Differential Footload of Male and Female Fisher, *Martes pennanti,* in Quebec

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We examined the mass, foot area and foot oad (mass/surface area) of Fishers (Carnivora: Mustelidae: *Martes pennanti*) captured during the 2006-2007 commercial fur season in southern Quebec, Canada. Body mass of males ($\bar{x}$ = 4.7 kg ± 0.5, n = 37) was significantly larger than that of females ($\bar{x}$ = 2.4 kg ± 0.2, n = 40*)*. Similarly, the size of male feet ($\bar{x}$ area = 130.5 cm^2 ± 10.9, n = 37) was significantly larger than that of females ($\bar{x}$ = 95.2 cm^2 ± 7.6 SE, n = 40). The resulting footload of males (36.2 g/cm^2 ± 6.1, n = 37) was 43% larger than that of females (25.3 g/cm^2 ± 2.3, n = 40). These results may help explain the differential behaviour and niche partitioning in this mustelid carnivore.

Key Words: Fisher, *Martes pennanti*, footload, foot size, snow, mass, niche, Quebec.

Environmental conditions greatly affect the ecology of northern animals. In snowy environments, energetic challenges are imposed by additional locomotory costs associated with travel in snow (Crête and Larivière 2003). To overcome these costs, northern animals adapt either through behaviour or morphology. Behavioral adaptations include traveling on hard surfaces (Murray and Boutin 1991), use of snow-free areas (Sweeney and Sweeney 1984), use of tracks or trails of other animals or humans (Murray et al. 1995; Bunnell et al. 2006), reduced movements (Nellemann 1996), or broadening of diet to reduce travel needs further (Dumont et al. 2005). In contrast, morphological adaptations include longer limbs (Telfer and Kelsall 1984), reduced mass (Hodges et al. 2006), larger feet (Murray and Larivière 2002), or reduced footloading, defined as the mass per foot area ratio (Murray and Larivière 2002).

The Fisher (*Martes pennanti*) is a medium-sized mustelid that occurs throughout the forests of North America. Fishers are sexually dimorphic, with males almost twice the size of females (Powell 1993). During winter, diet of males and females differs as the smaller females are more active hunters whereas males tend to rely more intensively on scavenging ungulate carcasses (Giuliano et al. 1989). Possibly, a linkage exists between behavioural ecology and morphology, especially in northern environments where deep snow increases locomotory costs (Crête and Larivière 2003). Thus, we used footload of Fishers at the northern limit of their range to help understand this linkage.

We collected Fishers that were captured during commercial fur trapping activities. Mass and sex were recorded before pelt removal. Collected carcasses were tagged and frozen until processing. Once thawed, the four unskinned paws were removed and their outline was traced to obtain a measure of foot area. A pencil was pressed against the periphery of the digital bones as it circled the paw, thereby compressing fur and toe (Murray and Larivière 2002). The resulting prints were photographed and their area was calculated with Photoshop software (Adobe Systems Incorporated). The pixels of each foot surface area were converted to cm^2 using a known surface. Statistical comparisons between males and females were tested with a Mann-Whitney U-test.

The majority of the Fishers collected (92.0%, n = 77) were captured between 16 November and 31 December. The body mass of males ($\bar{x}$ = 4.7 kg ± 0.5, n = 37) was significantly larger (U < 0.001, P < 0.001, n = 37) than that of females ($\bar{x}$ = 2.4 kg ± 0.2, n = 40*)*. Similarly, the foot area of males ($\bar{x}$ = 130.5 cm^2 ± 10.9, n = 37) was significantly larger (U = 9.00, P < 0.001, n = 77) than that of females ($\bar{x}$ = 95.2 cm^2 ± 7.6, n = 40). The resulting footload was significantly larger (U = 13.00, P < 0.001, n = 77) for males ($\bar{x}$ = 36.2 g/cm^2 ± 6.1, n = 37) than females ($\bar{x}$ = 25.3 g/cm^2 ± 2.3, n = 40).

Our study shows that although males have larger feet than females, their mass remains proportionally greater and this results in a higher footload. Interestingly, the footload of female Fisher (25.3 g/cm^2) is similar to that of the Canada Lynx (*Lynx canadensis,*

25.9 g/cm^2; Murray and Boutin 1991), but much higher than that of the American Marten (*Martes americana,* 9.4 g/cm^2; Krohn et al. 2003), a sister species with a much more northern distribution. Footload of male Fishers, albeit high compared to females, nonetheless is lower than that of coexisting canids such as Red Fox (*Vulpes vulpes*, 88.5 g/cm^2) and Coyote (*Canis latrans*, 170.3 g/cm^2; Murray and Larivière 2002) but higher than the footload of another scavenging mustelid, the Wolverine (*Gulo gulo*, 22 g/cm^2; Knorre 1959). These results may help explain the differential ecology of male and female Fisher, especially in northern environments where deep snow is a constraint. However, further work should be conducted on male-female differences to better understand their behavioural ecology.

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