Report

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Desk Based Study on Recreational Disturbance

to Birds on the Humber Estuary

Cruickshanks, K., Liley, D., Fearnley, H., Stillman, R., Harvell, P., Hoskin, R. & Underhill-Day, J.

Forest Office
Cold Harbour
Wareham
Dorset BH20 7PA
Tel/Fax: 01929 552444
info@footprint-ecology.co.uk

connecting wildlife and people

www.footprint-ecology.co.uk

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Summary

This report examines the current impacts of recreation on the Humber Estuary, in relation to disturbance to birds and has been commissioned by the Humber Estuary Management Scheme. Disturbance to birds is a complex issue, as it can result in a range of impacts, most of which involve a change in behaviour by the birds (such as birds flying away from particular areas). It is very difficult to interpret such behavioural responses in terms of their population context and a range of other factors (such as prey abundance) will interact to determine whether there are real consequences of disturbance at a population scale. The issue is particularly complex on the Humber, a large estuary system, where a range of factors may affect the birds. The estuary and adjacent areas are used for a variety of recreational activities and the estuary is also internationally important for a range of bird species (it is designated as a Special Protection Area (SPA) and a Ramsar site), which themselves are mobile and use the estuary in different ways.

We summarise data relating to the distribution and status of key bird species and have generated a series of maps that show the current distributions of the bird species. Bird numbers peak in mid winter, November – January, and this is the time when there may the most competition for resources. A number of the interest features of the SPA, including wintering/passage waders, wintering wildfowl, wintering hen harrier and little tern have all shown marked declines within the area. Many of these species are vulnerable to disturbance and there is evidence from other sites showing impacts from recreational disturbance. Little terns are a particularly vulnerable breeding species. Ten species of wintering wildfowl and waders have been highlighted by the BTO through the WeBS alert system.

We describe and map the access infrastructure such as car-parks, marinas and slipways. We have extracted data on housing numbers around the estuary to allow direct comparison with other estuarine SPAs and provide an indication of where residential use may be concentrated. Within 5km of the centre of the estuary both the north and south shores are similar, with the north holding slightly more properties (136,000 compared to 95,000). The south shore of the Humber is surrounded by more houses at large distance bands. However per unit area or per length of shoreline the number of houses in total around the estuary appears relatively low compared to other estuary sites in England, highlighting the large size of the estuary and the extensive areas of intertidal habitats.

Information on recreational use of the Humber was gathered from discussion with local experts, research, a site visit and a questionnaire consultation with local WeBS counters and experts. Recreational use can be divided into shore-based, water-based and air-borne activities with shore-based activities providing the most diverse range of potential disturbance events. Shore-based activities causing concern in terms of bird disturbance include walking, dog walking, horse riding, cycling, bird and seal watching, beach recreation, wildfowling, motorised access and recreation, samphire picking, angling and bait digging. Out on the water, motor cruising and personal watercraft including jet skis as well as yachting and the relatively new pastime of kite surfing are all activities on the increase. In terms of air-borne recreation, there are a number of airfields and flying clubs which operate around the Humber. A range of private aircraft regularly fly over the estuary, often at low altitude, including microlights, helicopters and small planes.

Questionnaire responses were received from 17 local experts and four WeBS counters providing information on the frequency of different activities and whether they cause disturbance to birds in

37 WeBS sectors out of 39. The quantitative data on frequency of occurrence of activities has been used to create a series of maps to indicate the busiest areas for shore-based, water-based and air-borne activities. A caveat to be noted is that the scores for individual activities are an average of the respondents scores and the resulting mean will not reflect the range of opinions (or level of knowledge) on the extent of activities in a particular WeBS sector. The respondents know the estuary very well but the subjective nature of the data collection further enforces the need for a standardised study into recreational activities. Overall the busiest areas and the locations where disturbance to birds has been observed are those which provide a particular feature like Spurn Head and Donna Nook for the wildlife and beach recreation. Additionally, parts of the SPA adjacent to the larger settlements of Hull, Grimsby and Cleethorpes are busy in terms of recreation due to the local visitor pressure.

While there is excellent data on the bird interest, there are clear gaps in our understanding of access patterns, visitor numbers and recreational use of the Humber. There are a wide range of activities that take place around the Humber, many of which occur outside user groups, clubs and have no form of regulation; gaining a systematic, comprehensive assessment of each activity at an estuary-wide level, let alone any estimate of total visitor numbers to the estuary, is beyond the scope of this desk-based study. Local people, tourists and day trippers come from varying distances to undertake a wide range of activities on the Humber Estuary. Visitor patterns will vary seasonally, spatially and in intensity, providing a complex mix of use. On site visitor counts and detailed survey work is required to fully understand visitor patterns and this information is not available.

On-site visitor surveys and monitoring is a clear priority for further work. We suggest simultaneous estuary-wide counts (similar to the WeBS counts for birds) conducted on a range of different dates and times as a means to get a clear understanding of total visitor use and numbers. We also suggest more detailed visitor survey work at a series of locations, involving questionnaires, to identify routes, time spent on site, home postcodes and other information. Such visitor work is the main gap in our understanding and would represent the minimal next steps for additional work.

There is little merit in additional ornithological work unless it looks at the whole estuary and sets out to look at disturbance in relation to prey abundance, tide and other factors. We have set out such a research programme, which would use visitor data, bird data, tide data and invertebrate data to further develop an existing bird model for the whole estuary. The model would allow different scenarios to be tested, providing the potential for impacts such as habitat loss (e.g. through coastal squeeze and industrial development), habitat creation (such as realignment) or shell fishing to be tested with different levels of disturbance. The model would indicate which species would be potentially vulnerable to disturbance. The models could be developed using existing invertebrate data (now ten years old) and this would be the most pragmatic and cost-effective next steps. Ideally additional invertebrate work would be undertaken, and this would provide the most comprehensive next steps.

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Marine stewardship is The Crown Estate's programme to support practical projects, relevant research, and other initiatives that improve the status and management of the marine estate. Since 1999 the entire programme has provided almost £5 million to aquaculture and dredging research, and to support coastal community projects. With around half the foreshore, approximately half of all estuary beds and tidal rivers and the seabed out to the 12 mile territorial limit, the marine estate is the largest and most diverse within The Crown Estate. The Crown Estate is committed to sustainable and long-term management of these unique assets.

Our thanks primarily to Tania Davey (HMS), who has managed the contract and accompanied DL on the site visits. Other members on the steering group included: Andrew Taylor (North Lincolnshire Council and HERAG Chair), Andrew Gibson (Yorkshire Wildlife Trust), Emma Hawthorne (Natural England), Will Maclennan (Natural England), Neil Jacobson (Crown Estate), Tim Russell (BASC), John Harradine (BASC), David Renwick (East Riding of Yorkshire Council) and Faith Spencer (Environment Agency). We are particularly grateful to Andrew Gibson for circulating questionnaires and for providing detailed information on disturbance around Spurn Head and to Emma Hawthorne for providing GIS data sets, reports and information.

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1. Introduction

Overview

1.1 This report addresses the impacts of recreation on the Humber Estuary, in relation to disturbance to birds and has been commissioned by the Humber Estuary Management Scheme. Within the report we clarify and define what constitutes disturbance, and bring together existing data to summarise the types of activities that occur on the estuary. We then set out the extent to which disturbance may be a current issue on the estuary. Finally we set out recommendations, both in terms of managing access on the estuary and for further research.

The Humber Management Scheme

1.2 The Humber Management Scheme (HMS) has been produced over five years (2000-2005) by a partnership of over 30 Relevant Authorities that have jurisdiction on or around the Humber Estuary. All relevant authorities are equal members of the Humber Estuary Relevant Authorities Group (HERAG) and are tasked with implementing the Scheme with the ongoing advice and support of the Humber Advisory Group. The HERAG collectively funds the Humber Management Scheme and they employ a Project Officer to coordinate the implementation of the scheme on a day to day basis.

1.3 The Humber Advisory Group (HAG) was formed in the development of the management scheme to create links with local interested stakeholders to support the HERAG. The HAG members represent a large range of voluntary organisations and individuals with diverse interests in the Humber including recreational groups, wildlife interest groups, community groups and tourism and industry members.

1.4 The HMS is built upon Natural England's conservation objectives for European Marine Sites and the specific advice provided for the Humber. The HMS has identified actions that may cause deterioration to the site and is responsible for producing management proposals that prevent such deterioration.

