006	9	16	0.89	0.44	0.11	0.67
	Jan 1999	15	28	0.93	0.40	0.00	0.00
	Jan 2000	10	20	0.80	0.80	0.00	0.20
	Jan 2001	6	10	0.66	0.50	0.00	0.00
	Feb 2002	10	13	0.90	0.10	0.00	0.00
	Jan 2003	8	9	0.75	0.00	0.25	0.25
	Feb 2004	13	18	0.92	0.31	0.00	0.23
	Jan-Feb 2005	11	12	0.45	0.55	0.00	0.25
Mtn. View	Feb-Mar 2006	5	13	0.80	0.80	0.00	0.00
	Jan 2006	7	10	1.00	0.00	0.00	0.86
Redbird	Mar 1997	9	14	0.67	0.56	0.11	0.33
	Jan 2000	7	9	0.86	0.29	0.00	0.14
	Mar 2003	3	3	1.00	0.00	0.00	0.00
	Jan 2006	5	5	0.20	0.20	0.60	1.00
Sheep Mtn.	Jan 2006	9	16	1.00	0.44	0.22	0.33
Wenaha	Mar 1997	12	15	1.00	0.08	0.08	0.50
	Jan 2000	10	12	1.00	0.10	0.00	0.10
	Mar 2003	5	7	1.00	0.20	0.00	0.60
	Jan-Mar 2006	9	15	0.89	0.11	0.11	0.78
Total (prevalence)		237	362	193(0.81)	76 (0.32)	18 (0.08)	39 (0.22)

Table 4. Annual adult survival in 8 Hells Canyon bighorn sheep populations, 1 June 1997 to 31 May 2006.

Gender Population	Survival ^a									\bar{x}
	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	
Ewes										
Asotin		0.88	0.86	1.00	0.83	1.00	0.83	0.57	1.00	0.87
Big Canyon		1.00	0.93	0.60	1.00	0.91	0.22	1.00	1.00	0.83
Black Butte	0.92	1.00	0.58	0.71	0.80	1.00	0.84	0.75	1.00	0.84
Imnaha	<i>0.80</i>	<i>0.74</i>	<i>0.78</i>	0.85	0.95	1.00	0.73	0.92	0.90	0.85
Lostine	<i>0.81</i>	<i>0.71</i>	<i>0.98</i>	1.00	1.00	0.94	0.93	0.88	0.86	0.90
Muir Creek	^b	1.00	0.87	0.69	1.00	0.50	1.00	0.80	0.71	0.86
Redbird	1.00	1.00	1.00	1.00	0.85	0.91	0.75	1.00	1.00	0.95
Wenaha	0.83	1.00	1.00	0.73	1.00	1.00	0.75	1.00	1.00	0.92
Average	0.87	0.92	0.88	0.81	0.93	0.91	0.76	0.89	0.93	0.88
Rams										
Asotin				<i>0.78</i>	<i>1.00</i>	<i>0.61</i>	0.80	0.75	0.33	0.71
Big Canyon		1.00	1.00	0.80	0.80	0.50	0.67			0.80
Black Butte	<i>0.46</i>	<i>0.99</i>	<i>0.73</i>	1.00	0.80	0.30	0.5			0.68
Imnaha	<i>0.68</i>	<i>0.80</i>	<i>1.00</i>	0.71	1.00	1.00				0.87
Lostine	<i>0.72</i>	<i>0.77</i>	<i>0.87</i>	0.80	1.00	0.75	0.64	0.75	0.67	0.77
Muir Creek		1.00	0.83	0.50	1.00		1.00			0.87
Redbird	<i>1.00</i>	<i>0.66</i>	<i>0.97</i>	1.00	0.80	0.75	0.83	0.60	1.00	0.85
Wenaha	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	0.67	1.00	1.00	0.86	0.86	1.00	0.93
Average	0.77	0.89	0.91	0.78	0.91	0.72	0.83	0.73	0.75	0.82

^a Survival estimated from annual counts in italics. All other survival estimates from radio-collared animals. Population-years with pneumonia-related adult mortality are in bold.

^b Insufficient data.

Table 5. Observed productivity and summer lamb survival in 9 herds in Hells Canyon, 2005.

Herd	No. radio-collared ewes observed with lambs (%)	Percent summer survival ^a
Asotin Creek, Washington	5/7 (71)	60
Big Canyon, Idaho	1/1 (100)	0
Black Butte, Washington	5/6 (83)	40
Imnaha, Oregon	10/10 (50)	50
Lostine, Oregon	12/14 (86)	92
Muir Creek, Oregon	7/7 (100)	0
Myers Creek, Idaho	2/2 (100)	14
Redbird, Idaho	7/11 (64)	0
Saddle Creek, Oregon	2/3 (67)	0
Upper Hells Canyon, Oregon	1/3 (33)	0
Wenaha, Oregon	6/9 (67)	50

^a Survival from birth to 1 October. Herds in bold are those where lambs were recovered with pneumonia.

Table 6. Hells Canyon bighorn sheep herd counts, 2005-2006.

