MOOSE CRATERING FOR *EQUISETUM* IN EARLY WINTER

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ABSTRACT: Moose (*Alces alces*) near Thunder Bay, Ontario cratered through 35-51 cm of snow to consume *Equisetum fluviatile* in January 1991. Laboratory analysis showed that sodium concentrations were 20-40 times higher than in nearby browsable twigs. This behaviour may extend the length of time sodium may be obtained from emergent aquatic vegetation.

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Moose use of horsetail (*Equisetum* spp.) as a spring or summer food is well documented on Isle Royale, Michigan (Murie 1934, Jordan *et al.* 1973, Aho 1978), British Columbia (Ritcey and Verbeek 1969), Ontario (Peterson 1955, De Vos 1958, Fraser *et al.* 1980, 1982, 1984), Sweden (Cederlund *et al.* 1980, Faber *et al.* 1988) and the USSR (Kalitskii 1965, Timofeeva 1965). Autumn usage of *Equisetum* spp. has also been observed in Alaska (Coady 1973). The principal species for which use has been confirmed in North America is swamp horsetail *E. fluviatile*. Belovsky and Jordan (1978) estimated 25 percent of aquatic intake by Isle Royale moose consisted of spike rush (*Eleocharis* spp.) and *E. fluviatile*.

Winter foraging by moose for *E. hiemale* was observed in the Buzuluksk forest in the U.S.S.R. (Knorre 1959) but similar behaviour has not been documented in North America. However, bison(*Bison bison*) have been observed to forage for this species in March on the Peace-Athabaska delta (Telfer, Pers. comm. 1991) and white-tailed deer (*Odocoileus virginianus*) were observed feeding on *Equisetum* spp. above the snow during January-March in North Central Minnesota (Karns, Pers. comm. 1991). We observed evidence of extensive foraging for *E. fluviatile* by moose during early winter. Foraging behaviour consisted of pawing through moderate depths of snow (cratering) to expose and consume *E. fluviatile*.

METHODS

In early January 1991, the authors, while flying routine early winter moose surveys for the Ontario Ministry of Natural Resources, spotted unusual feeding behaviour by moose. Evidence of this behaviour consisted of massive track aggregations with extensive cratering (Fig. 1) on the floodplain surrounding an artificially regulated wetland along the Mattawin River (48° 28'N, 90° 02'W). This area is located approximately 50km NW of Thunder Bay Ontario.

Along a 3 km stretch of frozen river, six large and six small moose track aggregations with cratering were observed and mapped from the air January 5, 1991. A ground inspection took place January 6, 1991. Eleven days had passed since the last snowfall of 2.5cm or greater. Snow depth was measured (Fig. 2) as was the length and width of 34 typical craters. One of the larger aggregations of tracks and craters was examined to estimate the total number of craters within the aggregation. Pellet samples were collected from 12 pellet groups found among the cratering locations. These pellet samples were taken to the laboratory,soaked in tapwater, dissected and the contents compared with samples of *Equisetum* collected at the site.

Samples of *Equisetum* were collected for identification and nutrient analysis. In addition, twigs were clipped from trembling aspen (*Populus tremuloides*), white birch (*Betula papyrifera*), red osier dogwood (*Cornus stolonifera)*, willow (*Salix* spp.), and speck-

Fig. 1. Small track aggregation with cratering on an artificially controlled wetland along the Mattawin River northwest of Thunder Bay, Ontario. Moose were forging for *Equisetum fluviatile*.