The Humber: Designations and Nature Conservation Importance

1.5 This contract focuses on the Humber Estuary, which is a European Protected Site within the Natura 2000 network and is covered by SPA, Ramsar and SAC designations. These designations bring particular and strict legal requirements relating to plans and projects which are not for nature conservation management. In accordance with Article 6(3) and 6(4) of the Habitats Directive, and Regulations 61 and 102 of the Conservation and Habitats Regulations 2010, any plan or project likely to have a significant effect upon a European site must be the subject of an assessment to determine the implications of that plan or project for the conservation objectives of the European site in question.

1.6 The designations reflect the importance of the sites for birds, plants and invertebrates. Disturbance is, of course, a particular issue for birds and is therefore relevant to the SPA and Ramsar designations.

1.7 For the purposes of this report the following details of site interest features therefore focuses upon the bird interest features of the SPA and Ramsar. Non-avian interest of European importance forms the interest of the SAC and a range of non-avian criteria of international importance are included within the Ramsar listing.

1.8 SPAs are classified in accordance with the requirements of Article 4.1 and Article 4.2 of the Birds Directive. The requirements within the Directive have been supplemented with guidelines for the appropriate selection of sites published by the Joint Nature Conservation Committee (JNCC).

1.9 Article 4.1 of the Birds Directive requires Annex 1 bird species (i.e. those listed on Annex 1 of the Directive) to be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution, and their most suitable territories are therefore classified as SPAs. The JNCC has determined that any area used regularly by 1% or more of the Great Britain population of a bird species listed on Annex 1 of the Directive should be considered in the process of selecting the most suitable territories. For classified SPAs, any such species form the site's qualifying interest, in accordance with Article 4.1 of the Directive.

1.10 Article 4.2 of the Birds Directive requires member states to take similar measures for regularly occurring migratory species not listed in Annex 1, with regard to their breeding, moulting, wintering sites and also their staging posts along migratory routes. The JNCC has determined that any area used regularly in any season by 1% or more of the bio-geographical population of a regularly occurring migratory species not listed on Annex 1 of the Directive should be considered in the process of selecting the most suitable territories. For classified SPAs, any such species also form the site's qualifying species, in accordance with Article 4.2 of the Directive.

1.11 In considering the wording of Article 4.2 of the Directive, the JNCC has also determined that any area used regularly in any season by a mixed species assemblage (not listed on Annex 1) of at least 20,000 waterfowl or seabirds should also be considered in the process of selecting the most suitable territories. Thus for classified SPAs any such collective groups of migratory species form the site's qualifying assemblage, in accordance with Article 4.2 of the Directive

1.12 In summary, the qualifying features of the SPA will be one of the following:

- Specific qualifying species listed on Annex 1 (during the breeding season or over winter) under article 4.1
- Specific qualifying migratory species not listed on Annex 1 (during the breeding season, overwinter or on passage) under article 4.2
- Migratory species not listed on Annex 1 that form part of the qualifying assemblage of waterfowl or seabirds under article 4.2.

1.13 Table 1 identifies the SPA interest features under each of the qualifying categories. It should be noted that it is the conclusion of the authors of this report, based upon their understanding of the Habitats Regulations, that adverse effects relating to a single species

that forms part of a qualifying assemblage should normally be taken to be an adverse effect upon the qualifying assemblage feature as a whole, because any higher threshold is currently unknown and the precautionary principle must therefore always apply.

1.14 The avian features for the Humber Estuary Ramsar site qualify under Criterion 6 of the Criteria for Identifying Wetlands of International Importance under the Ramsar Convention, i.e. sites that should be listed as Ramsar sites. Criterion 6 states that a wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird. Table 1 identifies the Ramsar site bird species that qualify under criterion 6.

Table 1: Summary of SPA and Ramsar Interest Features

Species	SPA					Ramsar
	Article 4.1, Annex 1 breeding	**Article 4.1, Annex 1 overwinter**	**Article 4.2, Migratory on passage**	**Article 4.2, Migratory SPA overwinter**	**Article 4.2, Qualifying assemblage**	**Species at levels of international importance (1%)**
Little Tern *Sterna albifrons*	✓ 2.6% of GB breeding population					
Marsh Harrier *Circus aeruginosus*	✓ 6.9% of GB breeding population					
Bar-tailed godwit *Limosa lapponica*		✓ 3.0% of GB wintering population			✓	✓ 2.3% of wintering population
Bittern *Botaurus stellaris*		✓ 2.0% of GB wintering population			✓	
Golden plover *Pluvialis apricaria*		✓ 11.7% of GB wintering population			✓	✓ 3.3% of north western Europe/ western continental Europe/ north western Africa wintering population
Hen harrier *Circus cyaneus*		✓ 2.7% of GB wintering population				

Species	SPA					Ramsar
	Article 4.1, Annex 1 breeding	Article 4.1, Annex 1 overwinter	Article 4.2, Migratory on passage	Article 4.2, Migratory SPA overwinter	Article 4.2, Qualifying assemblage	Species at levels of international importance (1%)
Redshank *Tringa tetanus*			✓ 2.9% of eastern Atlantic wintering population	✓ 3.0% of eastern Atlantic wintering population	✓	✓ 3.6% of wintering population
Sanderling *Calidris alba*			✓ 1.8% of eastern Atlantic/western and southern Africa wintering population		✓	
Dunlin *Calidris alpine alpine*				✓ 1.7% of northern Siberia/Europe/ western Africa wintering population	✓	✓ 1.7% of wintering population
Knot *Calidris canutus*				✓ 9.7% of north eastern Canada/Greenland/Iceland/ north western Europe wintering population	✓	✓ 6.3% of wintering population
Shelduck *Tadorna tadorna*				✓ 1.4% of north western Europe wintering population	✓	✓ 1.5% of north western Europe breeding population

Species	SPA					Ramsar
	Article 4.1, Annex 1 breeding	Article 4.1, Annex 1 overwinter	Article 4.2, Migratory on passage	Article 4.2, Migratory SPA overwinter	Article 4.2, Qualifying assemblage	Species at levels of international importance (1%)
Mallard *Anas platyrhynchos*					✓	
Cormorant *Phalacrocorax carbo*					✓	
Dark-b. brent goose *Branta bernicla bernicla*					✓	
Teal *Anas crecca*					✓	
Curlew *Numenius arquata*					✓	
Pochard *Aythya farina*					✓	
Goldeneye *Bucephala clangula*					✓	
Oystercatcher *Haematopus ostralegus*					✓	
Ringed Plover *Charadrius hiaticula*					✓	
Grey plover *Pluvialis squatarola*					✓	
Lapwing *Vanellus vanellus*					✓	
Black-tailed godwit *Limosa limosa islandica*					✓	✓ 3.2% of wintering population
Wigeon *Anas Penelope*					✓	
Whimbrel *Numenius phaeopus*					✓	

Disturbance to Birds

1.15 Human disturbance to birds is essentially any activity that results in a change in a bird's behaviour. There is wide range of studies and a large volume of scientific literature that considers disturbance and its consequences. The impacts and issues are complex and researchers tend to focus on the ecological or theoretical implications of their research and avoid making practical recommendations. While there is a large body of scientific and grey literature addressing the impacts of access in coastal environments, and a number of reviews on the effects of access are available (for example see Hockin *et al.* 1992; Hill *et al.* 1997; Nisbet 2000; Saunders *et al.* 2000; Penny Anderson Associates 2001; Kirby *et al.* 2004; Woodfield & Langston 2004; Lowen *et al.* 2008) these rarely provide detailed guidance to inform policy or planning. It is often difficult for conservation practitioners or policy makers to fully understand the implications of the research, let alone see a plan or project through appropriate assessment or understand the practical measures necessary to avoid adverse effects on the integrity of a site.

1.16 Studies have shown disturbance effects for a wide range of activities besides simply people, for example aircraft (see Drewitt 1999), traffic(Reijnen, Foppen, & Veenbaas 1997), dogs (Lord, Waas, & Innes 1997; Banks & Bryant 2007) and machinery (Delaney et al. 1999; Tempel & Gutierrez 2003). There is still relatively little work on the effects of different types of water based craft and the impacts from jet skis, kite surfers, windsurfers etc (see Kirby *et al.* 2004 for a review). Some types of disturbance are clearly likely to invoke different responses. In very general terms, both distance from the source of disturbance and the scale of the disturbance (noise level, group size) will both influence the response (Delaney *et al.* 1999; Beale & Monaghan 2005). On UK estuaries and coastal sites, a review of WeBS data showed that, among the volunteer WeBS surveyors, driving of motor-vehicles and shooting were the two activities most perceived to cause disturbance (Robinson & Pollitt 2002).