Herd	Survey date(s)	Total				Estimated population
		bighorns	Ewes	Lambs	Rams	
Asotin, WA ^a	3/8/06	63	34	13	16	65
Bear Creek, OR	7/17/05	41	19	14	8	45
Big Canyon, ID ^a	3/11/06	9	9	0	0	15
Black Butte, OR ^a	3/3/06	18	12	1	5	30
Black Butte, WA ^a	3/16/06	31	19	3	9	40
Lostine, OR ^a	2/7-15/06	74	38	22	24	90
Lower Hells Canyon, OR	3/12/06	22	15	3	4	30
Lower Imnaha, OR ^a	3/11/06	162	94	26	42	180
Mountain View, WA ^a	3/15/06	33	16	10	7	35
Muir Creek, OR ^a	1/27-3/11/06	25	19	0	6	30
Myers Creek, ID	1/12-27/06	8	6	1	1	10
Redbird, ID ^a	3/11-12/06	118	80	7	31	130
Saddle Creek, OR	1/7/06	8	5	0	3	10
Sheep Mountain, OR ^a	6/20/06	25	20	1	4	25
Upper Hells Canyon, ID	^b					20
Upper Hells Canyon, OR	4/14/06	18	10	0	8	25
Wenaha, OR/WA ^a	3/13/06	71	35	15	20	90
Total						870
Average						55

^a Populations monitored intensively under the Hells Canyon Initiative.

Table 7. Permits and harvest of bighorn sheep in Hells Canyon through 2005.

State	Herd	Total permits	Total number harvested ^a	2005 Permits	2005 Season
Washington ^b	Black Butte/ Joseph Creek	17	20	0	None
	Mountain View	8	6	0	None
	Wenaha	16	14	0	None
Idaho	Redbird	13	21	2	8/30-10/13
	Upper Hells Canyon	20	11	0	None
Oregon	Black Butte/ Joseph Creek	9	7	0	None
	Bear Creek	7	6	1	9/6-17
	Lostine	79	73	2	9/6-17
	Lower Hells Canyon	3	3	0	None
	Lower Imnaha	100	97	6	9/6-17, 10/18-28
	Sheep Mountain	9	8	0	None
	Wenaha	12	12	0	None
	Total	293	278	11	

^a Number of bighorns harvested includes auction and lottery tags.

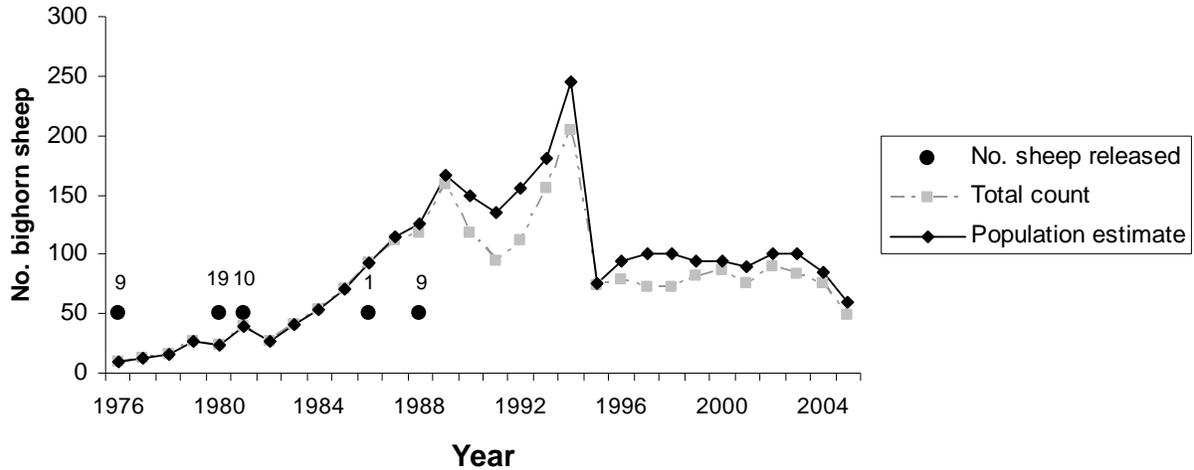
^b No season has been authorized since 1996.

