The parasite *Syngamus trachea* in an insular metapopulation of house sparrows in northern Norway.

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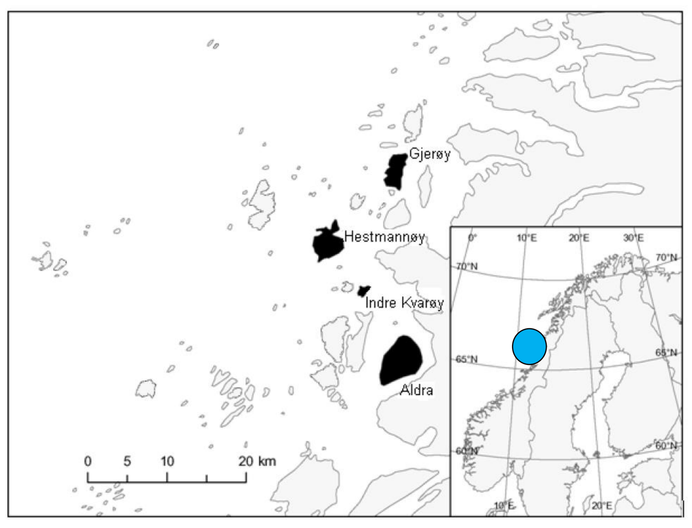
Parasites may have severe consequences on individual host fitness, as well as on food-web interactions. Still we know little about spatial and temporal dynamics of parasites and their fitness consequences in wild host populations.

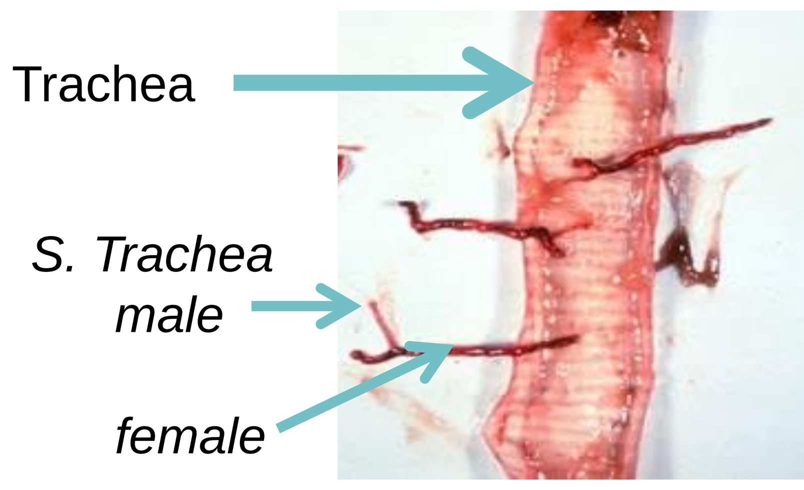


We investigated the spatio-temporal dynamic of a common avian parasite, *S. trachea* hosted by a House sparrow metapopulation at the coast of Helgeland in northern Norway.

Objectives

1) We explored **the spatial and temporal variation in prevalence of *S. trachea,*** both the seasonal pattern, within and among years as well as within and among island populations.
2) We also investigated whether ***S. trachea* affected annual survival probabilities** among house sparrows.

The host: House sparrow Photo Henrik Jensen



The parasite: Gapeworm

Facts about the parasite; the gapeworm (*S. trachea*)

- ✓ *S. trachea* is a nematode that has a cosmopolitan distribution and has been found in most terrestrial bird genera (Yamaguti 1961).
- ✓ The parasite is known as “Gape worm” in the domestic bird industry, where outbreaks have caused substantial problems (Atkinson *et al.* 2008).
- ✓ The adult male parasite is 3-5 mm long and the adult female is 17-30 mm long (Barus and Blazek 1965).

Lifecycle of the parasite

- ✓ Host can be infected either directly by eating *S. trachea* larvae in for instance contaminated water or by eating paratenic hosts containing an egg or larvae of *S. trachea* (Clapham 1934).
- ✓ *S. trachea* larva establish in the tracheas (lungs) of the host, where it stays during the adult stage and copulate with a male and reproduce. (adults can live 2-4 months, Barus 1966b).
- ✓ The adult female *S. trachea* releases eggs which are coughed up by the host and then swallowed (Atkinson *et al.* 2008).
- ✓ The eggs then pass out in the faeces of the host and may enter another bird either directly or via a paratenic hosts (Clapham 1934; Bakke 1973).