1.17 Disturbance can have a variety of impacts. There are studies showing behavioural effects, such as birds changing their feeding behaviour (Fitzpatrick & Bouchez 1998; Verhulst, Oosterbeek, & Ens 2001), taking flight (Burger 1998; Blumstein et al. 2003; Fernandez-Juricic et al. 2005; Webb & Blumstein 2005) or being more vigilant (Fernandez-Juricic & Schroeder 2003; Randler 2003, 2005). Other studies have focused on physiological impacts, such as changes in the levels of stress hormones (Remage-Healey & Romero 2000; Tempel & Gutierrez 2003; Walker, Boersma, & Wingfield 2005) or heart rate (Hubert & Huppop 1993; Nimon, Schroter, & Stonehouse 1995; Weimerskirch et al. 2002).

1.18 Direct mortality resulting from disturbance has been shown in a few circumstances (Liley 1999; Yasue & Dearden 2006), for example through the accidental trampling of eggs, and many (but not all) studies have shown a reduction in breeding success where disturbance is greater (Murison 2002; Bolduc & Guillemette 2003; Ruhlen et al. 2003; Arroyo & Razin 2006). There are also many examples of otherwise suitable habitat being under-used as a result of disturbance (Gill 1996; Liley & Clarke 2003; Kaiser et al. 2006; Liley & Sutherland 2007).

1.19 Despite this large body of work, there is still contention (see Gill 2007) as it is often difficult to understand whether there is a real issue and whether disturbance is a cause of conservation concern. For example, the fact that a bird takes flight when a person approaches is to be expected and a short flight in unlikely to have a major impact on the individual in question, let alone the population as a whole. However, repeated flushing, over extended periods or in particular circumstances may have consequences for the population as a whole (West et al. 2002). Very few studies have actually placed disturbance impacts in a population context, although there are examples where the actual impact of disturbance on population size has been demonstrated (West et al. 2002; Liley & Sutherland 2007; Mallord et al. 2007; Stillman et al. 2007; Kerbiriou et al. 2009).

1.20 Many authors define a definitive distance beyond which disturbance is assumed to have no effect and this is then used to determine set-back distances or similar (Rodgers & Smith 1995, 1997; Stalmaster & Kaiser 1997; Fernandez-Juricic, Jimenez, & Lucas 2001; Fernandez-Juricic, Vaca, & Schroeder 2004; Fernandez-Juricic *et al.* 2005). It is difficult and probably inappropriate to set such distances as responses to disturbance vary between species (Blumstein *et al.* 2005) and between individuals of the same species (Beale & Monaghan 2004). Particular circumstances, such as habitat, flock size, cold weather or variations in food availability will also influence birds' abilities to respond to disturbance and hence the scale of the impact (Stillman *et al.* 2001; Rees, Bruce, & White 2005; Goss-Custard *et al.* 2006). Birds can also modify their behaviour to compensate for disturbance, for example by feeding for longer time periods (e.g. Urfi, Goss-Custard, & Lev. Dit Durell 1996). Birds can become habituated (Nisbet 2000; Kloppers, St Clair, & Hurd 2005; Walker, Dee Boersma, & Wingfield 2006; Baudains & Lloyd 2007) to particular disturbance events or types of disturbance, and this habituation can develop over short time periods (e.g. Rees *et al.* 2005). The frequency of the disturbance event will determine the extent to which birds can become habituated, and therefore the distance at which they respond.

1.21 Some authors suggest that disturbance events can be interpreted as in the context of how birds perceive the threat or perceived predation risk (Frid & Dill 2002; Beale & Monaghan 2004). Such an approach essentially views the behavioural response to disturbance as the result of a trade-of between the perceived threat from the disturbance and the cost of responding. If there is lots of competition for space and birds loose a territory when they leave it, then the cost of fleeing is likely to be high, and birds might be expected to respond to disturbance only when it is nearby and perceived to be particularly dangerous. Equally if food supplies are limited or cold weather places additional energetic demands then it might be expected that birds 'appear' tame. When food supplies are plentiful, there is little competition and alternative foraging locations exist, it would be expected that birds would respond to disturbance even when the risk is perceived to be relatively low. In such circumstances birds might fly even when the source of disturbance is some considerable distance away.

1.22 Rather than rely on set distances, it is instead necessary to consider the species' ecology, use of an area, habitat quality and other factors that may influence the scale of the disturbance. This information can then be used to identify what kinds of disturbance, at which locations, are likely to have an impact. It is important to understand the human use

of the area in detail. The spatial patterns of recreational access (both on the water and on the shore) and other disturbance (commercial shipping, industry, military training etc) are also critical to understand. Disturbance can then be understood in context. It is often necessary to understand the access patterns and recreational use in detail, through for example detailed visitor surveys, in order to determine how frequently particular activities occur, in which locations and under what conditions. Such visitor work is often the missing piece in the jigsaw as few ecologists are interested in such research (but see Clarke et al., 2008b, Liley et al., 2008, Liley et al., 2006b).

Aims and Objectives

1.23 This report was commissioned in the context that

- there have been declines in the numbers of some bird species on the Humber
- industrial and residential development is likely to increase
- there are plans to improve coastal access within the UK (see Natural England 2007, 2009)
- there are clear gaps in the reporting and monitoring of recreational use of the Humber which need to be filled to inform the management decisions as part of the Humber Management Scheme

1.24 There is a clear need for a greater understanding, and this report aims to bring together the available information relating to the issues and identify potential next steps. The report follows from an initial scoping study (Garlick 2009) and has the following objectives:

- Clarify and define what constitutes disturbance
- Collate available information to understand the range of access types that occur around the Humber
- Predict how recreational pressure may change in the future
- Identify where disturbance may currently have an adverse effect on the SPA
- Identify possible short-term management measures
- Outline further work necessary to fully understand the impact of disturbance on the SPA

2. Our Approach

2.1 We structure the report with sections that:

- Describe the bird interest (we set out the current status of the SPA interest features and set out key locations and times of year when each species is present)
- Present information on recreational use (we identify the range of different activities that take place, where and when they occur)
- Identify where disturbance occurs
- Set out issues (focusing on what might constitute an adverse effect on integrity and reviewing how access may change in the future)
- Recommendations for short term management (we set out potential measures that may resolve issues)
- Set out further research (we set out next steps needed to develop a fuller understanding of the issues relating to disturbance).

2.2 Our information has come from a range of sources. We draw heavily on information provided to us by the steering group for the contract and through direct contact with site based staff (in various organisations) around the Humber. We contacted WeBS counters and other local experts directly with a questionnaire which allowed us to develop scores for levels of use and identified activities that were known to cause disturbance. In order to inform the literature review sections searches for reference material were undertaken online (primarily using Google Scholar) and key words relating to the Humber, access, disturbance, recreation and birds. We have also drawn from work recently conducted on other estuarine sites (in particular the Suffolk Estuaries, the Solent and the Exe) to inform potential research approaches.

2.3 Data on the status and trends of key species on the Humber was drawn largely from the BTO WeBS alerts and other BTO reports. WeBS data were provided directly by the BTO; core count data for all count sections on the Humber (Map 34) for the period April 1999-March 2009 were extracted and summarised by species and by month. Bird data were plotted on a series of species specific maps to highlight key areas for each species. The maps show the mean peak scores, calculated by taking the maximum count for each section over the ten year period, and then calculating the average score from these ten values.

2.4 Maps were also generated, as far as possible, for the recreation data, using scores from the questionnaires and other information using the WeBS sectors (Map 34). The locations and scale of access infrastructure provides a useful indication of the levels and distribution of recreational use. Car-parks, jetties, marinas, slipways and other boating infrastructure were located using Ordnance Survey[1] maps (at both 1:50,000 and 1:10,000 scale), and additional checks made using aerial photographs. Marinas and car-parks were plotted as point data within the GIS and for each a capacity was estimated using aerial photographs or Google Earth. All capacities were estimated by one person (PH) and many of the access

[1] Provided under copyright by Natural England

points and their capacity were subsequently checked through site visits made over two days in early August.

2.5 The car-park data were used to construct drivetime isochrones to highlight which settlements were within a given travel time from a parking location that provided access to the SPA. Drivetime isochrones were generated using the Routeware™ add-on for MapInfo and ITN road network data provided under copyright by Natural England.

2.6 The numbers of housing at different distance bands from the SPA and within different drivetime isochrones were extracted within the GIS using Royal Mail Postzon™ data (data purchased February 2010), which gives the number of residential properties within each postcode and provides the postcode data as point data (100m accuracy).

2.7 The various maps are provided as a separate annex to this report and provide a means of directly comparing the assembled information on bird distributions and recreational use. All GIS data and maps were generated using MapInfo™ (version 10.5).