APPENDIX A

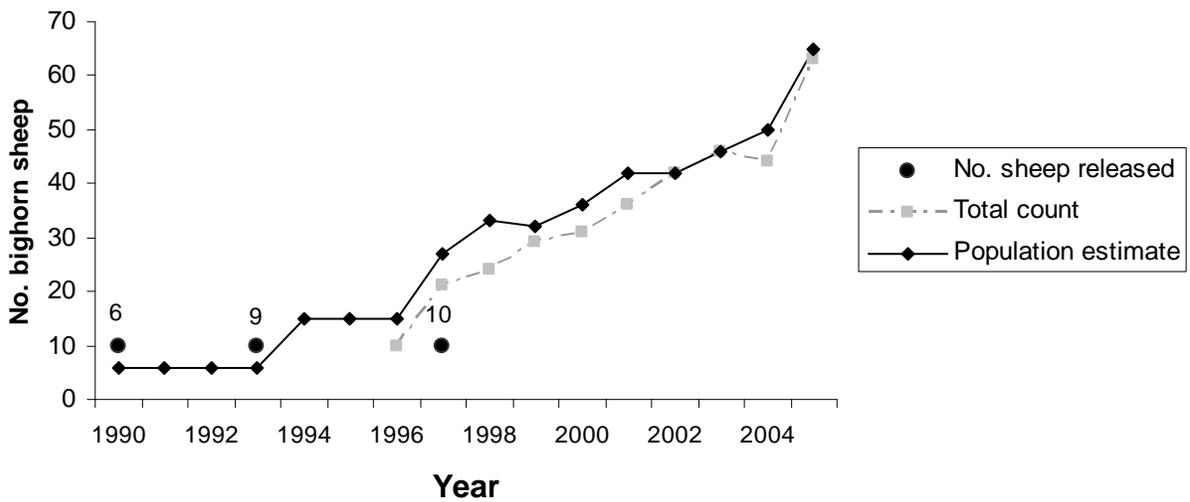
HELLS CANYON BIGHORN SHEEP POPULATION DYNAMICS 1997-2005

Appendix A.

Black Butte, WA - Joseph Cr. OR
Total bighorn sheep released = 39 (in Black Butte)

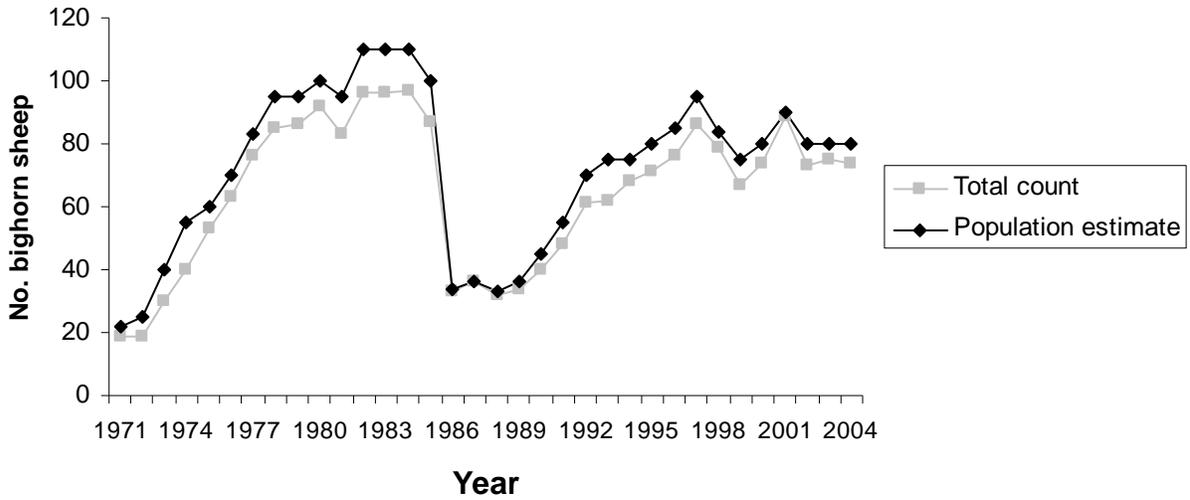


Asotin Creek, WA
Total bighorn sheep released = 25

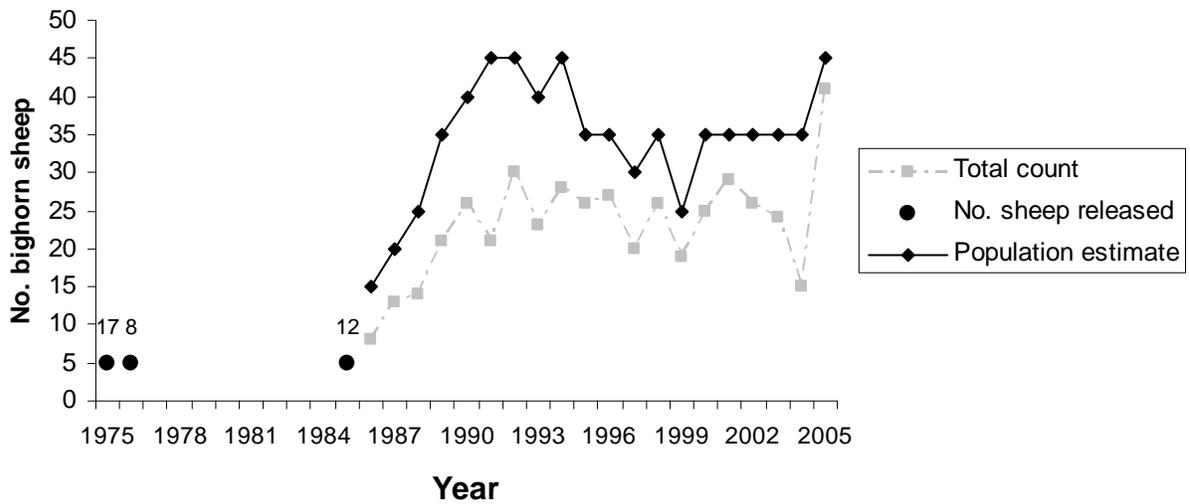


Appendix A. Continued.

