

# Reproductive management of Rocky Mountain elk (*Cervus canadensis nelsoni*)

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## Abstract

Of the six subspecies of elk known to have inhabited North America in historical times, four remain, including the Roosevelt's (*C. canadensis roosevelti*), tule (*C. canadensis nannodes*), Manitoban (*C. canadensis manitobensis*) and Rocky Mountain elk (*C. canadensis nelsoni*). Rocky Mountain elk (*Cervus canadensis nelsoni*) are a subspecies of elk found in the Rocky Mountains and adjacent ranges of Western North America. Assisted reproductive technologies described in elk include estrous synchronization, artificial insemination, embryo transfer and in-vitro fertilization. Semen cryopreservation has also been described and semen sales are a large portion of the economic mainstay of elk farmers. Studies on fertility of sex-sorted elk semen are limited but most reviews note the resilience of wapitoid spermatozoa to pass through the sorting process and maintain fertility. Given that profit in this industry is driven by velvet sales and the hunting market, both exclusive to males, the use of sex-sorted semen in the elk industry is increasing each year.

**Key words:** wapiti, Rocky Mountain elk, theriogenology, artificial insemination

## Introduction

Until recently, red deer and elk were considered to be one species, *Cervus elaphus*, with over a dozen subspecies.<sup>2,20</sup> Mitochondrial DNA studies conducted in 2004 on hundreds of samples from red deer and elk subspecies and other species of the *Cervus* deer family, strongly indicate that elk are a distinct species, namely *Cervus canadensis*. DNA evidence validates that elk are more closely related to Thorold's deer and even sika deer than they are to the red deer.<sup>7,16</sup>

The Rocky Mountain elk (*Cervus canadensis nelsoni*), also known as wapiti (a term that originates from the Shawnee and Cree word 'waapiti', meaning 'white rump'), is one of the largest species within the *Cervidae* family. Nomenclature applied in the cattle industry is also acceptable in the elk farming industry. Namely, the terms bull, cow and calf are utilized. The terms stag and hind are encountered in some literature when referring to male and female cervids respectively.<sup>13</sup>

Similar to other livestock enterprises, elk farming has increased in the past decade. There are over 1000 elk farms located across North America.

Elk convert forage efficiently into protein, and with proper management they can be raised on marginal land.<sup>8</sup> Elk also fit well into an existing grazing operation. Another advantage is the high ratio of lean meat produced per pound of live weight. The labor requirements for elk production are minimal, while the profit potential can be much greater than that of a comparable beef cow-calf operation.<sup>13</sup>

A recent move toward a more intense production of elk, using traditional agricultural methods, requires intensified management and enhanced understanding of reproductive technologies. The application of artificial insemination is becoming

more widely used in the North American elk farming industry. A review of both female and male reproduction will be presented as a guide for practicing veterinarians to understand and address the peculiarities of this species.

## Female reproductive management

Body condition scoring of cows pre-breeding is significantly associated with conception rate, conception date, and weight of weaned offspring, while body condition scoring during pregnancy is associated with dystocia and ability of the cow to rear a calf to weaning.<sup>1,8,21,24,26</sup>

The female reproductive tract in wapiti is similar to that of cattle and sheep.<sup>17,18,19,21,22</sup> In non-pregnant females, the entire reproductive tract is contained within the pelvic cavity.<sup>7</sup> The ovaries are small measuring 15 × 5 × 8 mm.<sup>7,13</sup>

The uterus is bicornuate with ventrally curled horns, which are 5-8 cm in length in the nulliparus cow. The body of the uterus is short, about 3 cm long. There are 3-7 caruncles on the mesometrial side of each horn. The cervix is 10-15 cm long and narrow, especially in the nulliparus cow (1.5 cm in diameter), and contains 4-6 cervical rings. The vagina is approximately 20 cm long.<sup>7</sup>