Consultation process – WeBS and other local experts questionnaires

2.8 A questionnaire was sent to 40 WeBS counters via the BTO and a similar questionnaire was sent to 27 additional people including Humber Advisory Group members, local experts and site and area managers in the Humber area with a request to circulate the document to any other useful contacts. The questionnaire was designed to identify the issues that WeBS counters and local experts perceived to be the major threats and how these have changed over the time that they have been counting for WeBS or been familiar with the Humber. All data collected on activities and disturbance were collected by WeBS sectors to enable mapping of the data (Map 34).

2.9 The questionnaire asked which recreational activities caused disturbance (i.e. flushing birds) in their WeBS sectors that they are familiar with. Information about shore-based, water-based and air-borne activities such as dog walking, horse riding, angling, wildfowling, boating and pleasure aircraft etc. was requested. Respondents were asked to score the types of recreational activity and disturbance in each sector (from 0, indicating that the activity does not take place, to 6, indicating that the activity occurs very frequently) in order to gain more detail about the relative intensity of the different activities around the Humber. Respondents were also asked to score the intensity of different recreational activities by month and free text questions were asked regarding any other issues and suggestions for managing problematic disturbance.

2.10 Maps have been generated using the questionnaire data to show the total scores for the frequency of shore-based, water-based and air-borne activities combined and mapped by WeBS sectors. Similarly the total counts of respondents witnessing activities causing disturbance to birds have been mapped and presented as a combination of shore-based, water-based and air-borne activities. The mean frequency score for a suite of key activities within each WeBS sector has been presented in a series of maps.

3. Overview of the Humber

Introduction

3.1 This report focuses on recreational disturbance, but it is necessary to consider disturbance in context with the other issues on the estuary. In this section we provide an overview of the habitats present, the current condition of the SSSI, summarise the various issues currently affecting the site and summarise the levels of residential development around the estuary.

Description of the Estuary

3.2 The Humber Estuary is one of the largest estuaries in the UK and drains around 20% of the total land surface of England (English Nature 2003). Detailed descriptions of the estuary, it's geology and habitats are provided by a variety of sources (English Nature , 2003; Allen et al. 2003; Edwards & Winn 2006; Hemingway et al. 2008).

3.3 The intertidal habitats are largely comprised of soft silty clay apart from the outer part of the south bank where the intertidal area is predominantly sandy. There are no natural rocky outcrops, except where the Humber Bridge is situated on the chalk of the Lincolnshire and Yorkshire Wolds. The bridge represents the first crossing point and the suspension bridge, spanning 1.41km is a major landmark on the estuary. Construction on the bridge started in 1973 and the bridge opened for traffic in 1981[2].

3.4 In the outer estuary, the Spurn Head forms a conspicuous spit protruding 8km into the mouth of the estuary from the north. Spurn Head is comprised mainly of sand dunes, which protect extensive mudflats (Spurn Bight) inside the estuary.

3.5 Much of the dynamic nature of the estuary is constrained by sea defences along almost its entire length, with these structures restricting the development of intertidal mudflats and saltmarsh. Possibly the most dynamic section of the estuary is the inner reach between the Humber Bridge and Trent Falls where there are frequent channel migrations around Read's Island. The sea defences enclose much of the estuary and industrial complexes such as chemical works, oil refinery complexes and power stations dominate areas of its shores.

Current Condition

3.6 Here we describe the current condition of the Humber SPA based on the SSSI condition assessments. Condition assessments for the Humber SSSI units date from April 2000 to March 2010. Habitat condition assessment is being carried out this summer (2010) and data were not available for this report. Furthermore a desk based assessment will be undertaken in the near future to assess the bird population attributes of the SPA for the first time.

3.7 Across all SSSI units in the SPA 98.92% are favourable condition (93.80%) or in unfavourable and recovering condition (5.12%). The remainder of the site is unfavourable no change (0.18%) and unfavourable declining (0.89%). Here we consider the remaining

[2] http://www.humberbridge.co.uk/explore.php

area of the SPA which does not meet the PSA target based on issues relating to recreational access.

3.8 There are two standing open water canal SSSI units located at Barton and Barrow clay pits where fly tipping and excess litter is an issue. In the Barton and Barrow area the condition assessment cites high disturbance due to water sports activity. There are units in this area where fish stocking and un-consented fishing is noted as the reason for adverse condition assessment. Overgrazing by horses combined with the creation of horse jumps means that 9.52ha of grazing marsh at Easington is in unfavourable condition with no change in the recent assessment. There is a small area of relict dune behind the Discovery Centre in Cleethorpes which experiences high disturbance from recreational activities from the surrounding car park, light railway and visitor centre. There are some desire lines across the site and some litter. The site is now cut for hay under the management of North East Lincolnshire Council.

Port and Industrial Use

3.9 The Humber Estuary is a busy commercial waterway. The estuary has the UK's largest port complex, with over 91m tonnes of cargo handled in 2006 (Edwards 2008). Associated with the ports are large industrial complexes, particularly chemicals, oil refining, iron and steel, and food processing.

Local Human Population Size and Distribution of Housing in Relation to the SPA

3.10 The number of houses surrounding sites can be a good indicator of recreational pressure (e.g. Liley, Clarke, Mallord, *et al.* 2006; Liley, Clarke, Underhill-Day, *et al.* 2006). The number of houses surrounding the Humber, at different distances, is summarised in Figure 1. The graph splits the north and south shore, with essentially semi-circular buffers being drawn within the GIS from the centre of the estuary. Within 50km there are more houses surrounding the south shore (a total of 994,481 properties) compared to the north (a total of 615,723). Taking a cut-off point of 25km from the shore there is also more housing around the south rather than the north shore (281,165 properties compared to 241,150 properties). At the very close distance bands however it appears that the north shore has more people living nearby, as within 5km there are a total of 126,222 properties, compared to 95,093 properties within 5km of the south shore.

3.11 These figures can be put into context by comparisons with visitor survey results in other areas. For example results from visitor work at conducted at a selection of estuarine SPAs in southern England in the winter 09/10 (Footprint Ecology *in prep*) involved 784 interviews with visitors, and all were asked for their home postcode. Straight line distances were calculated between each home postcode and the interview location. Median distances (i.e. 50% of interviewees' home postcodes fell within the given distance) for each activity undertaken were 48km for boating (5 interviews), 10km for fishing (8 interviews), 10km for kite surfing (1 interview), 2.7km for walking (404 interviews) and 1.2 km for dog walking (289 interviews).

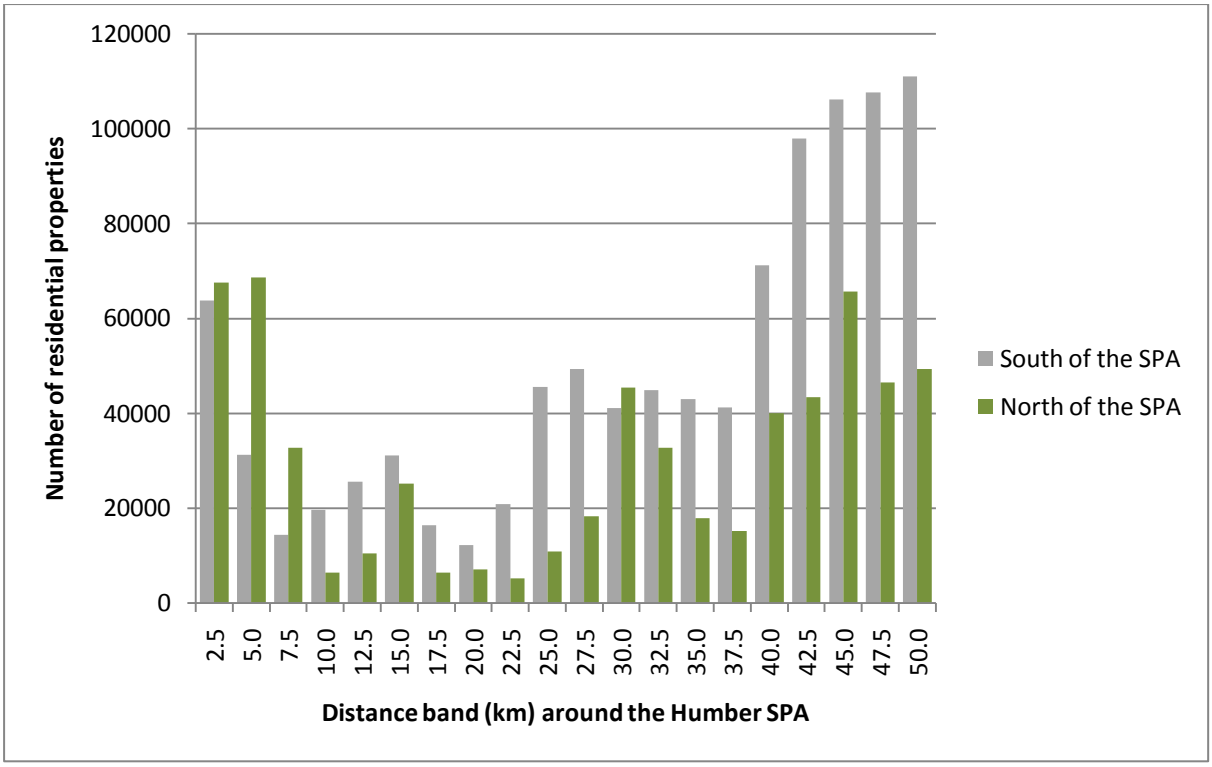

Figure 1: Numbers of houses at different distance bands from the Humber SPA. Housing data extracted from postcode data giving the number of residential properties per postcode. Data extracted using bands of 2.5km.