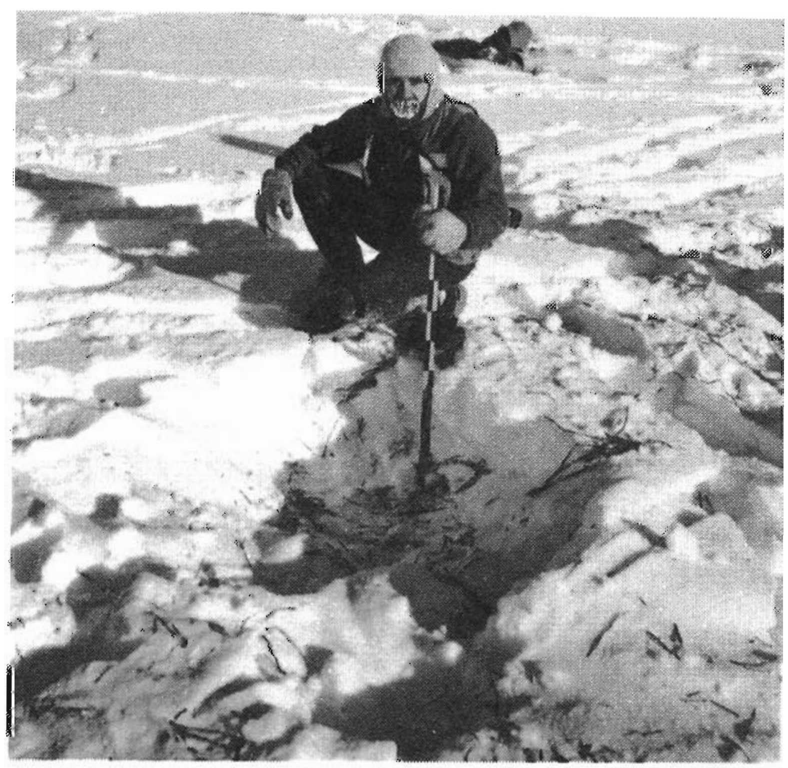

Fig. 2. Snow depth was measured at 34 typical cratering locations.

led alder (*Alnus rugosa*) shrubs on the adjacent shoreline, for laboratory analysis of crude protein (Kjeldahl), sodium content (atomic absorbtion), and neutral detergent fibre by Agri-food Laboratories, Guelph, Ontario.

RESULTS AND DISCUSSION

The craters appeared to have been constructed in the snow by moose pawing down to the frozen surface of the underlying ice. The shape, and evidence of plant material and snow being thrown from the craters indicated that the excavations were made primarily with the hooves, although they may also have used their muzzles. At the bottom of all craters were frozen emergent aquatic plants, predominantly *E. fluviatile* (Fig. 3). Occasionally some other marsh plants such as grasses or sedges were observed, but these were infrequent. Depth of snow at all cratering locations ranged from 35 - 51 cm with a mean snow depth to frozen substrate of 42 cm (*n*=26). Crater width varied from 45 - 180 cm with a mean width of 118 cm (*n*=34). Crater length varied from 110 - 800 cm with mean length of 226 cm (*n*=34). Uncrusted snow depths did not appear to hinder free movement and were considered low according to Peterson and Allen (1974).

The size of one of the larger track and crater aggregations was estimated to be an egg-shaped oval approximating 60-80 m wide and 360 m long. Within this area, the estimated number of craters, based on 3 full length transect counts, was approximately 0.8-1.6 per 10 m^2 for a total estimate of approximately 1720-3450 craters. Evidence from the size and quantity of tracks and fecal pellet groups suggested the cratering had been done by approximately 6 animals. Four moose were seen on the river near one of the cratering locations on January 4, 1991.