## Estrous cycle

Elk, like most cervids, are short-day breeders and are seasonally polyestrous, with an estrous cycle length of approximately 21 days.<sup>1,2,3,17,18,19</sup> Estrous synchronization protocols involve the use of a bovine controlled intravaginal drug-releasing device (CIDR), that delivers a continuous concentration of progesterone, and pregnant mare serum gonadotropin (PMSG) at the time of CIDR withdrawal.<sup>7</sup> The CIDR device is inserted for 12-14 days.<sup>7</sup> It has become routine to administer 200-250 IU of pregnant mare serum gonadotropin (PMSG) at the time of CIDR withdrawal.<sup>7,9,10,13</sup> Pregnancy rates in wapiti averaging around 70% have been reported with this protocol.<sup>6</sup>

Alternative protocols use a synthetic gonadotropin-releasing hormone (GnRH) analog or a combination of PMSG and human chorionic gonadotropin at the time of CIDR removal.<sup>10,25</sup>

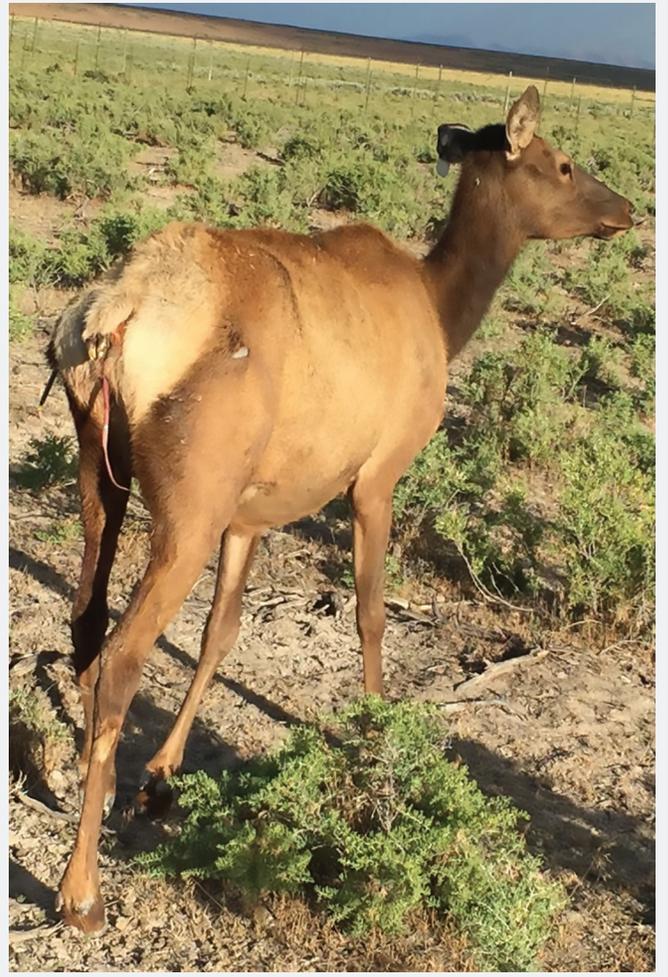
## Timed artificial insemination

Timed artificial insemination of cows is performed 60-66 hours after device removal.<sup>6,7</sup> A rectal-transcervical method (similar to that in cattle) is performed in this species. To avoid the possibility of entering the urethral opening on the floor of the vagina, the insemination gun should be inserted into the vulva upward at a 30°-40° angle with the hand placed transrectally, place the cervix onto the insemination rod (Figure 1). Maintain slight forward pressure on the gun while manipulating the cervix slightly ahead of the tip of the instrument. The target for semen deposition, the uterine body, is quite small. Accurate instrument tip placement is among the most important skills involved in the whole artificial insemination technique. Most producers introduce a backup bull 10-14 days after artificial insemination.<sup>17</sup>

**Figure 1:** The insemination gun should be inserted into the vulva upward at a 30°-40° angle.



**Figure 2:** Dystocia in a cow. Calf has a posterior, dorsosacral presentation.



Pregnancy can be confirmed by blood testing (Pregnancy Specific Protein B) after day 40 or by ultrasonography at 40-45 days of gestation. When in question, the parentage of the calves is determined by DNA analysis.