Consequences of being infected

- ✓ The parasites feed on blood in the trachea tissue causing mechanical damage, anaemia, inflammation and excess mucus production. The birds that are infected may develop symptoms consisting of gasping, wheezing and shaking of the head. This discomfort may affect food uptake, and combined with the blood loss, may cause death (Atkinson *et al.* 109 2008).

Methods

House sparrows were captured and measured for several morphological traits. A faecal sample from each sparrow was obtained by placing the bird in a paper bag for a few minutes. The faecal sample was stored in a small tube of distilled water and later counted for the number of *S. trachea* eggs. We applied generalized linear mixed models (package glmmADMB version 0.7.2.5) with a Bernoulli response variable and a logit link function to model prevalence. Individual identity was included as a random factor in order to avoid pseudoreplication. We applied AICc to identify the best candiate model(s).

We analysed the annual survival probabilities by applying a multistate capture-mark-recapture model where information about the recorded infection state of individuals was included (see Kéry & Schaub 2011),

Results 1): spatiotemporal variance in prevalence

The mean prevalence increase during the breeding season to a general maximum in late summer and then decline towards autumn. The best model (Fig 1) indicated that;

- prevalence differed between islands and years per se as well as the interaction island*year effect.
- seasonal changes in the prevalence pattern varied among years and islands
- Juveniles and adult females had generally higher prevalence than adult males

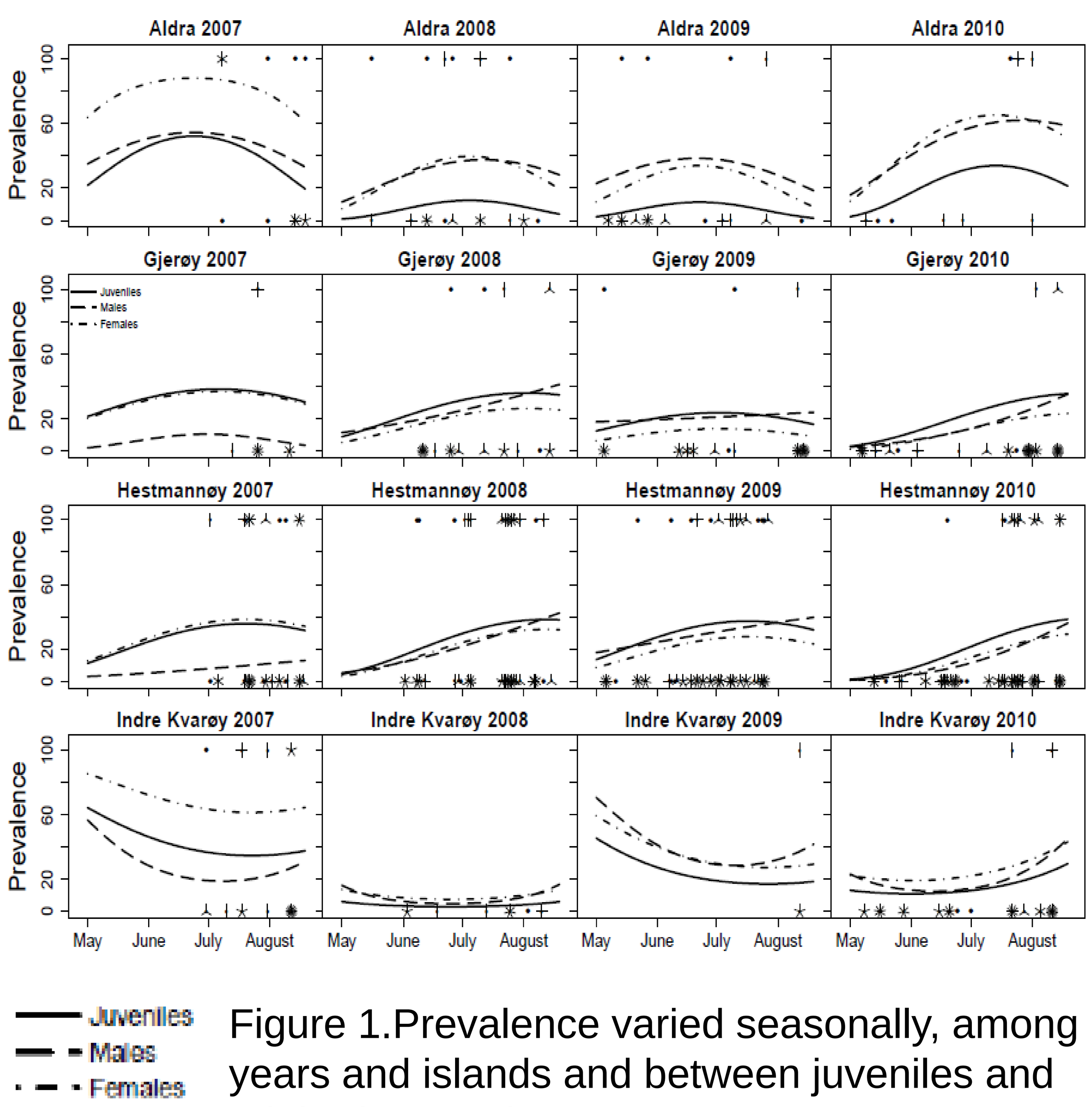
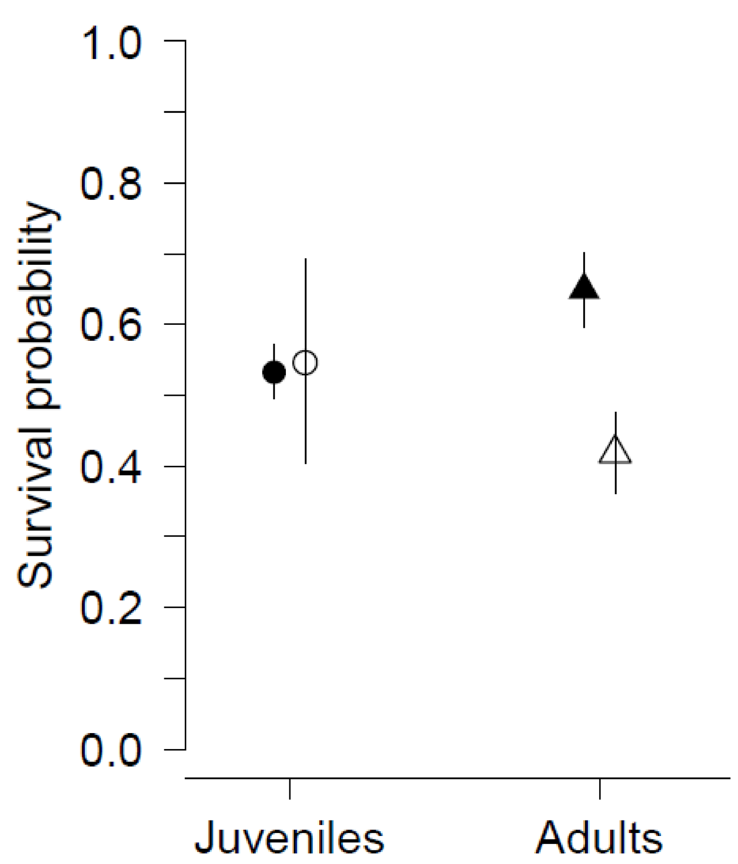