3.12 Table 2 shows the extent of housing within 5km and 25km for a range of SPA estuaries in England as derived from residential postcode delivery point data. The Humber is the 3rd largest SPA unit by area, 4th longest by perimeter length and in terms of density of housing the Humber is the 3rd highest in terms of housing within 25km of the SPA boundary which extends out to Doncaster, York, Pontefract and Skegness. However when looking at the density of housing within a 5km area around the SPA, the Humber comes 13th out of 27 estuaries. The number of delivery points within 5km of the SPA boundary per hectare of the SPA demonstrates the low level of housing around the Humber relative to the size, and might indicate that recreational disturbance may be less of an issue on the Humber compared to other sites. For example, the Humber is eight times the size of the Thames Estuary and Marshes SPA by area but with half the density of housing within 5km of the SPA boundary.

3.13 However it should also be noted that whilst the Humber is a large SPA, the housing surrounding the estuary is concentrated within larger settlements (Cleethorpes, Mablethorpe, Grimsby and Kingston-upon-Hull). This may indicate that certain areas of the estuary will receive high levels of recreation and other areas may be relatively quiet.

Summary

3.14 The Humber is a particularly large estuary and there are a range of other issues besides disturbance that may affect bird numbers and distribution. Most of the SSSI is considered by Natural England to be in favourable condition, but for those units in unfavourable condition recreational use and disturbance is an issue.

3.15 The north shore of the Humber has more housing than the south shore, within 5km of the centre of the estuary. Looking wider, the south shore has higher numbers of housing at greater distances, particularly beyond 25km from the centre of the estuary. This may indicate that the north shore may have localised areas of high disturbance, particularly around Kingston-upon-Hull, where most of the housing is concentrated. The south shore is within a typical day-trip of a greater number of households.

3.16 Compared to other estuarine SPAs within the UK the Humber has a relatively high number of houses within 5km of the shoreline, potentially indicating that the number of visitors could be high in comparison to other sites (assuming visitor rates per household to be roughly equivalent around the country). However per unit area or per length of shoreline the number of houses appears relatively low compared to other estuaries, highlighting the width of the estuary and the extensive areas of intertidal habitats.

Table 2: Number of residential delivery points within 5km and 25km of SPA estuaries in England displayed as a ratio of the number of residential delivery points to perimeter length of the estuary and the area of the estuary (ordered by the number of properties within 5km per hectare of the SPA unit).

SPA name	SPA area (hectare)	SPA perimeter length (km)	Number of residential delivery points within 5km	Number of residential delivery points within 5km per km of shore	Number of residential delivery points within 5km per ha of estuary	Number of residential delivery points within 25km	Number of residential delivery points within 25km per km of shore	Number of residential delivery points within 25km per ha of estuary
Portsmouth Harbour	1246.23	51.97	555874	10695.31	446.04	162036	3117.66	130.02
Crouch and Roach Estuaries	1738.73	196.35	554049	2821.77	318.65	113924	580.21	65.52
Thames Estuary & Marshes	4785.48	144.08	1122608	7791.67	234.59	92003	638.56	19.23
Mersey Estuary	5007.06	211.6	1100181	5199.47	219.73	265512	1254.81	53.03
Pagham Harbour	2700.04	62.01	539065	8692.83	199.65	168190	2712.19	62.29
Deben Estuary	976.991	45.64	186800	4092.86	191.2	30786	674.53	31.51
Breydon Water	1198.43	34.04	220340	6472.78	183.86	35858	1053.38	29.92
Medway Estuary and Marshes	4669.59	213.95	685620	3204.61	146.83	113005	528.19	24.2
Solent and Southampton Water	5387.03	433.42	784300	1809.56	145.59	303880	701.12	56.41
Poole Harbour	2307.64	272.11	291479	1071.18	126.31	91836	337.49	39.8
Chichester and Langstone	3722.3	94.18	432705	4594.48	116.25	70978	753.65	19.07
Dengie	3122.05	43.03	339037	7878.66	108.59	5706	132.6	1.83
Exe Estuary	2360.18	42.98	251056	5841.6	106.37	76047	1769.47	32.22
Tamar Estuaries Complex	1938.79	113.73	190601	1675.91	98.31	96090	844.9	49.56
Ribble & Alt Estuaries	12408.29	147.89	1164826	7876.41	93.87	205570	1390.04	16.57
Colne Estuary	2709.42	159.82	253629	1586.99	93.61	44044	275.59	16.26
Stour and Orwell Estuaries	3657.83	93.76	309205	3297.89	84.53	98464	1050.19	26.92
The Swale	6485.77	132.66	544364	4103.58	83.93	69503	523.93	10.72
Alde-Ore Estuary	2393.13	98.91	159730	1614.97	66.75	9617	97.23	4.02
The Dee Estuary	11989.51	72.16	794650	11012.82	66.28	74013	1025.72	6.17
Severn Estuary	17550.2	360.31	1069442	2968.12	60.94	150479	417.64	8.57
Foulness	10900.86	279.75	507842	1815.32	46.59	34953	124.94	3.21
Humber Estuary	**37494.12**	**284.3**	**522313**	**1837.2**	**13.93**	**231315**	**813.63**	**6.17**
Morecambe Bay	36858.51	461.21	457222	991.35	12.4	169233	366.93	4.59
Duddon Estuary	6756.03	94.54	80891	855.66	11.97	38461	406.84	5.69
Upper Solway Flats & Marshes	43493.81	187.56	142031	757.24	3.27	26975	143.82	0.62
The Wash	61817.21	122.35	187047	1528.76	3.03	43889	358.71	0.71

4. Bird Interest

Introduction

4.1 In this section we provide an overview of the ecology, distribution and status of the bird species of interest. We provide a brief summary of the evidence for disturbance effects for each species and then synthesise the information to highlight which species are vulnerable to disturbance and in what circumstances.

Overview of Bird Interest

4.2 Detailed accounts of the bird interest of the Humber are provided in Allen *et al.* (2003) and English Nature (2003).

Wintering and Passage Waders

4.3 Extensive areas of intertidal flats are found throughout the Humber and support dense populations of intertidal invertebrates which are a crucial food source for several of the Annex I species. In general, more sheltered areas with soft mud (i.e. a high silt content) support a richer biomass – for example the flats behind Spurn Head along from Kilsea to Paull. This high biomass of invertebrates includes key species such as mudsnails *Hydrobia ulvae*, cockles *Cerastoderma edule*, marine worms such as ragworms *Nereis diversicolor* and lugworms *Arenicola marina* and crustaceans such as *Corophium volutator*.

4.4 The use of intertidal flats and choice of substrates varies between species. Golden plover are very mobile and major concentrations occur in the inner estuary, although large numbers also occur east of the Humber Bridge, particularly around Saltend to Sunk Island, where flocks have contained in excess of 10,000 birds (English Nature 2003). The intertidal flats close to the RSPB reserve at Tetney Marshes also support large flocks of roosting golden plover and more recently large numbers have been recorded at Spurn (e.g. a count of 10,000 in December 2004, Neal 2007).

4.5 Bar-tailed godwits occur almost exclusively on the outer estuary, although smaller numbers are found around Whitton Sands, Reads Island and Barton and Barrow Claypits. Ringed plover, grey plover, redshank and dunlin feed throughout the estuary on marine polychaete worms, crustaceans and molluscs such as the Baltic tellin *Macoma balthica*. They favour areas that have abundant invertebrate prey species such as Tetney Marshes. Sanderling tend to occur on sandy substrates and feed at the water's edge, and are largely restricted to the outer southern shore of the estuary. Large numbers are found from Humberston to Cleethorpes, at Tetney Marshes and along the northern shore of Spurn Peninsula. Knot also feed on the outer estuary, although they will move further inshore during periods of severe weather. The intertidal sandflats of Cleethorpes are an important feeding area for sanderling and knot during the winter (English Nature 2003).

