

Introduction

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Davidson, N.C. & Rothwell, P.I. 1993. Introduction. *Wader Study Group Bull.* 68, *Suppl.*: 1-2

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People have used estuaries for a great variety of purposes and for many centuries. Increased leisure time has led in recent decades to increasingly widespread and varied recreational use of coasts and estuaries in north-west Europe. Similarly, increasing recreational pressure is occurring in other places such as in North America (e.g. Melvin *et al.* 1991) and Australia (e.g. Lane 1987). Increasing recreational use of estuaries is often now considered to be one of the most major concerns for the continued safeguarding of the nationally and internationally important breeding, migrant and wintering waterfowl which depend upon these places (Davidson *et al.* 1991; Rothwell & Housden 1991).

In addition to the infrastructure developments and shore-based facilities such as marinas, and housing and leisure complexes that contribute to the continued land-claim and habitat losses on estuaries (e.g. Davidson 1991), most concerns relate to disturbance to feeding and roosting birds. Such recreational pressure comes from a wide variety of leisure activities. These can be water-based (e.g. sail-boarding, sailing and water-skiing), 'land'-based (e.g. informal walking and dog-walking on shoreline and tidal flats, trail-bikes, trikes and 4-wheel drive vehicles) or airborne (e.g. low-flying light aircraft). Other sources of potential disturbance, often noise-related, come from wildfowling and overflying by military and civilian jet aircraft.

Many of these potentially disturbing human activities are very widespread around estuaries (Davidson *et al.* 1991) and can be widespread also within single estuaries although much depends on the shape and habitat distribution within the estuary. Many activities can take place simultaneously within an estuary. Hence not only is there potential disturbance from each activity on its own, but there may be a complex interplay between the effects of a variety of activities in their resulting disturbance to waterfowl. Such disturbance can affect feeding and resting wildfowl on the water, feeding waterfowl on tidal flats, saltmarshes and coastal grasslands, and waterfowl roosting during high tide.

There is widespread belief that these various human activities can, and often do, cause serious disturbance to estuarine waterfowl and so reduce their survival, particularly at times when they are stressed by, for example, severe winter weather. Indeed it is chiefly to protect waterfowl against the effects of disturbance from wildfowling that statutory bans on wildfowling are now introduced in Britain during prolonged periods of severe winter weather.

In general, however, there is very little quantified assessment of the effects of recreational and other kinds of disturbance to waterfowl on estuaries and little understanding of the extent of the impact of such disturbance. Yet such information is vital to estuarine conservation managers and all those making decisions about human use of estuaries particularly when seeking to avoid unnecessary conflict between people and wildlife and in directing damaging developments away from sensitive wildlife areas. Such actions are vital in developing effective estuarine management planning.

Much of the research reporting disturbance effects to estuarine waterfowl is scattered through research reports and in the scientific literature, and the extent to which the available results can be extrapolated to other times and places is not generally clear. Recent research, particularly with regard to various parts of the international Wadden Sea, has produced helpful insights into the disturbance effects of various activities, but has not been widely reported.

In March 1991 the then Nature Conservancy Council and The Royal Society for the Protection of Birds brought together researchers and conservation managers from Britain, Denmark, Germany and the Netherlands for a briefing meeting (held at RSPB headquarters in southern England) to discuss recent findings about disturbance to estuarine waterfowl. This volume publishes versions of many of the papers presented at that meeting, so as to make these recent results accessible to a wider audience. Some of the presentations at the meeting (and included in this volume) summarise research previously unpublished or

available only in internal research reports of restricted availability; others provide new analyses prepared especially for the meeting.

For this volume we have focussed on the effects of various types of disturbance on wintering and migrant waterfowl within estuaries. Some studies deal primarily with disturbance to waders and other disturbance to wildfowl - differences in the ways waders and wildfowl use estuaries can lead to very different types of disturbance effect on the two groups. Breeding waders also face sometimes serious disturbance from recreation and we have included two papers that cover this topic.

We believe that together these reports provide a much wider range of insights into disturbance effects than has previously been published. Nevertheless, there are undoubtedly many more unanalysed data sets that contain information on the effects of human disturbance: many waterfowl researchers' data collection is all too frequently interrupted by the appearance of recreational users of estuaries. We hope, therefore, that this volume stimulates further analyses of existing data, as well as further research into the factors affecting the magnitude

of disturbance effects, and into the extent of the impact on waterfowl induced by the observed patterns of disturbance. The subject is undoubtedly complex and worthy of future attention, because recreational pressure on estuarine wildlife is set to increase rather than diminish.

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