Figure 1.Prevalence varied seasonally, among years and islands and between juveniles and adults (N=1152).
Figure from: Holand et. al. (in press) Temporal and spatial variation in prevalence of the parasite Syngamus trachea in a metapopulation of House Sparrows (Passer domesticus). Parasitology

Results 2): reduced survival probability of heavily infected male

- We found no difference in annual survival probability of house sparrows between infected and non-infected adults or juveniles based on presence/absence of *S. trachea* eggs in host faeces, respectively.



- The results suggested that <u>adult house sparrows carrying obvious symptoms (gasping behaviour)</u> of infection by *S. trachea* had reduced annual survival probability (Fig.2)

Figure 2. Adults with visible symptoms of being infected by S. trachea (denoted with white symbols) had reduced annual survival probability. Black symbols displayed no visible symptoms of being infected. Figure from: Holand et. al. (in prep)

Conclusions

- This study demonstrates that the prevalence-pattern of a macroparasite, *Syngamus trachea* (gapeworm) show complex spatio-temporal variation both within seasons, within and among islands and years in a insular metapopulation of a wild passerine species in northern Norway.
- The results suggested that adult house sparrows carrying obvious symptoms (gasping behaviour) of infection by *S. trachea* had reduced annual survival probability
- Accordingly, the presence of *S. trachea* in a host population may have a negative effect on individual lifetime reproductive success in wild bird populations through its effect on reducing individual lifespan

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