4.6 Oystercatchers mainly feed on shellfish such as cockles, oysters and mussels, and also marine worms and crustaceans. They feed predominantly on the outer estuary, around Spurn Bight and along the north Lincolnshire coast. Black-tailed godwit and curlew also feed on the invertebrates in the intertidal mudflats. The Pyewipe frontage is of key

importance as a feeding and roosting area for black-tailed godwit, although smaller numbers also feed at Immingham docks.

4.7 The saltmarshes throughout the estuary provide an important communal roosting site for many waders such as redshank, dunlin, grey plover, knot and lapwing. The saltmarshes at Tetney and Grainthorpe Havens, Pye Hall, Skidbrooke to Saltfleet and Saltfleetby to Theddlethorpe are all important. In addition, Donna Nook is of particular importance on very high spring tides when Tetney and Grainthorpe are completely covered by water. Golden plover and bar-tailed godwit may also utilise the lagoons such as those on Read's Island as a high tide roost.

Wintering Waterfowl

4.8 Shelduck feed in groups on the mid to outer estuary where there are extensive areas of intertidal flats. Large numbers of moulting shelduck are also found on the estuary during July and August. They are concentrated to the west of the Humber Bridge, particularly around Whitton Sands and Brough.

4.9 A mixture of grain and feedstuff are spilt into the estuary during the handling procedure at New Holland Jetty and this has resulted in a number of species exploiting this artificial food source. Mallard and several species of diving duck (pochard, goldeneye and scaup) feed here. These species will also feed close to Goxhill Skitter. The pochard and goldeneye feed on a falling tide and then roost and loaf on the ebbing water, drifting down as far as Immingham docks and Pyewipe (English Nature 2003). These diving ducks will utilise habitats of varying salinity, although scaup are the most marine species. They feed at night, predominantly on mussels, although they also feed where there are artificially high densities of food, such as those found around sewage outfalls. On the Humber, they gather in large flocks to feed around Spurn Bight.

4.10 Dark-bellied brent geese feed over mudflats rich in Zostera, *Enteromorpha* and less frequently other green plants. The geese occur almost exclusively on the outer estuary, principally along the southern shore from Cleethorpes to Saltfleetby with lesser numbers on Sunk Island and Spurn Bight where there are areas of dwarf eelgrass beds *Zostera noltei*. Brent geese will also feed and roost on inland areas, on fields of pastures, cereals and oilseed rape. Wigeon and pochard also feed on plant material, using mostly maritime habitats during the winter, especially where there are extensive areas of intertidal muds and sands.

Other Wintering Species: Bittern and Hen Harrier

4.11 Bitterns will tend to winter in areas with reedbeds and open water, utilising areas where they breed and also often other locations with smaller reedbeds. Key sites for the species on the Humber include Blacktoft Sands and Far Ings.

4.12 The wintering population of hen harrier will use reedbeds as roost sites, favouring the south bank of the inner estuary, although they are also seen in the dune slacks on the north Lincolnshire coast and at Humberston Fitties. Wintering birds may roam widely and will hunt over farmland, reebeds and saltmarsh.

Breeding Species

4.13 A pair of marsh harriers bred in the reedbeds at Blacktoft or Broomfleet in the years 1963-66. These are the first known records this century. There were sporadic records of birds breeding during the 70s and 80s in the Blacktoft Sands reedbeds with more regular breeding attempts each year from the late eighties. In 1995, a national survey recorded 10 pairs breeding and a possible additional pair around the Humber, with 6 and a the possible additional pair at Blacktoft, two pairs in reedbeds on the north side of the Humber, one on the south and a further pair on Read's Island. In that year ten successful pairs fledged 28 young. In the years leading up to the first national survey, harriers were still subjected to persecution with at least three nests robbed of eggs, poisoning of an adult bird and a brood of young birds taken in Lincolnshire between the years 1985 and 1994.

4.14 The next national survey in 2005, recorded 25 pairs around the Humber of which 18 were successful, fledging at least 50 young. The outcome of a further two nests was unknown, 3 nests failed during incubation, and two after hatching. There were no records of persecution in that year. The distribution of nests is shown Map 4 with four pairs on the RSPB reserves at Blacktoft Sands and Read's Island and two pairs at the Lincolnshire Wildlife Trust reserve at Far Ings. Of the remaining pairs, nine were on or close to the south shore of the Humber in North Lincolnshire and the remaining 10 were on or close to the north shore in East Yorkshire.

4.15 Little terns are summer migrants, arriving in April/May and present through into the autumn. The species can breed in loose colonies on open sandy/shingly beaches. In the past there have been five regular little tern breeding colonies on the Humber, with the main one at Easington lagoons, where the colony is wardened and protected. A total of 26 pairs bred at Easington in 2009, but no young were raised (see detailed account of the 2009 season in Roadhouse 2010). Other locations have included areas of sand at Donna Nook, Tetney, Spurn Point and Saltfleetby to Theddlethorpe dunes. None of these locations raised any young in 2008: there were three scrapes made at Spurn which were washed out by the tide (Thomas 2010) and no breeding attempts at all recorded along the south shore (Lincolnshire Bird Club 2010).

Identifying key areas and times of year when birds are present

4.16 WeBS data are summarised in Maps 5 – 25 which highlight which areas are important for each species. Appendix 1 gives the maximum counts for each section for each species, and also highlights key sections for each species. The maps and tables are derived from the WeBS core count data, collected around high tide. At low tide birds will disperse widely and are particularly difficult to count on the Humber, given the huge expanse of intertidal habitat. Low tide data are for the Humber are summarised by Mander and Cutts (2005). In addition detailed accounts of individual roost sites are given in Mander, Cutts and Thomson (2006).

4.17 In Figure 2 and Figure 3 we show how bird numbers vary over time. Numbers of birds peak in mid winter (November and January being the months with the highest mean counts) and are at their lowest in June (Figure 2). Numbers of waders and wildfowl build fairly steadily

through the autumn, from June through to October, and then decline sharply after January.

4.18 Data for individual species show varying patterns over the year (Figure 3). Wader numbers can be high in the spring and autumn, especially for some species, while wildfowl tend to be present for the mid winter period only.

4.19 For example black-tailed godwit numbers peak in August and September and then decline, whereas Ringed Plover and Sanderling tend to have two peaks, coinciding with spring (May) and Autumn (August) passage. Dunlin numbers show a relatively flat pattern throughout the year, with only June holding relatively low numbers.

4.20 Wildfowl, such as wigeon and dark-bellied brent goose, peak in the mid winter and tend to remain high throughout the winter period, but with very small or no birds present in the early autumn. Brent geese numbers fall markedly in March whereas wigeon numbers tend to remain relatively high at this time. Goldeneye show a single peak in January.

