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Reproduction and Health of a Beaver (*Castor canadensis*) Population in Prince William County, Virginia

Timothy R. Brophy and Carl H. Ernst

Abstract.-Reproduction and health were studied in a beaver (*Castor canadensis*) population from Prince William County, Virginia during 1998. Copulating beavers were observed in Quantico Creek at Prince William Forest Park on 22 January. Seven females from Quantico Marine Base were trapped between January and May, sacrificed, and dissected. Those reproductively active weighed over 39 pounds (17.7 kg) and were trapped before 1 March. Mean litter size based on counts of corpora lutea was 4.80 young (3-7); however, litter size based on the number of embryos present was only 2.75 (1-3), comparable to most others reported in the literature. Five of the seven dissected females had prime pelts, one an average pelt, and one a poor quality pelt. Subcutaneous fat deposits and those at the base of the tail were moderate to high in all females. Four contained moderate mesenteric deposits, while three had low to no mesenteric fat present. No abnormalities were found in the heart, lungs, liver, kidneys, or bladder. Four females had suffered wounds to either the tail and/or body, possibly from male courtship. The females harbored two of the most common beaver helminths: the stomach nematode, *Travassosius americanus* (100% incidence) and the cecal trematode, *Stichorchis subtriquetrus* (86% incidence). Compared to other reported studies, these worm burdens were moderate to average.

Introduction

With the development of the fur trade in the eighteenth and nineteenth centuries, the beaver (*Castor canadensis*) became the most widely and intensively sought natural resource in North America. Beaver pelts were so sought after that eastern populations were severely decimated and almost extinct in the mid-Atlantic region by 1900. The beaver was extirpated in Virginia by 1911 (Hill 1976), and those in northern Virginia also disappeared during this period (Handley 1991). In the early 1950s, Virginia's Commission of Game and Inland Fisheries reintroduced *C. c. canadensis* into northern Virginia where it exists today. Since its reintroduction, it has invaded new waterways and increased in numbers to the point of often being a destructive nuisance (Davis 1992).

Despite their impressive comeback in northern Virginia, little is known about current beaver populations other than scattered anecdotal information. As part of an intensive population study (Ernst and Brophy 1998) at Prince William Forest Park and Quantico Marine Base (Prince William County, Virginia), reproduction and health were assessed.

Methods and Materials

Beavers were trapped at Quantico Marine Base as part of an ongoing beaver management plan. Traps used were 330 Conibears set in natural or fabricated channels leading to a scent mound. Seven female beavers were captured between 23 January and 26 April 1998, weighed in the field, and immediately brought to the laboratory at George Mason University

Upon arrival, beavers were dissected to determine their reproductive status. Dates of individual dissections were recorded to correlate embryonic development throughout the season. The female reproductive tract was removed above mid-vagina and the uterus was incised to allow examination for embryos. The number of corpora lutea on each ovary and the number of embryos in each uterine horn were recorded from the fresh reproductive tracts. Embryos present were measured with a metric ruler to the nearest 0.5 mm. Additional reproductive data were based on field observations by the authors and their trapper.

The same dissected females were examined to determine health status. The amount of subcutaneous and mesenteric fat deposition (high, moderate, low) was noted, as was the amount of deposited tail fat. Condition of the pelt (prime, average, poor) was also recorded and any wounds on the body or tail noted. In addition, the digestive tract was excised from the lower esophagus to the rectum. A lengthwise incision was made along the entire tract and the stomach, intestines, and cecum were examined macroscopically for parasitic helminths. The heart, lungs, liver, kidneys, and bladder were also dissected and examined for parasitic worms. The site and number of any worms present were noted. Worms were fixed in 40% neutral formalin and transferred to 70% ethanol after 48 hours for preservation and future identification.

Results and Discussion

Reproduction

Copulating beavers were observed in Quantico Creek at Prince William Forest Park on 22 January 1998 (Andrew Angelacci, pers. comm.). In North America, *C. canadensis* experiences one reproductive cycle per year. Mating usually takes place in the winter, normally in January or February, but sometimes occurs as early as December (Bergerud and Miller 1997, Hodgdon and Hunt 1953).

Reproductive data for the seven dissected females are presented in Table 1. The earliest collection date of a pregnant female during the current study was 25 January 1998, indicating a December or early January mating. The last pregnant female was trapped on 1 March 1998. No lactating females were captured. The seven dissected females averaged 18.2 kg (40.1 lbs.) and ranged from 8.2-25.9 kg (18-57 lbs.). Those over 17.7 kg (39 lbs.) were reproductively active. Yearling females trapped on 1 March (8.2 kg, 18 lbs) and 26 April (9.5 kg, 21 lbs.) showed no signs of reproductive activity. This is not surprising, as both sexes of beaver become sexually active at about 1.5-2.0 years of age (Brenner 1964, Henry and Bookhout 1969, Larson 1967).

Table 1. Reproductive data for seven female beavers collected at Quantico Marine Base, Virginia.

