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IS *BRUCELLA PINNIPEDIALIS* UNABLE TO SUSTAIN A LONG TERM INFECTION IN HOODED SEALS (*CYSTOPHORA CRISTATA*)?

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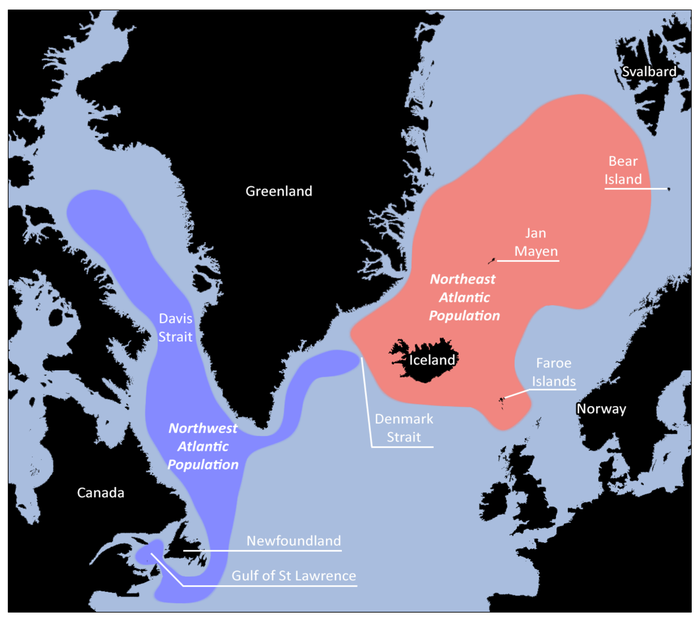
INTRODUCTION

Facultative intracellular bacteria in genus *Brucella* [1] cause brucellosis, the most common bacterial zoonosis worldwide [2]. *Brucella pinnipedialis* and *Brucella ceti* were included in the genus in 2007, with pinnipeds and cetaceans as preferred hosts [3]. There are two stocks of hooded seals (*Cystophora cristata*) (Pic. 1); the increasing Northwest- and the declining Northeast Atlantic stock (Pic. 2) [4, 5]. Previous studies have shown a high prevalence of *Brucella*-positive seals in the Northeast Atlantic stock [6, 7], compared to in the Northwest Atlantic stock [8]. The discrepancy in stock size and *Brucella*-prevalence prompted us to investigate if *B. pinnipedialis* induced reproductive disorders and had any effect on a the stock decline.

Pic. 1. Juvenile hooded seal. Credits: Poltermann (IMR, Norway).



Pic. 2. The Northwest- (blue, increased since the 1980s, estimated size 2005: 593 500) and the Northeast Atlantic stock (red, decreased since the 1940s, estimated size 2013: 84 020) [4, 5]. Credits: Hansen (Greenlit Games Norway).

MATERIALS AND METHODS

This study evaluated the relationships between *Brucella*-serostatus [9] in hooded seals (n = 379) of the Northeast Atlantic stock and age, sex, body condition and reproductive history (presence of *corpus luteum* and *corpus albicans*). The effect of age on the presence of bacteria in organ samples was evaluated [10]. *In vitro* infection of human THP-1 macrophages and hooded seal primary macrophages [11, 12], and *in vivo* infection of BALB/c mice was performed [13].

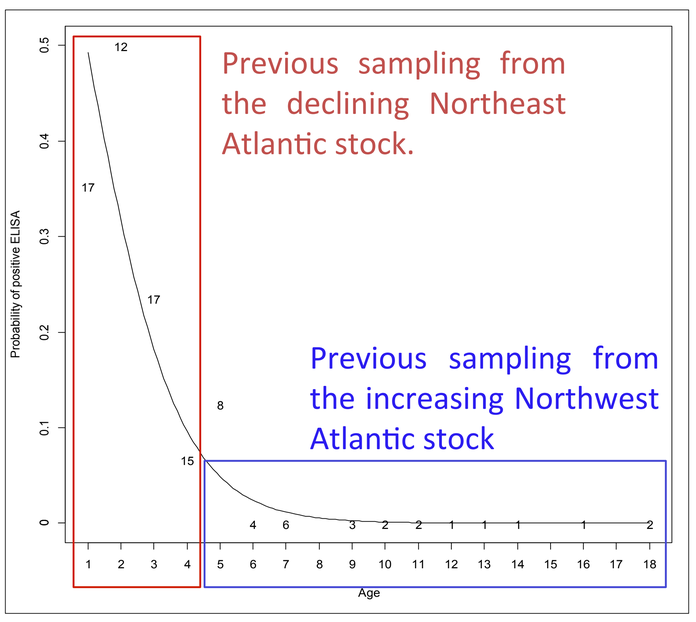


Fig. 1. Mean influence of age on the probability of being *Brucella* seropositive (solid line). The numbers show sample sizes, and their locations the empirical probabilities [10]. The squares show ages sampled in previous studies [6, 7, 8].