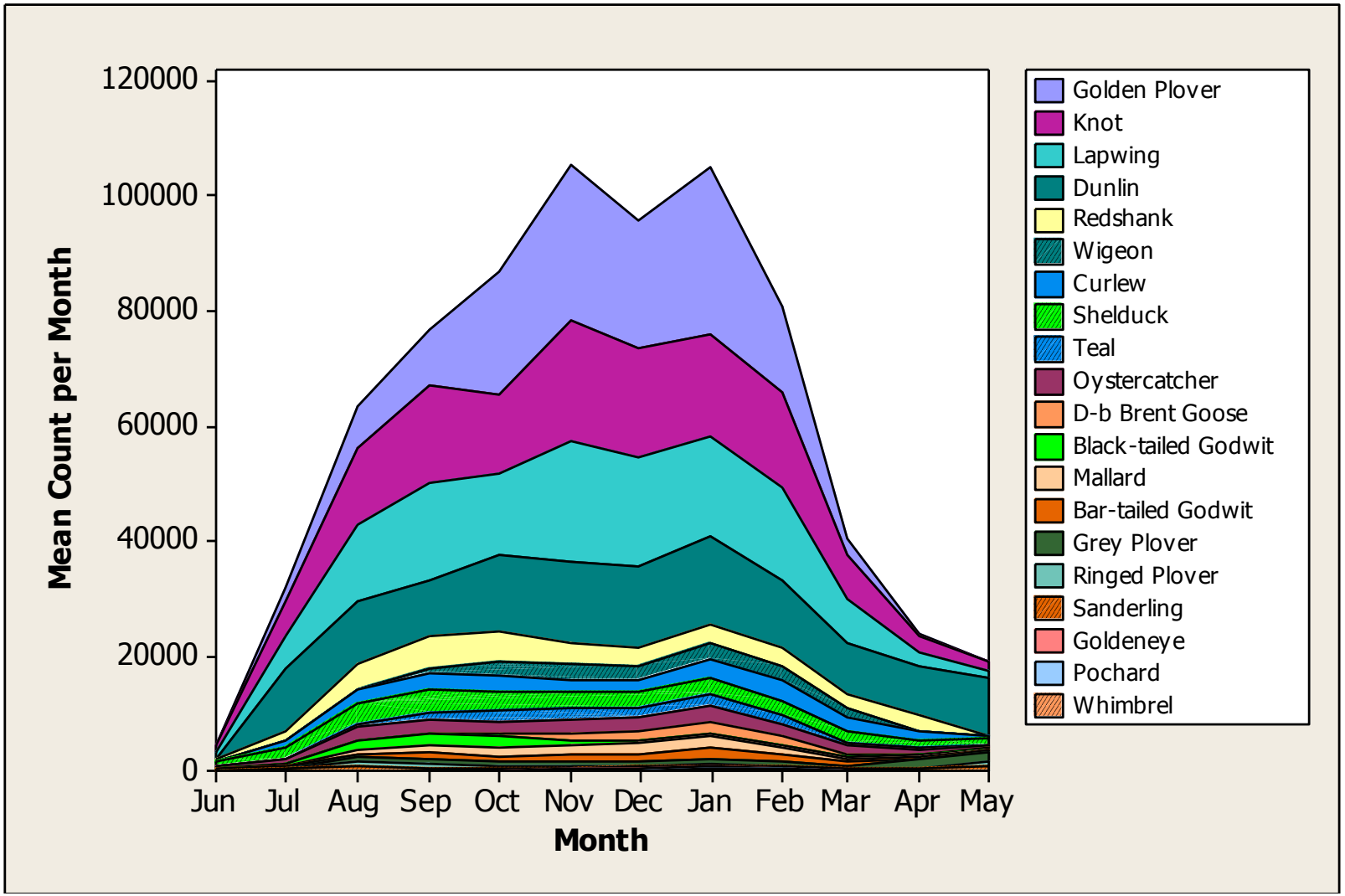

Figure 2: Mean monthly values for selected wader and wildfowl species on the Humber for the period 1999 – 2009.

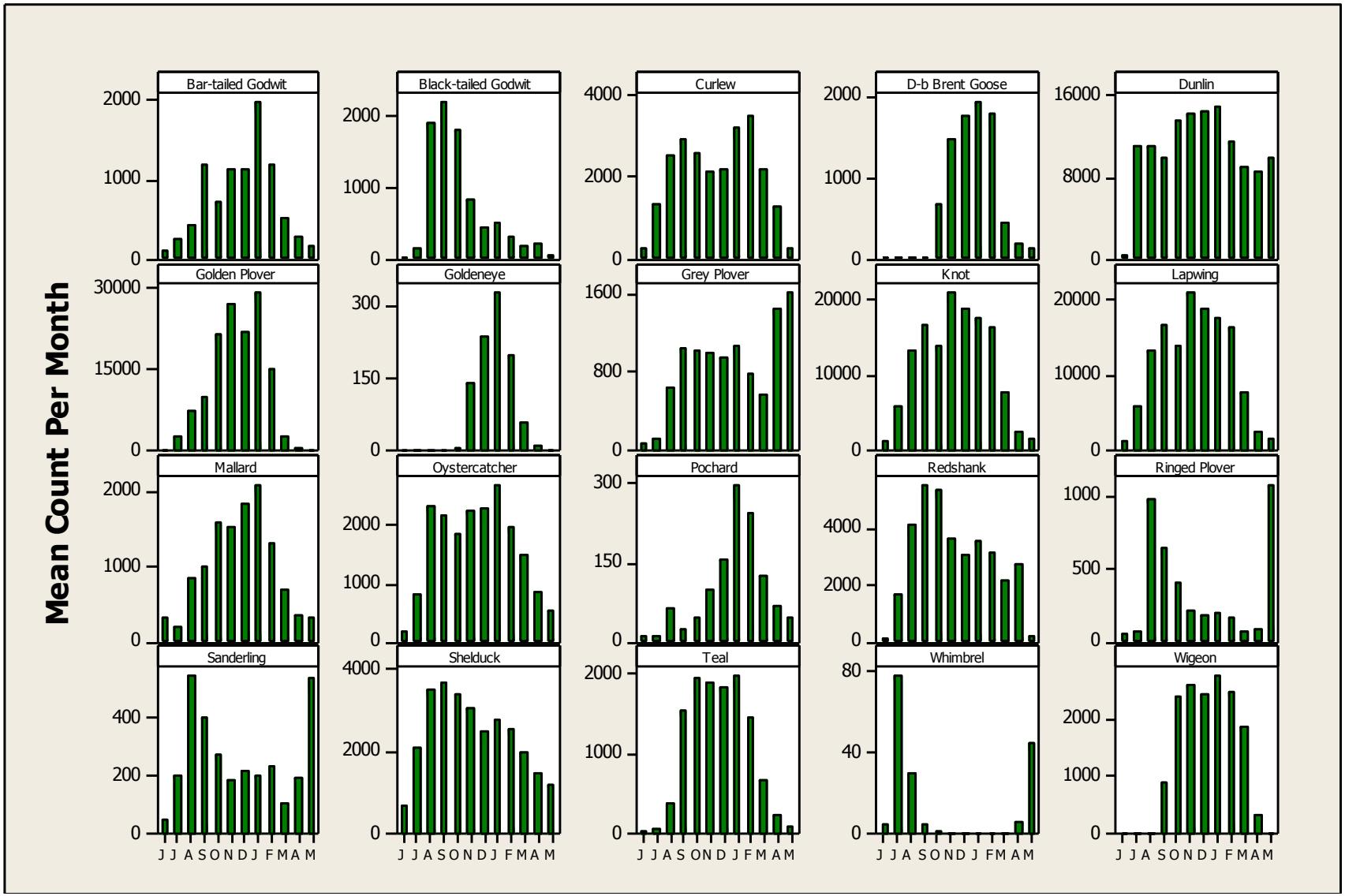

Figure 3: Mean values per month for selected wader and wildfowl species on the Humber for the period 1999 – 2009, shown on individual panels.

Status of key bird species

4.21 Overall in the UK, most coastal waterbird species and particularly waders have remained fairly stable or have increased in recent years (Maclean & Austin 2008, 2009). However, there are some general patterns. For example, numbers on the south-west coasts of Britain have either tended to decrease (or increase less) than numbers on the east coast, particularly in eastern England (Essex, Suffolk,Norfolk and Lincolnshire). While the extent and distribution of intertidal habitat has not changed markedly during this period, there have been clear climatic trends, including those towards milder winters throughout Britain (Maclean & Austin 2009).

4.22 Detailed analysis of WeBS data have been conducted to determine bird trends on the Humber by the BTO (Austin *et al*. 2008). Austin *et al.* generated smoothed population trends for the 15 year period 1991/2 – 2006/7, for each of 23 waterfowl species. For each species the importance of each sector in relation to the whole estuary population was determined, and sections that had significant changes in importance over time where highlighted. Over the whole estuary, numbers of mallard, oystercatcher and dunlin had declined. A number of species had also increased, but for one at least (golden plover) the increases were less than the increases within the region as a whole. The analyses highlighted that most wader species and shelduck had declined across a wide geographical area from Pyewipe to the eastern end of the estuary.

4.23 WeBS alerts are calculated by the BTO and identify (at a series of different spatial scales) species that have undergone major declines in numbers. The data for individual SPAs and full details of the methods are published on the web[3].

4.24 For the Humber alerts have been issued for ten species (Table 3), three of which qualify for high alerts (declines exceeding 50%) and the other seven for medium alerts (declines exceeding 25%). For two species (bar-tailed godwit and redshank) the medium alert has some caution attached to it, as the degree of change could be within the normal range of a 'healthy population'.

