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Appendix 1

Intensity of *Trichostrongylus tenuis* infection in grouse

Medicated grit was provided constantly to grouse from 2008 onwards. It was withdrawn on one beat in summer 2013 and on the remaining four beats the following year. *T. tenuis* infections in grouse were estimated by counting adult worms in the caeca of all fresh, intact grouse carcasses (n = 20). This sample was supplemented by collecting grouse caecal faeces (autumn to spring, n = 409) and counting worm eggs (see Seivwright et al. 2004 for a description of both methods). Caecal collection was not distributed at random, but focused on areas with the highest grouse densities. All samples were stored in a refrigerator until analysis.

Adult worm counts gave a geometric mean of 8 worms (95%CI 4-15, range 0-400). The faecal egg counts gave an estimated mean of 27 (24-30) worms, which varied between years (Table A1). Overall, 67% of the samples had fewer than 100 worms (including 51% without any evidence of worm eggs), and only 1% had more than 3000 worms.

In all years, the mean worm burden of grouse at Langholm was well below the infection levels at which negative effects on reproductive performance or population growth were observed, generally in excess of a mean of 3000 worms bird^{-1} (Potts et al. 1984, Hudson 1986, Hudson et al. 2002). On an individual level, 1% of the samples, all in the early study period, were infected with >3000 worms, which may have affected their body condition. However, lethal effects were generally observed at higher infection rates; grouse that died of strongylosis or were found dead without external injury had on average 7000-8000 worms, in extreme cases up to 30 000 (Hudson et al. 1992, Richardson and Baines unpubl.). Nevertheless, grouse with higher infection rates may be more susceptible to predation (Hudson et al. 1992, but see Moss et al. 1990).

Table A1 Mean annual worm burden estimated from *T. tenuis* eggs in caecal faeces of red grouse.

Year	n	Mean (95%CI)	Range	<100 worms	100-1000 worms	1000-3000 worms	>3000 worms
2008	14	40 (19-80)	4-1307	50%	36%	14%	0%
2009	43	150 (103-219)	4-4347	37%	33%	26%	5%
2010	40	36 (25-52)	4-3875	58%	38%	3%	3%
2011	54	13 (10-17)	4-3209	72%	24%	2%	2%
2012	42	7 (5-9)	4-527	83%	17%	0%	0%
2013	19	95 (58-156)	4-2242	58%	16%	26%	0%
2014	78	21 (17-25)	4-711	73%	27%	0%	0%
2015	97	20 (16-25)	4-1822	74%	20%	6%	0%
2016	22	64 (39-102)	4-1003	55%	41%	5%	0%

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