



Conserving freshwater biodiversity: The value, status and management of high quality ditch systems



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ARTICLE INFO

Article history:

Received 4 April 2014

Received in revised form

30 September 2014

Accepted 24 October 2014

Keywords:

Coastal and floodplain grazing marsh

Ditches

Freshwater biodiversity

Protected sites

ABSTRACT

Freshwater biodiversity is globally threatened and while most conservation efforts are focussed on natural and larger freshwater systems such as rivers and lakes, in many lowland agricultural landscapes artificial water bodies including ditches may be equally important as habitats for freshwater species. Ditches occur across the agricultural landscape but in particular, those associated with coastal and floodplain grazing marsh, have high conservation value. The importance of this habitat for rare and threatened species afforded priority status under the UK Biodiversity Action Plan is explored. The characteristics of ditches that have high conservation value are described and a set of targets against which such ditches can be assessed are presented. An analysis of the current condition of Sites of Special Scientific Interest (SSSI) for the wider coastal and floodplain grazing marsh habitat demonstrates the range of pressures affecting these sites and highlights that alongside generic freshwater issues such as eutrophication and non-native species, these sites have a unique set of pressures associated with their ongoing management and the vulnerable location of many sites at the coast. Wider conservation strategies for freshwater biodiversity in lowland landscapes across Europe need to factor in the different management requirements of artificial habitats such as ditches alongside more ambitious restoration projects for natural waterbodies. In low lying coastal areas the threat of coastal squeeze for many important grazing marshes will require a strategic approach to allow upstream migration of important biodiversity.

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Introduction

At a global scale freshwaters are relatively insignificant in terms of area (<1% global surface) but support a disproportionate number of species (~10% of all known species) (Strayer & Dudgeon, 2010). The extent to which humans depend upon freshwaters for a wide range of ecosystem services (Millennium Ecosystem & Assessment, 2005) and the strong interactions between land use and management and freshwater quality means that this important component of biodiversity is increasingly threatened (Strayer & Dudgeon, 2010; Vörösmarty et al., 2010). At regional and local levels, freshwater habitats are generally in poorer condition for biodiversity than terrestrial habitats. As an illustration of this, rivers and lake protected areas in England are more likely to be in unfavourable condition than their terrestrial protected areas (Natural England, 2008).

A major cause of freshwater species loss has been the simplification and channelisation of rivers and their associated floodplain habitats. Large, lowland river systems are naturally highly connected across their flood plains with small waterbodies, wetlands and multiple channels all connected during periods of flooding and high water. This connectivity and the potential refuge it can provide from high flow and pollution events, is important for maintaining conditions for a range of species (e.g. Bornette et al., 1998; Amoros & Bornette, 2002). In England, as in much of the densely populated areas of western Europe, land drainage and river engineering to facilitate agriculture, building development and flood management have led to a loss of floodplain habitats, a loss of connectivity within the floodplain and dramatically changed the nature of the main river channel (Purseglove, 1988). Natural waterbodies (periodically linked floodplain lakes and ponds; meander cut-offs and ox-bows and back channels) have often been lost or isolated from the main channel. Such losses are important because small floodplain water bodies can be important reservoirs of species richness (Williams et al., 2003).

Drainage schemes both within the floodplain and in low lying coastal areas have typically created a series of channels to carry water and maintain lower water levels. Artificial drainage networks

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are characterised by larger channels (drains) and smaller channels called ditches or dykes. These 'ditches' typically have a linear planform, follow linear field boundaries, often turning at right angles and show little relationship to natural landscape contours (Davies et al., 2008). The extent of drainage ditches in Great Britain has been estimated as 128,000 km (Clare & Edwards, 1983). Many of these ditches are now surrounded by intensive agriculture and are managed accordingly with low water levels and subject to regular vegetation management. Such management can mean that ditches have lower conservation value than other wetlands (Davies et al., 2008) but in some contexts ditches, whilst artificial, can be an important replacement for lost natural floodplain habitats, in some cases supporting similar or greater numbers of plant and invertebrate species in comparison with habitats of natural origin (Armitage et al., 2003; Verdonschot et al., 2011; Williams et al., 2003). Even where land has been converted to arable agriculture the drainage ditches may still occasionally support species of conservation interest (Mountford & Arnold, 2006).

Despite the widespread nature of ditches, it is generally in certain contexts that these artificial habitats have highest conservation value. Those areas where wetlands or periodically inundated land has been retained as grassland with ditches are a particularly important land use with both cultural and biodiversity value. In England these modified wetlands are found in areas that have been reclaimed for agriculture in river floodplains and in coastal areas. The resulting land use is often described as *coastal and floodplain grazing marsh* and this land use is a priority habitat under the UK Biodiversity Action Plan (UK BAP) in recognition of its biodiversity importance. Coastal and floodplain grazing marsh is frequently grazed by sheep or cattle, with ditches serving as wet fences. These artificial habitats have become increasingly important for a range of freshwater and wetland species as natural wetlands have been lost. Coastal and floodplain grazing marshes typically support a high diversity of aquatic and wetland plants and invertebrates and can also be important for wetland birds (Ratcliffe, 1989). In some cases the grassland created through drainage can be important in its own right supporting communities suited to periodic inundation and low intensity grazing.

