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The impact of sika deer grazing on the vegetation and infauna of Arne saltmarsh

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Abstract

Arne saltmarsh, an RSPB reserve, is situated in Poole Harbour on the English south coast. In recent years, there has been concern about possible changes in the suitability of the site for Redshank (*Trigna totanus*) due to sika deer (*Cervus nippon*) grazing. In order to assess these changes, 50 plots were established in three different locations: 20 in grazed areas, 20 in ungrazed areas and 10 fenced enclosures. Deer grazing was found to significantly affect structural and species diversity of the saltmarsh vegetation. *Spartina anglica* dominated in ungrazed areas whilst *Salicornia ramosissima* and, to a lesser extent, *Puccinellia maritima* dominated in grazed sites. In grazed areas the vegetation cover was significantly lower, as was vegetation height and volume. In addition, significant changes were observed in the root biomass, which was lower in grazed areas. Infaunal diversity was generally low throughout the survey area. However, significant variations were observed. Invertebrates abundance was more abundant in grazed plots than in ungrazed plots, and least abundant in fenced plots. The study indicated that in its current condition, localised areas of Arne saltmarsh do not provide adequate habitat requirements for *Tringa totanus*.

Keywords: Sika deer; Grazing; Macrofauna; Nature conservation; Poole Harbour; Redshank; Saltmarsh; *Spartina anglica*

1. Introduction

Saltmarshes are an extremely important coastal habitat (Esselink et al., 2000) which have long been impacted upon by human activities. These activities include: land claim for port and marina facilities; waste disposal; agriculture; erosion and/or coastal squeeze due to coastal protection works and changes in estuarine morphology on the seaward edge and fixed flood defence walls and other construction on the landward side. In the UK, saltmarshes are subject to a Biodiversity Action Plan (BAP). The total extent of coastal saltmarsh, including transitional communities, in the UK is estimated to be 45,500 ha (JNCC, 1999). Currently, 80% of saltmarsh area is designated as Sites of Special Scientific Interest (SSSI) and 10 areas have been proposed as Special Areas of Conservation (SACs) for their saltmarsh features (JNCC, 1999). The BAP aims to maintain the area of saltmarsh and offset current losses (estimated to be 100 ha per year), in addition to creating a further 40 ha of saltmarsh each year (JNCC, 1999). The intention of the BAP is to maintain the existing resource in terms of its species diversity and, where necessary, restore the nature conservation interest through management.

Saltmarshes are a particularly important habitat for many breeding and over-wintering bird species (Davidson et al., 1991). Among the breeding waders, saltmarshes are of particular importance for Redshank (*Tringa totanus*). In Britain, approximately 50% of the breeding pairs nest in such habitat (Cadbury et al., 1987; Brindley et al., 1998). This makes Britain's coastal saltmarshes of national importance with regard to the conservation of Redshank (Norris et al., 1997). In addition, the saltmarsh nesting pairs in Britain are thought to represent 5–12% of the breeding pairs in north-western Europe (Piersma, 1986;

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Tucker and Heath, 1994) and, consequently, our saltmarshes are of international importance (Norris et al., 1997). In Britain, this species has been declining in abundance and is now thought to have an unfavourable conservation status (Brindley et al., 1998). This reflects a decline throughout Europe (Tucker and Heath, 1994). These declines are through to be due to the loss and degradation of important breeding sites combined with an intensification of agriculture (Tucker and Heath, 1994; Norris et al., 1998). In Britain, however, this decline has been attributed to a change in grazing practices on saltmarshes rather than loss of habitat (Brindley et al., 1998; Norris et al., 1998).

Redshank build their nests in grass tussocks or patches of relatively tall vegetation (Nethersole-Thompson and Nethersole-Thompson, 1986; Hale, 1988). However, they are visual feeders (Goss-Custard, 1969) and, therefore, require swards of shorter vegetation with patches of surface water (Vickery et al., 1997; Milsom et al., 1998, 2000). Consequently redshank need a habitat of varied vegetation structure. Such a habitat is characteristic of a saltmarsh moderately grazed by cattle (Norris et al., 1997). Overgrazing and grazing by sheep tends to produce a short uniform sward whilst ungrazed saltmarshes promotes a tall sward, both of which are unsuitable for redshank (Norris et al., 1998).