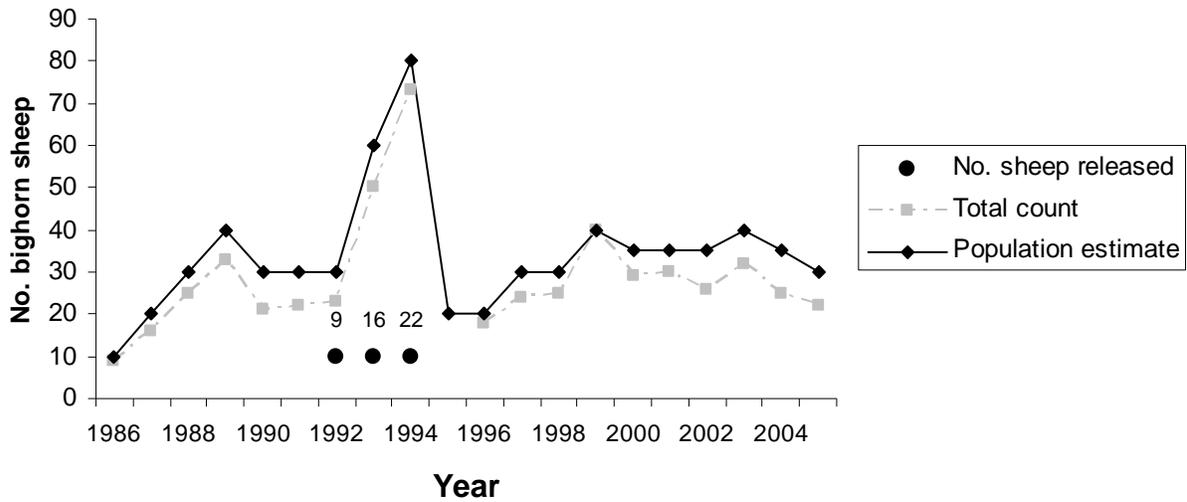
Lostine, OR
Total bighorn sheep released = 20



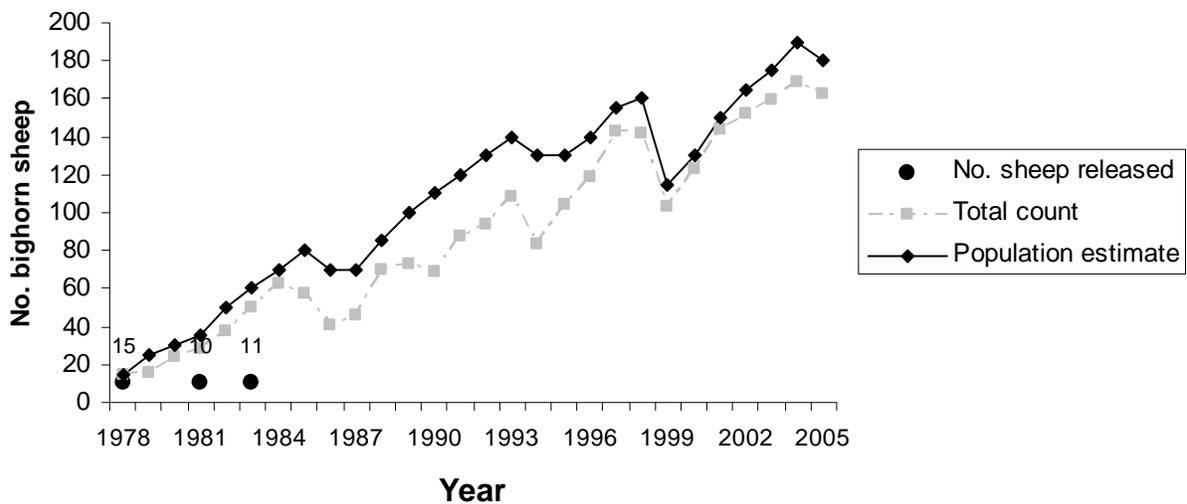
Bear Creek, OR
Total bighorn sheep released = 37



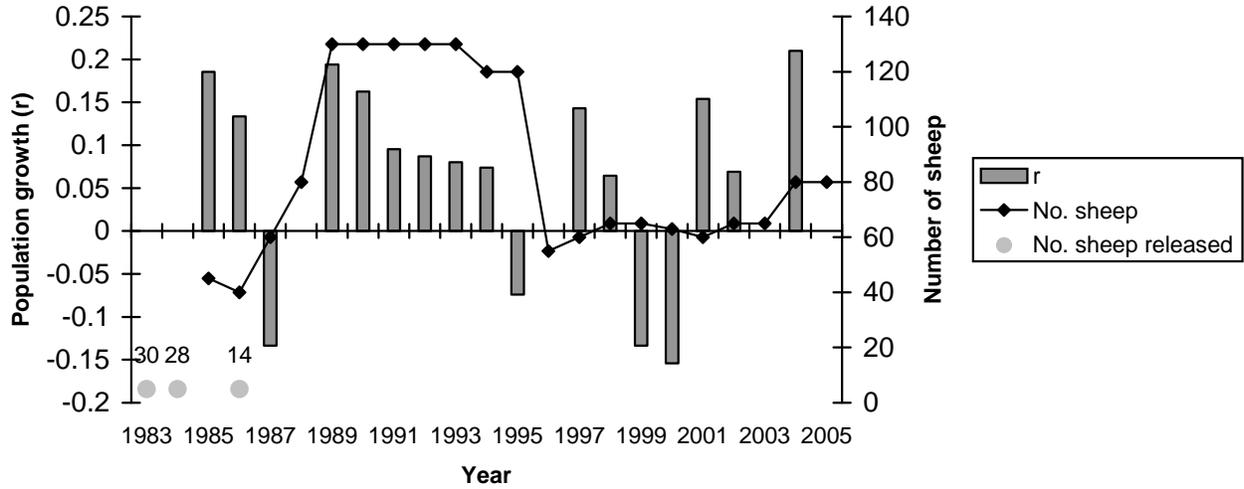
Lower Hells Canyon, OR Total bighorn sheep released = 47