### Gestation length and parturition

The gestation length in this species is 247±5 days.<sup>12</sup> A gestational table is provided to facilitate breeding management (Table 1).

Parturition in elk is similar to that seen in other domestic and wild ruminants.<sup>3</sup> The three-stage process occurs over periods of 1-3 hours. Cows will often separate themselves from the herd, similar to other ruminants, in preparation for calving. Cows will fence pace in an apparent attempt to find a more suitable location for calving or to get away from pen mates.

**Twinning in elk is uncommon.** Three sets of twins and one set of triplets gave a multiple birth ratio of 1 in 271 calvings in a Canadian survey of wapiti.<sup>8</sup> Dystocias are uncommon in elk but do occasionally occur.<sup>15</sup> Data show dystocia rates on commercial elk farms to average less than 1% (Lawrence and Thorne). Malpresentations in elk are the same as those described in sheep and goats (Figure 2). As with other cervids and small ruminants, manual correction of the malpresentation can be accomplished easily by a skilled veterinarian.

**Placentophagia is common.** It has been suggested that this a predatory defense mechanism. It has also been suggested, based on research in rats, that the placenta contains opioid-enhancing factor and that ingestion enhances opiate analgesia.<sup>3,14</sup>

## Male reproductive management

### Rut physiology

The calling sound made by rutting males is known as bugling. This distinctive sound begins deep and resonant, and becomes a high-pitched squeal before ending in a succession of grunts. It occurs whether or not they are placed with cows.<sup>23</sup>

The behavior of bulls changes abruptly once antler velvet is shed and antlers become fully calcified. During the rut, the scrotal circumference increases markedly. A three-fold increase in size between early summer and autumn has been observed.<sup>11</sup> The behaviors at this time include aggressive antler rubbing, wallowing, bugling, preputial palpitation with or without urine spraying (known as thrashing urination), and sparring with other males.<sup>23</sup> It is important to note that this aggressive behavior can be directed towards humans. Even the most docile of bulls cannot be trusted during the rut.

Similar to the ram effect described in sheep, a “stag effect” can be achieved by early introduction of a bull prior to the breeding season. This will hasten the median conception dates by 8-10 days. The sight, sound and smell of the bull all serve to stimulate reproductive activity in the females. To achieve the maximum benefit of the “stag effect,” it is advisable to introduce a breeding

**Table 1:** A gestational table based on a 247-day gestation in elk. (Note that reported gestation in this species is 247 +/-5 days)

Elk Breeding/Calving Date (247 Day Gestation)			
Breeding Date	Calving Date		
	1		6
	2		7
	3	M	8
	4	A	9
	5	Y	10
	6		11
	6		12
S	7		13
E	8		14
P	9		15
T	10		16
E	11		17
M	12		18
B	13		19
E	14		20
R	15		21
	16		22
	17		23
	18		24
	19		25
	20		26
	21		27
	22		28
	23		29
	24		30
	25		31
	26		1
	27		2
	28	J	3
	29	U	4
	30	N	5
O	1	E	6
C	2		6
T	3		7

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bull 2-3 weeks before the expected date of breeding. In the Northern Hemisphere, this is best accomplished by introduction of the bull in late August or early September.<sup>25</sup>

A single bull may cover a maximum of 35 or 40 cows.<sup>2,5</sup> It is common for producers to group bulls with less than 10 hinds, although no data are available to justify this practice.

### Semen collection and cryopreservation

The use of an artificial vagina and teaser cow have been described for semen collection in elk. However, the use of an electroejaculator in a restrained or sedated bull has also proven to be a more reliable and common method of collection using a standard ram probe or a small bovine probe.

Semen cryopreservation is similar to what has been described in other ruminants. Commonly used sugar-based tris and/or citrate-buffered extenders developed for small ruminants may be used on elk semen.<sup>4</sup> Some of these commercially available extenders contain egg yolk and glycerol as a cryoprotectant.<sup>13,15</sup> The author's preference is to use commercial ovine extenders for semen cryopreservation in his species.

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