Collection Date	Weight (lbs.)	Corpora Lutea	Embryos	Embryo Length
1/23/98	53	1L:4R	0	N/A
1/25/98	57	2L:3R	2L:1R	1-2 mm
2/10/98	51	1L:3R	1L:0R	1-2 mm
2/15/98	42	1L:2R	1L:2R	3.5-4 mm
3/1/98	39	3L:4R	3L:1R	6-7 mm
3/1/98	18	0	0	N/A
4/26/98	21	0	0	N/A

Mean litter size in this study, based on the number of corpora lutea present on the ovaries of five adult females, was 4.80 (3-7). The right ovary was more active in these females, ovulating 16 eggs compared to only eight by the left ovary. Mean litter size, based on embryos present in four of the adult females, was only 2.75 (1-3). An adult female collected 23 January 1998 had five corpora lutea but no embryos. It is possible that she had not yet mated, or that the eggs had only just been fertilized and were not detected during macroscopic examination of her oviducts.

Based on numbers of corpora lutea, placental scars, or embryos, most North American beaver populations have mean litter sizes of 3-4, and a range of 1-9 young (Bradt 1938, Brenner 1964, Grasse and Putnam 1950, Hay 1957, Henry and Bookhout 1969, Hodgdon 1949, Leege and Williams 1967, Miller 1948, Osborn 1953, Payne 1984, Wigley et al. 1983). Litter size is positively correlated with female body weight (Pearson 1960), but does not necessarily increase with age. It is probably more correlated with the quality and quantity of winter food supplies and severity of the winter weather (Jenkins and Busher 1979).

Mean fertility rate (total # embryos/total # corpora lutea) for females with embryos was 60.54% (25-100). Although 12 corpora lutea were present on the right ovaries, the right uterine horns contained only four embryos (33% fertility rate). The left ovaries, however, had seven corpora lutea and the left uterine horns had seven embryos (100% fertility rate).

Embryo length ranged from 1-2 mm in late January to 6-7 mm in early March. This roughly translates to an embryonic growth rate of 5mm/month during the early stages of development. The gestation period at Quantico Marine Base is most likely 120 days, with parturition in mid- to late May (Bradt 1939, Grasse and Putnam 1950).

Health

Health data for the seven dissected females are presented in Table 2. Five of the seven dissected females had prime pelts, one an average pelt, and one a poor quality pelt with several wounds. Quantity of subcutaneous fat was moderate to high in all specimens. Four females contained moderate mesenteric fat deposits, while three had low to no mesenteric fat. Fat deposits at the base of the tail were moderate to high in all seven females. Overall, fat reserves were judged to be moderate to high. Four females had suffered wounds on the body and/or tail, possibly from amorous males.

Table 2. Health data for seven female beavers collected at Quantico Marine Base, Virginia.

Collection Date	Weight (lbs.)	Pelt Condition	Tail Damage	Fat Reserves	Nematodes	Trematodes
1/23/98	53	Average	Yes	Moderate-High	19	24
1/25/98	57	Prime	No	Moderate-High	27	0
2/10/98	51	Prime	Yes	Low-Moderate	1	46
2/15/98	42	Prime	No	Moderate-High	112	26
3/1/98	39	Prime	Yes	Moderate-High	31	16
3/1/98	18	Prime	No	Moderate-High	76	36
4/26/98	21	Poor	Yes	Moderate	354	19

The beavers harbored two species of helminths, the stomach nematode, *Travassosius americanus* (Chapin 1925), and the cecal trematode, *Stichorchis subtriquetrus* (Chapin 1925). Both are common, widespread parasites of beavers (Babero 1953, Bennet and Humes 1939, Brenner 1970, Erickson 1944). No helminths were found in the heart, lungs, liver, kidneys, or bladder.

Travassosius americanus was found in 100% of the females examined. Host incidence of this stomach nematode is often high. Erickson (1944) reported that 124 of 140 (88.6%) Minnesota beavers

harbored this worm, and Babero (1953) found it in 34 of 56 (60.7%) Alaskan beavers. The Quantico beavers averaged 88.6 (1-354; S.D. 122.9) *T. americanus* per individual. All but one of these (found in duodenum) were found in the stomach. Erickson (1944) reported an average of 142 *T. americanus* per beaver in Minnesota with a maximum of 1197, and Babero (1953) also found infestations of over 1,000 worms in Alaskan beavers. The maximum number of stomach nematodes in Pennsylvania beavers was 225 (Brenner 1970).

Stichorchis subtriquetrus was found in all but one (86%) of the Quantico females. Quantico beavers averaged 23.9 (0-46; S.D. 14.7) trematodes per individual. All of these were found in the cecum. Erickson (1944) recovered cecal trematodes from 110 of 140 (78.6%) Minnesota beavers, but Babero (1953) found the worm in only eight of 56 (14.0%) Alaskan beavers. Brenner (1970) reported a maximum of 65 cecal trematodes from Pennsylvania beavers.

The beaver population at Quantico Marine Base is reproductively similar to healthy populations throughout North America, and despite their moderate worm burden, Quantico beavers appear to be of average to above average health. Given these factors, beaver populations should continue to thrive in northern Virginia as long as suitable habitat is available.

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