Moose consumption of *Equisetum* was confirmed when traces of *Equisetum* were

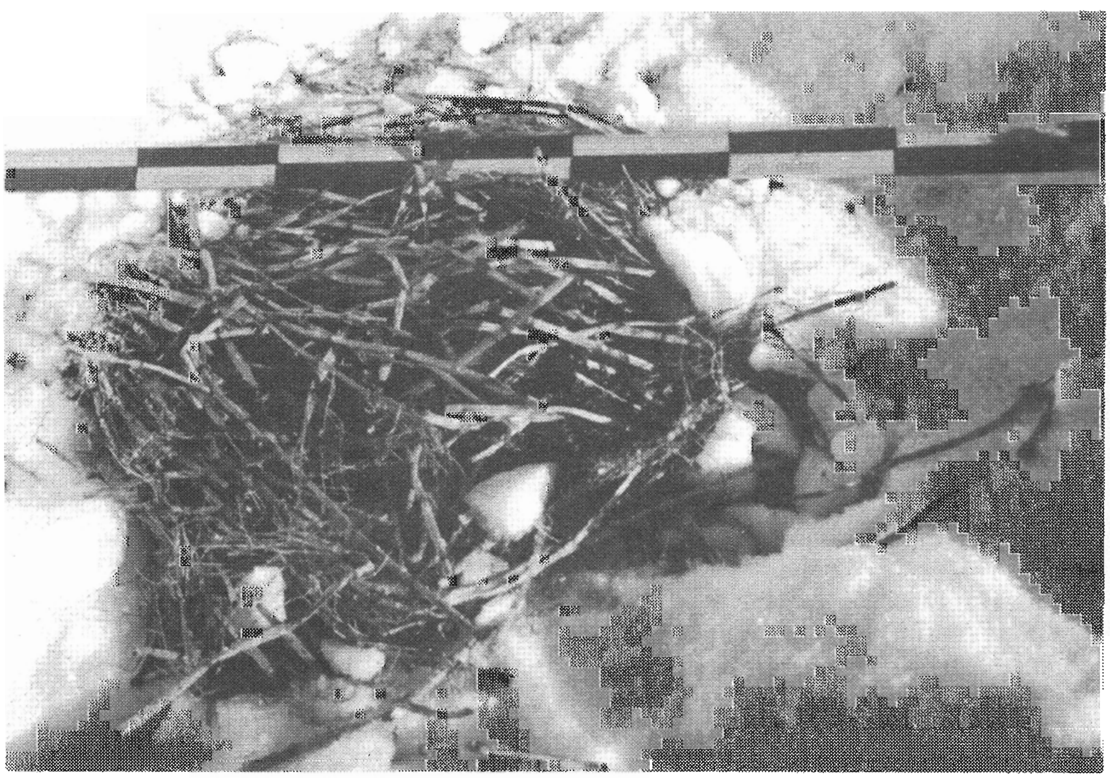

Fig. 3. *Equisetum fluviatile* was found at the bottom of most of the feeding craters.

positively identified in the fecal pellet samples collected from the study site. The analysis of crude protein and sodium suggests that the moose were seeking sodium (Table 1), as they do during their summer aquatic feeding behaviour (Fraser *et al.* 1982, 1984; Jordan 1987). The concentrations of sodium in the *E. fluviatile* were 18-41 times higher than the levels of sodium in the browse located along the frozen shoreline. The sodium levels observed were similar to those reported from spring/summer samples elsewhere; 1574 ppm (Jordan *et al.* 1973) and 450-2175 ppm (Faber *et al.* 1988).

Table 1. Crude protein, sodium, and neutral detergent fibre content of *Equisetum fluviatile*, four preferred moose browse species and one non-browse species (*A. rugosa*) collected 6 January 1991 from the Mattawin River flood plain, Ontario. Neutral detergent fibre is inversely proportional to digestibility.

Species	Crude Protein (% DM)	Sodium (ppm DM)	Neutral Detergent Fibre (% DM)
Cornus stolonifera	4.37	59	63.97
Salix spp.	5.48	70	62.71
Betula papyrifera	4.30	94	74.23
Populus tremuloides	5.80	46	51.20
Equisetum fluviatile	5.95	1878	54.09
Alnus rugosa	8.35	59	55.50

These data suggest that moose in northwestern Ontario may seek sodium in the winter months by pawing through moderate depths of snow to forage on non-living emergent aquatic vegetation. Belovsky and Jordan (1981) suggest that 94-96 percent of the sodium intake of adult moose comes from aquatic plants but that they are only available for 20 percent of the year. Perhaps this cratering behaviour provides a means of extending the period of time sodium is available in a concentrated form.

We conclude that sodium can be obtained from *E. fluviatile* which will be consumed even when an abundant source of browse is available nearby. Large quantities of preferred browse species were available in several 5 - 15 yr. old cutovers both north and south of the Mattawin River. These findings suggest that wetlands with abundant emergent aquatic vegetation not only provide for summer aquatic feeding but may also enhance the value of early winter habitats for moose.

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