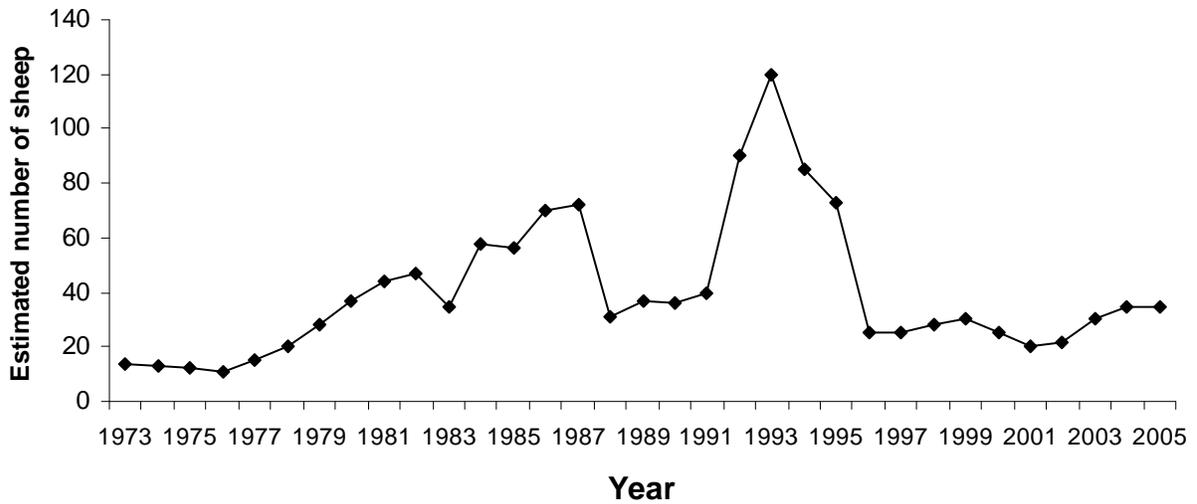
Lower Imnaha, OR Total bighorn sheep released = 36



Wenaha, OR / WA
Total bighorn sheep released = 72

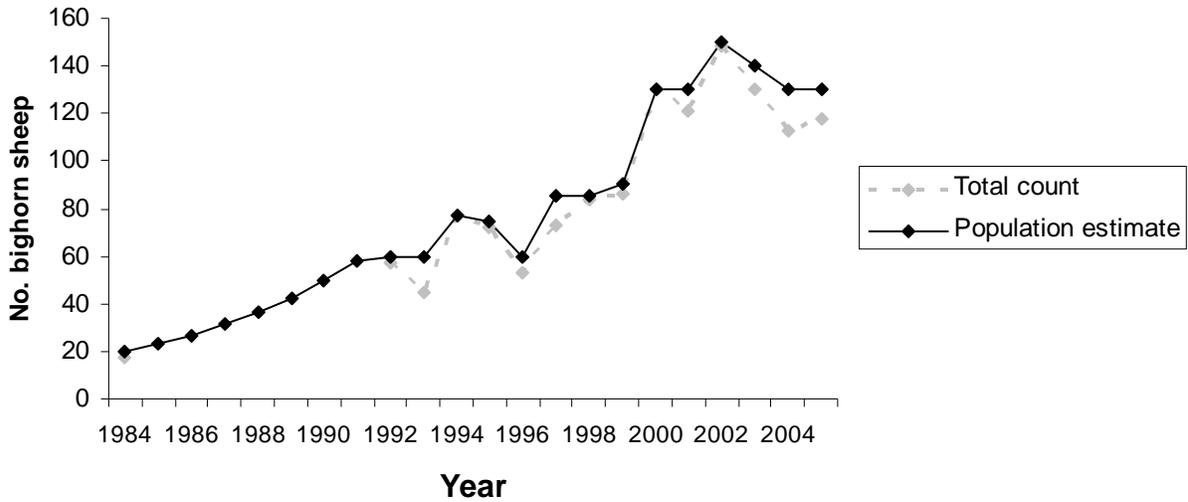


Lost Prairie/Cottonwood/Mountain View, WA/OR
Total bighorn sheep released = 4 (in Asotin Creek)