Poole Harbour, on the British south coast, is recognised as an important area for wildlife, with many designations including Special Site of Scientific Interest (SSSI), Special Protection Area (SPA), and a RAMSAR site. The harbour also contains a RSPB nature reserve at Arne. Concerns have been expressed by the RSPB regarding the impact of sika deer (*Cervus nippon*) grazing on the saltmarsh habitat and, consequently, its impact on the redshank population of the harbour.

Sika deer are an alien species in Britain, originally imported between 1860 and 1920 from eastern Asia and Japan (Mitchell-Jones, 1997; Putman, 2000). In their native habitat, sika deer generally occupy a large home range and are neither typical forest dwellers nor adapted for open spaces (Borkowski, 2000), instead they usually inhabit the forest edge (Takatsuki, 1991). They are generalists that can quickly change their behaviour to adapt to changes in environmental variables such as food availability (Borkowski and Furubayashi, 1998). In both Japan and Britain, open habitats are generally used between dusk and dawn for feeding whilst closed habitats, such as woodland, offer protection and shelter during resting (Mann and Putman, 1989; Mitchell-Jones, 1997; Borkowski and Furubayashi, 1998). At Arne, the deer are often observed feeding at dawn and dusk on the saltmarsh, retiring to the woodland backing the saltmarsh during the day.

In the earlier parts of the 20th century, the harbour held relatively large populations of redshank, but recent surveys suggest just 14 pairs now breed at Arne (Price, 1997). This may in part be due to the decline in saltmarsh habitat within the harbour (Raybould, 1997), but may also be due to changes in the remaining saltmarsh habitat due to deer grazing. The aim of the present study is to assess this impact by investigating the effect of deer grazing on the vegetation diversity and structure and also on the invertebrate fauna of the harbour.

2. Methods and materials

During the summer of 2002, a survey of Arne saltmarsh was undertaken to assess the general extent of deer grazing at Arne. From this survey, three sites were identified for more focused analysis (Fig. 1). Grip Heath contained 10 grazed and 10 lightly or ungrazed plots (hereafter referred to as ungrazed), Crichton's Heath north 10 grazed, 5 ungrazed and 5 fenced plots and Crichton's Heath south contained 5 grazed, 5 ungrazed and 5 fenced plots (Fig. 1). Each plot measured 2 m × 2 m and were marked out using bamboo canes to enable repeat sampling. The fenced plots were sited within heavily grazed areas and were set-up in 1989 as part of a previous study at Arne. In addition, the fenced plots were 2.5 m × 2.5 m, but data was only collected from the central 2 m × 2 m portion of the enclosures, leaving a 0.5 m buffer zone immediately inside the fence.

The impact of deer grazing was investigated using a standard vegetation survey within each plot to determine species composition and abundance. The vegetation data were analysed using standard multivariate techniques with the package PRIMER (Plymouth Routines In Multivariate Ecological Research; Clark, 1993). The Bray–Curtis similarity measure was used to calculate similarities among replicate observations, and cluster analysis undertaken. Similarity percentages (SIMPER) were used to determine the key taxa (i.e. those that accounted for 80% of the similarity) and relative dissimilarities between assemblages (Clark, 1993). Two way nested analysis of similarities (ANOSIM) was conducted on the data from Crichton's Heath comparing the fixed factors of site (north and south) and grazing regime (grazed, ungrazed and fenced). Due to the lack of fenced plots at Grip Heath it was not possible to include this site in this part of the analysis.

Above ground vegetation volume was assessed by visually recording the percentage occupancy of slices of the plot cube at 10 cm height intervals. Percentage cover of individual species was recorded for the plot as a whole. To assess the possible impact of deer grazing below ground, root biomass was also investigated. A 20 cm diameter augur drill was used to obtain three core samples to a depth of 10 cm. These samples were sieved using a 0.5 mm mesh to retain the root biomass. Where necessary, i.e. when the core contained very large amounts of root biomass, cores were subsampled. The root biomass obtained was washed clean and transferred to an oven at 70 °C to dry for 48 h, after which the samples were weighed. These data were analysed using a Kruskall Wallis test comparing grazed, ungrazed and fenced sites. The relationship between above ground vegetation cover and below ground root biomass was assessed using a Spearman's Rank Correlation. The abundance of the macro-infauna of the