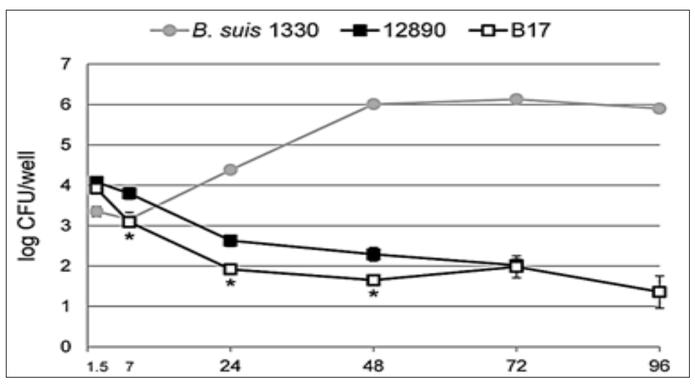


Fig. 2. Infection of human THP-1 macrophages with *B. suis* (1330), *B. pinnipedialis* reference strain (12890) and hooded seal strain (B17). No multiplication of *B. pinnipedialis* [12].

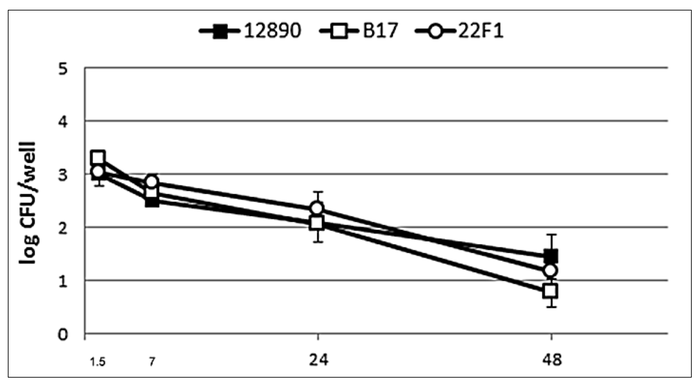


Fig. 3. Infection of hooded seal primary macrophages with *B. pinnipedialis* reference strain (12890) and hooded seal strains (B17 and 22F1). No multiplication of *B. pinnipedialis* [11].

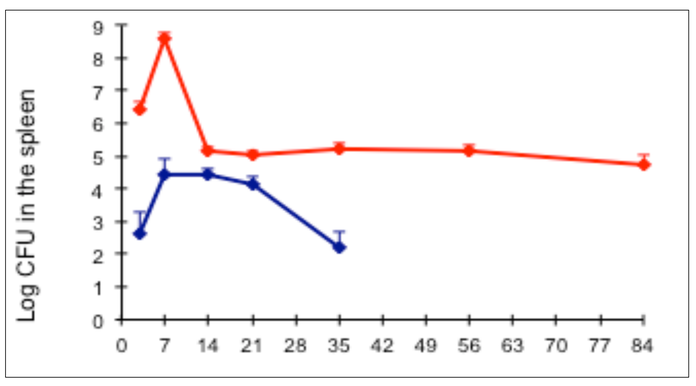


Fig. 4. Spleen replication pattern from infection of BALB/c mice with with *B. suis* (1330, red) and *B. pinnipedialis* hooded seal strain (22F1, blue). *B. pinnipedialis* is attenuated in this model [13].

RESULTS

No relationship between *Brucella*-serostatus and sex, body condition or reproductive history [10].

Pups of the year had lower probability of being seropositive (4/159, 2.5 %) than yearlings (6/17, 35.3 %) [10].

For seals > one year the probability of being seropositive decreased with age with no seropositives older than five years (Fig. 1) [10].

***B. pinnipedialis* was isolated from the retropharyngeal lymph node of a one year old female [10].**

***B. pinnipedialis* did not multiply in human or hooded seal macrophages (Fig. 2 and 3) [11, 12].**

***B. pinnipedialis* is attenuated in the mouse model (Fig. 4) [13].**

CONCLUSIONS

No effect of the infection on health and reproduction was recorded [10].

The serological age-dependent pattern indicate loss of titre with chronicity or clearance of infection (Fig. 1). The latter is likely as *B. pinnipedialis* could only be isolated from a one year old and has never been isolated from hooded seals > 18 months [10].

We hypothesize an environmental aquatic exposure to *B. pinnipedialis* post weaning during the first year of life, with a subsequent clearance of infection, rather than a mother-to-pup transmission [10].

The results are in accordance with work in cell models (Fig. 2 and 3) [11, 12] and a mouse model (Fig. 4) [13].

The previously described discrepancy in *Brucella*-prevalence between the stocks [6, 7, 8] is likely due to sampling of different age groups (Fig. 1) [10].

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