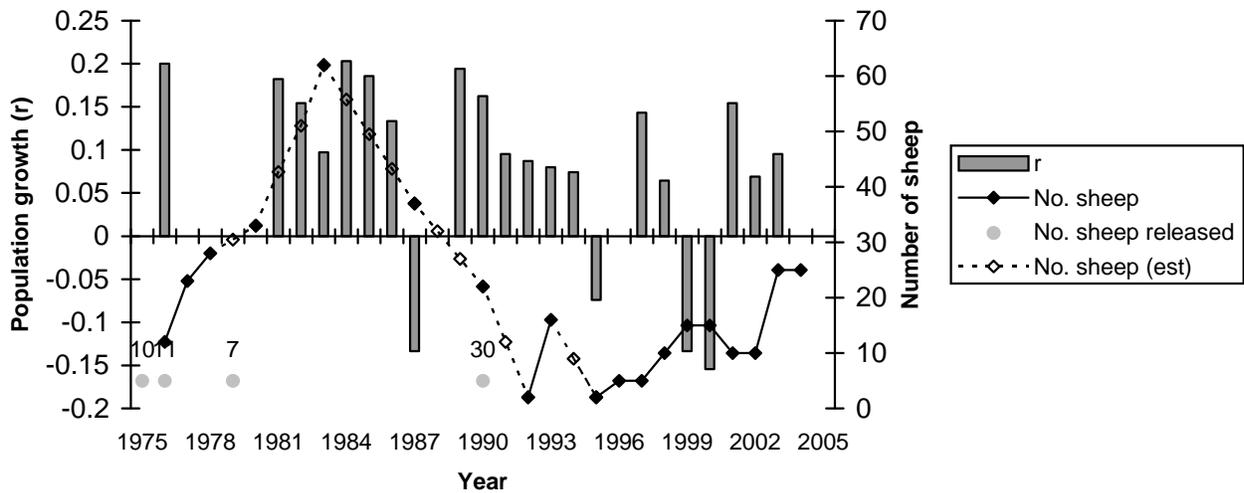
Redbird, ID

Total bighorn sheep released = 17

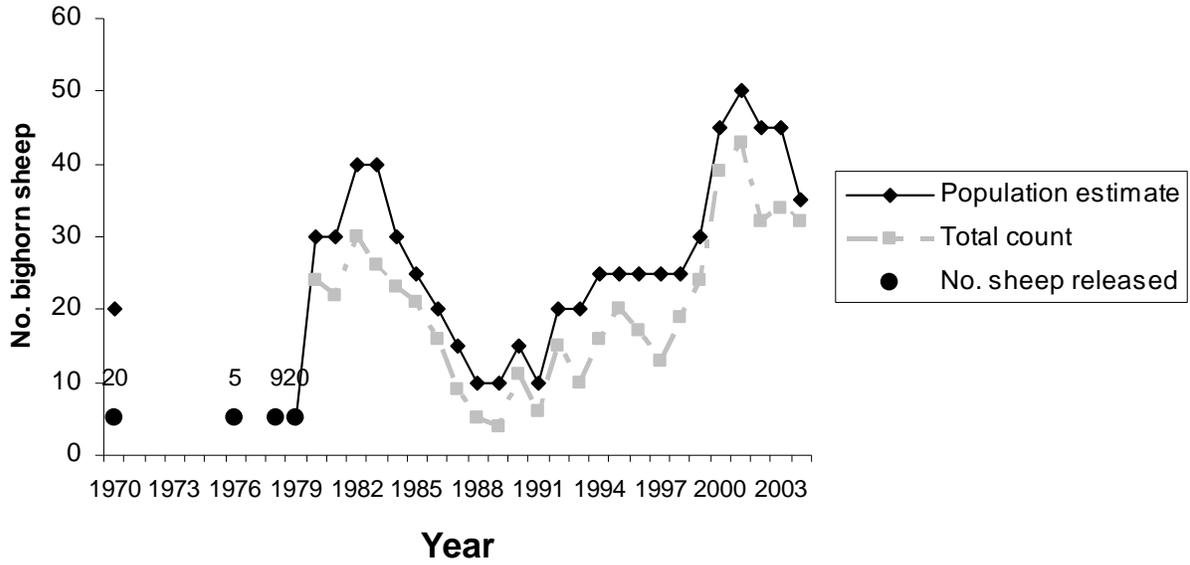


Upper Hells Canyon, ID

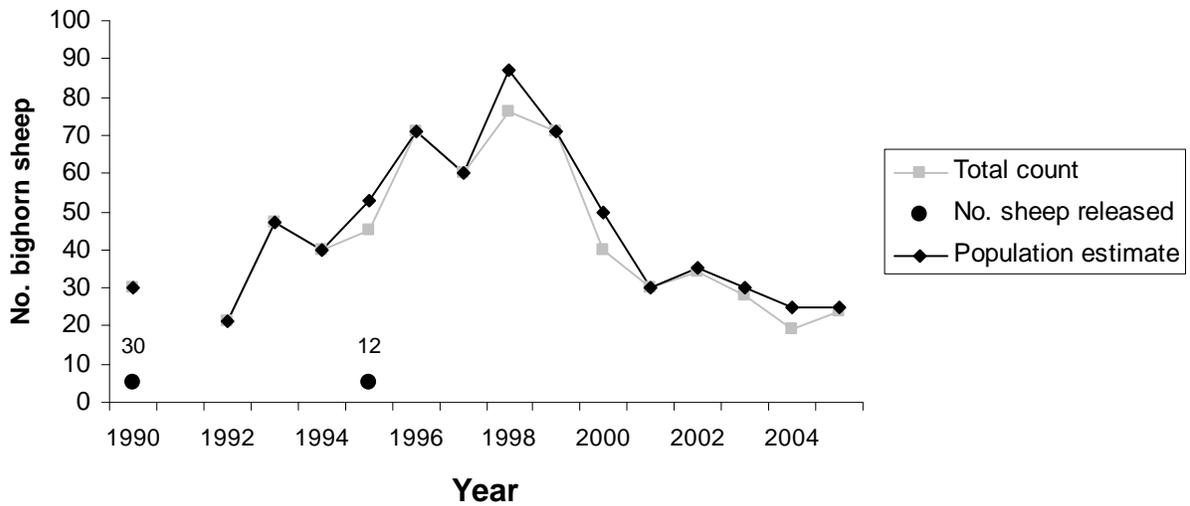
Total bighorn sheep released = 58



Upper Hells Canyon, OR Total bighorn sheep released = 54

