The dynamics of parasite transmission between the Saiga antelope and domestic livestock in Kazakhstan

by

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“Then, cleaving the grass, gazelles appear,
The gentler dolphins of kindlier waves.”

Sturge Moore (1870-1944)

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Declaration

Some of the data analysed in this thesis were collected by authors in Kazakhstan and have already been published. In such cases authors are fully cited in the text. All work presented in this thesis was conducted by the author, unless otherwise indicated. This thesis has not been submitted for a degree at any other university.

Summary

This thesis aims to further our understanding of the factors that affect parasite transmission within and between saiga and livestock populations in Kazakhstan, using a combination of approaches. Archive data from previous parasite surveys are re-evaluated in the light of recent thinking on parasite ecology, and parasite abundance in different host groups is measured using *post mortem* parasite extraction and coprological techniques. Abomasal nematodes are identified as a group of major significance, and work is focused on them. Detailed examination of specimens reveals *Marshallagia marshalli* and *Marshallagia mongolica* to be present in both saigas and sheep, while *Nematodirus gazellae* appears to be restricted to saigas and *Haemonchus contortus* to sheep. Comparison of parasite burdens between host groups, taking account of overdispersion and observation error, suggests that immunity has little effect on parasite burdens, except in the oldest hosts. The times and places of peak transmission seem to differ between species.

A model of parasite transmission is developed, that considers multiple host populations, saiga migration, and the effect of climatic variation on the free-living parasite stages. The model demonstrates that differences in the life histories of *Haemonchus*, *Marshallagia* and *Nematodirus* can account for observed patterns of parasite acquisition in time and space. The principal sources of uncertainty in the model predictions are identified and used to prioritise future work. Manipulation of the model is used to examine the importance of host population size and distribution to parasite persistence, and to explore strategies for reducing the risk of interspecific transmission of abomasal nematodes.

Terms and Abbreviations used in this thesis

Statistical terminology

sd - standard deviation

CV - coefficient of variation

NS - not significant

Russian and Kazakh terms

Dekad - 10-day period.

Dzhut - A winter with heavy snowfall, or a climatic event of rain followed by freezing temperatures, causing a layer of ice to cover the vegetation.

Oblast - Province.

Raion - District.

Zhailau - Land used for summer grazing, remote from the farm buildings.

Abbreviations and acronyms

CS - Coverslip Flotation

DCF - Direct Centrifugal Flotation

DM - Dry Matter

epg - Eggs per Gram

FEC - Faecal Egg Count(s)

MLE - Maximum Likelihood Estimation

McM - McMaster's flotation-dilution test

NBD - Negative Binomial Distribution

PPP - Pre-patent Period

Q_i - Predicted instantaneous reproduction ratio

R - Finite annual rate of population growth

R_e - Effective reproduction ratio

R_o - Basic reproduction ratio

Variables and parameters used in the transmission model

See Table 8.1.