The management of ditches within coastal and floodplain grazing marsh for drainage purposes has traditionally helped maintain high biodiversity across sites, with regular dredging and re-profiling resetting the habitat to an earlier succession stage before a ditch fills with sediment and plant material once again. Provided ditches across a site are managed in rotation, so that a range of ditch ages are present, a range of species can persist (Painter, 1999). In recognition of the important role that these drainage ditches can play in conserving freshwater biodiversity, many areas of coastal and floodplain grazing marsh in England are legally protected as Sites of Special Scientific Interest (SSSI), a national level nature conservation designation. This paper explores the nature of ditches and the wider coastal and floodplain grazing marsh land use. Methods for determining SSSI value and condition of the freshwater component are described and major threats to ditch biodiversity discussed. The emphasis here is on the freshwater or ditch component of the grazing marsh habitat but reference to the wider habitat is included where appropriate.

Freshwater conservation value

The importance of coastal and floodplain grazing marshes in parts of lowland Europe has long been recognised and in the UK it is a priority habitat type under the UK Biodiversity Action Plan. In addition, around 15% of the total grazing marsh area in England

(total approx. 220,000 ha) is protected as Sites of Special Scientific Interest (SSSI). The principal reason for protection and designation as SSSI is the ditch plant and or invertebrate community; in some sites the extensively grazed grassland which the ditches drain can also support important plant communities and populations of wetland birds. The ditches of coastal and floodplain grazing marsh represent both fully aquatic and marginal habitat for flora and fauna and can be an important freshwater habitat in their own right. There are currently 74 SSSIs with lowland ditches as a notified feature, that is to say that 'lowland ditches' are one of the reasons that the site has been afforded legal protection as an SSSI. Most of these are found within the approximately 31,000 ha of coastal and floodplain grazing marsh habitat protected within SSSI but as ditches can occur in other land uses there is not complete overlap. Nevertheless there is strong affinity between high quality ditches and coastal and floodplain grazing marsh and hence any discussion of conservation value must consider both ditches and the wider coastal and floodplain grazing marsh land use.

The species of conservation concern that are associated with the different components of coastal and floodplain grazing marsh are listed in Table 1. A literature review of species requirements showed that there are 47 UK Biodiversity Action Plan species associated with coastal and floodplain grazing marsh compared with 77 species for ponds, 40 for lakes and 76 for rivers (Webb et al., 2010). Fig. 1 shows the relative importance of the two different components of grazing marsh habitats for UK Biodiversity Action Plan species. The high proportion of geographically restricted species associated with ditches demonstrates the significance of this freshwater component of the overall coastal and floodplain grazing marsh habitat. It is important to note that rarely can species be considered obligate ditch species and often species associated with ditches can be found other types of wetland habitats which share similar characteristics. Species affiliated with open water conditions may be found in lakes, ponds and slow flowing rivers whereas species associated with later succession stages and found in ditch margins are also found in fens, marsh and swamp habitats (Webb et al., 2010).

There are a number of characteristics of ditches that may contribute to their conservation value and these characteristics are recognised both in the guidelines for proposing SSSIs (Ratcliffe, 1989) and the methods for assessing the conservation status of sites once designated (JNCC, 2005). The key features of high quality ditches can be summarised as: geographical context; physical structure (Higler, 1976); vegetation composition and structure (Armitage et al., 2003; Clare & Edwards, 1983; Foster et al., 1990;

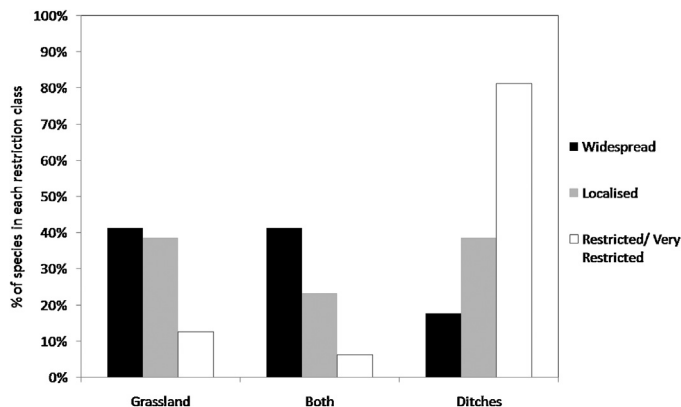


Fig. 1. Proportion of UK Biodiversity Action Plan coastal and floodplain grazing marsh species associated with different habitat zones. Widespread: recorded from over 100 10 km squares; Localised: recorded from 16–100 10 km squares; Restricted: recorded from 15 or less 10 km squares and over five sites; Very restricted: recorded from 1–5 sites.

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