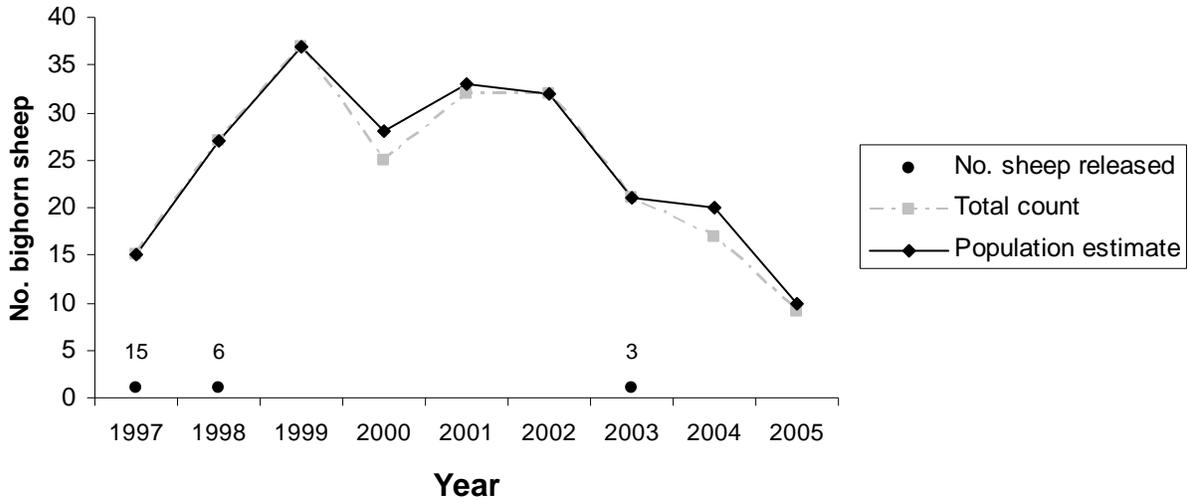


Sheep Mountain, OR Total bighorn sheep released = 42



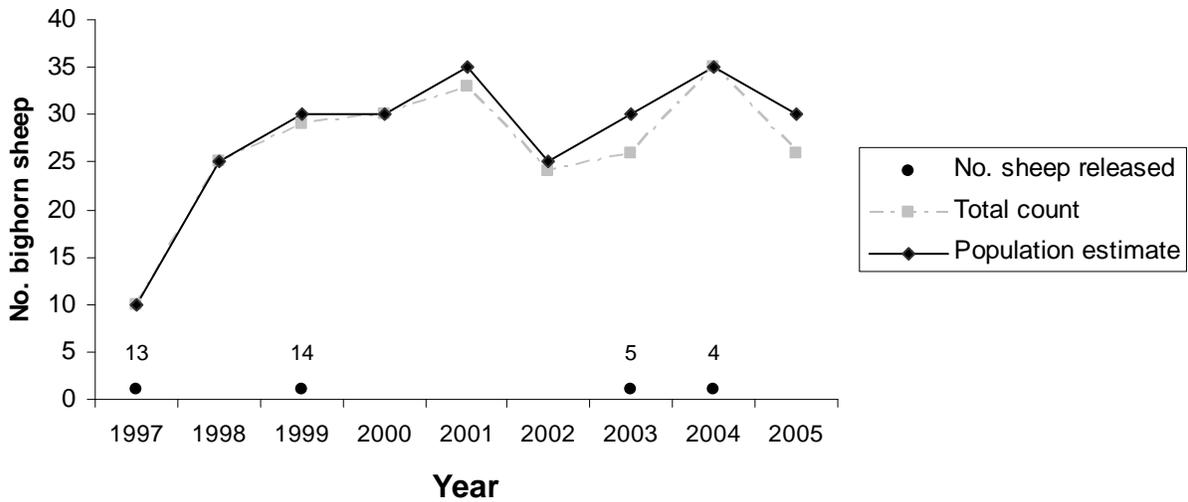
Big Canyon, ID

Total bighorn sheep released = 24



Muir Creek, OR

Total bighorn sheep released = 36



Submitted by:

Frances Cassiren

Wildlife Research Biologist

Approved by:

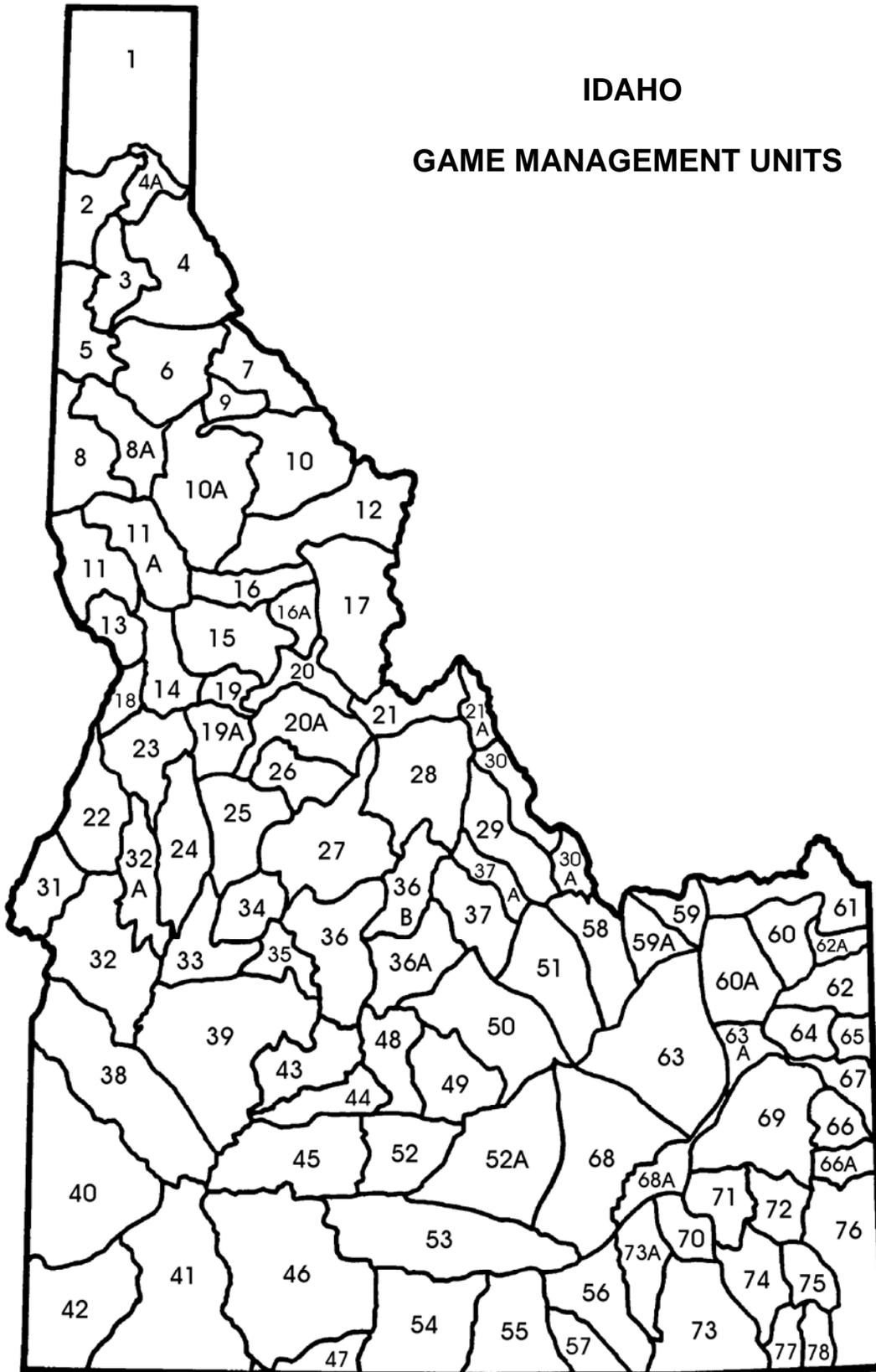
IDAHO DEPARTMENT OF FISH AND GAME

Dale E. Toweill
Wildlife Program Coordinator
Federal Aid Coordinator

James W. Unsworth, Chief
Bureau of Wildlife

IDAHO

GAME MANAGEMENT UNITS



FEDERAL AID IN WILDLIFE RESTORATION

The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sale of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program then allots the funds back to states through a formula based on each state's geographic area and the number of paid hunting license holders in the state. The Idaho Department of Fish and Game uses the funds to help restore, conserve, manage, and enhance wild birds and mammals for the public benefit. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes necessary to be responsible, ethical hunters. Seventy-five percent of the funds for this project are from Federal Aid. The other 25% comes from license-generated funds.