[3] http://www.bto.org/webs/alerts/

Table 3: Summary of WeBS alert data for the Humber SPA. Colours reflect medium (orange) and high (red) alerts. Parentheses indicate caution as the change could be expected for a 'healthy population' of the species. Table summarised from http://www.bto.org/webs/alerts/alerts2010/Results/UK9006111/siteaccount.pdf

Species	First Winter	Reference Winter	Short-term % change	Medium-term % change	Long-term % change	% change since designation	Alert status
D-b Brent Goose	81/82	06/07	42	20	112	15	
Shelduck	81/82	06/07	21	8	11	26	
Wigeon	81/82	06/07	-11	-21	**-48**	**-28**	Medium alert long term Medium alert since designation
Teal	81/82	06/07	-12	69	-14	69	
Mallard	81/82	06/07	-19	-13	**-67**	**-26**	High alert long term Medium alert since designation
Pochard	81/82	06/07	32	-72	177	**-64**	High alert medium term; High alert since designation
Goldeneye	81/82	06/07	-11	-18	558	4	
Cormorant	88/89	06/07	-2	4	47	1	
Oystercatcher	81/82	06/07	-18	-21	-20	**-25**	Medium alert since designation
Ringed Plover	81/82	06/07	**-41**	**-35**	-2	**-27**	(Medium alert short term) Medium alert medium term Medium alert since designation
Golden Plover	81/82	06/07	25	31	644	18	
Grey Plover	81/82	06/07	31	6	367	29	
Lapwing	81/82	06/07	5	**-27**	122	**-53**	High alert since designation Medium alert medium term
Knot	81/82	06/07	-4	28	14	19	
Sanderling	81/82	06/07	**-26**	**-29**	-2	**-41**	(Medium alert short term) Medium alert medium term Medium alert since designation
Dunlin	81/82	06/07	-21	**-33**	**-29**	**-28**	Medium alert medium term Medium alert long term Medium alert since designation
Black-tailed Godwit	82/83	06/07	129	244	2240	1363	
Bar-tailed Godwit	81/82	06/07	**-40**	-5	118	45	(Medium alert short term)
Curlew	81/82	06/07	6	53	115	77	
Redshank	81/82	06/07	**-30**	-21	45	-13	(Medium alert short term)

4.25 The decline in mallard numbers is discussed by English Nature (English Nature 2003), which identified that the distribution had also changed on the estuary, shifting from the inner estuary to the outer north shore.

4.26 Wintering hen harriers have also been declining over recent years, with for example roosting birds present at Blacktoft Sands on just 16 dates between January and April 2008 (Thomas 2010).

4.27 The two breeding species of interest, marsh harrier and little tern, have shown markedly different trends in recent years. A characteristic feature of little tern colonies is that they tend to be transitory with the birds responding to habitat change (they tend to nest in areas with particularly dynamic coastlines), changing food supplies, disturbance, predation or other factors (Brown & Grice 2005). The transitory nature of colonies means that an overall assessment of change is difficult, however the national data (national censuses began in the late 1960s) show a marked decline and a tendency for birds to congregate within fewer, larger colonies (Brown & Grice 2005). Marsh harriers by contrast have been increasing nationally over the past 40 or so years, and in all areas of the UK numbers have been rising steadily such that the current population is possibly the largest in at least 200 years (Brown & Grice 2005).

Vulnerability' to Disturbance

4.28 In Table 4 we provide an overview of the interest features of the SPA, and we summarise key areas for each species and provide a summary of evidence for disturbance impacts to each species. There are a limited number of species specific studies, and the literature provides some evidence of disturbance impacts for most waders and wildfowl species. It is difficult therefore to single out any particular species of waders or wildfowl that may be particularly vulnerable. Of particular note is however little tern, for which disturbance has been widely implicated in population declines.

Table 4: Key species within the SPA and a summary of where they occur, when and evidence of impacts of disturbance. Key locations are WeBS sectors that have the the highest counts in the past 10 years (core count data, see Appendix 1).

Species	Key WeBS sectors / locations	Times of year when numbers peak on Humber	Evidence for disturbance impacts from general literature (not Humber specific)
Bar-tailed Godwit	38441, 38442, 38443	Sept - Feb, marked peak in Jan	There are many general papers on waders and disturbance and strong evidence of behavioural responses but relatively little work directly on this species (Davidson *et al*. 1993; Hirons & Thomas 1993; Kirby, Clee, & Seager 1993; Smit & Visser 1993; Fitzpatrick & Bouchez 1998; Burton *et al.* 2002; Ravenscroft *et al.* 2008).
Bittern	38409, 38414, 38415, 38430		Widely considered to be sensitive to disturbance: and very rare in the UK. Access adjacent to reedbeds, especially on raised banks, might displace breeding and wintering birds. Little evidence in the literature of disturbance effects, but believed to be an issue (Underhill-Day & Wilson 1978)
Black-tailed Godwit	38201, 38405, 38440,	July, August, September	Limited evidence for any impacts of disturbance on populations / carrying capacity of UK estuaries during the winter (Gill, Norris, & Sutherland 2001; West *et al.* 2007), but some evidence of avoidance of areas close to footpaths (Burton *et al.* 2002)
Cormorant	35480, 35483,		Most studies focus on breeding colonies (see Nisbet 2000)
Curlew	38441, 38442, 38443	August - March	A variety of studies show behavioural effects of disturbance to wintering birds (e.g. Fitzpatrick & Bouchez 1998).
Dark-bellied Brent Goose	35481, 35485, 38444	Oct - Feb	A number of studies showing range of impacts (Owens 1977; Stock 1993; McKay *et al.* 1996; Riddington 1996)
Dunlin	38441, 38442, 38443	July - April	Evidence of disturbance during breeding season and winter (Burton, Rehfisch, & Clark 2002; Burton *et al.* 2002; Finney 2004; Pearce-Higgins *et al.* 2007))
Golden Plover	38430, 38440, 38441	Oct - Feb	Plenty of literature on impacts of disturbance to breeding birds (see Natural England 2007, 2009) but little work on wintering birds on estuaries.
Goldeneye	38411, 38412, 38414	Nov - Dec	Disturbance impacts probably similar to other wildfowl (see Kirby *et al.* 2004 for a review)
Grey Plover	38441, 38442, 38443	Sept - May	There are many general papers on waders and disturbance and strong evidence of behavioural responses but relatively little work directly on this species (Davidson *et al*. 1993; Hirons & Thomas 1993; Kirby, Clee, & Seager 1993; Smit & Visser 1993; Fitzpatrick & Bouchez 1998;

Species	Key WeBS sectors / locations	Times of year when numbers peak on Humber	Evidence for disturbance impacts from general literature (not Humber specific)
			Burton *et al.* 2002; Ravenscroft *et al.* 2008). This species is territorial in winter (Turpie 1995) and this means disturbance can have particular consequences.
Knot	38401, 38443, 38444	Aug - Feb	Tends to concentrate in large roosts and avoids sites with high levels of boat activity nearby (Peters & Otis 2007); Avoids areas close to footpaths (Burton *et al.* 2002).
Lapwing	38430, 38432, 38441	Aug - Feb	Relatively little evidence that disturbance is an issue during the breeding season (Fletcher, Warren, & Baines 2005) or the winter (Milsom et al. 1998)
Little Tern	38443		Colonial breeder – usually associated with beaches and known to be adversely affected by recreational access, disturbance, nest trampling and predation (Gochfeld 1983; Calado 1996; Catry *et al.* 2004; Medeirosa *et al.* 2007)
Mallard	38430, 38441, 38442	Oct - Feb	A variety of studies show disturbance impacts to wildfowl (see Kirby *et al.* 2004 for a review) and show behavioural responses to disturbance. One study shows that distribution of this species is affected by presence of anglers (Cryer *et al.* 1987)
Oystercatcher	35478, 35485, 38444	Aug - Feb	There are a very wide range of disturbance studies, many of which are on breeding birds. One of the best researched species. Disturbance impacts linked to quality and availability of food (Goss-Custard & Verboven 1993; Fitzpatrick & Bouchez 1998; Verboven, Ens, & Dechesne 2001; Verhulst et al. 2001; Stillman & Goss-Custard 2002; West et al. 2002; Goss-Custard et al. 2006)
Pochard	38412, 38433	Dec - Mar	A variety of studies show disturbance impacts to wildfowl (see Kirby *et al.* 2004 for a review) and show behavioural responses to disturbance. There are a range of studies showing disturbance impacts (Cryer *et al.* 1987; Fox *et al.* 1994; Marsden 2000; Mori *et al.* 2001; O'Connell *et al.* 2007)
Redshank	38201, 38441,	Aug - Apr	Evidence of avoidance of areas of suitable habitat close to sources of disturbance (Burton et al. 2002; Burton et al. 2002) and also some evidence for use of nocturnal use of some sites where disturbance higher (Burton & Armitage 2005)
Ringed Plover	38418, 38441, 38444	Aug - Sept and May	Clear population consequences of recreational disturbance for this species and other beach nesting plovers (Flemming et al. 1988; Burger 1991; Schulz & Stock 1993; Burger, Gochfeld, & Niles 1995; Liley 1999; Ruhlen et al. 2003; Baudains & Lloyd 2007; Liley & Sutherland 2007), but

Species	Key WeBS sectors / locations	Times of year when numbers peak on Humber	Evidence for disturbance impacts from general literature (not Humber specific)
			relatively little work on non-breeding birds (but Lafferty 2001a see)
Sanderling	38401, 38444	Aug - Sept and May	Disturbance can reduce time birds spend foraging and dogs off leads a particular issue (Burger & Gochfeld 1991; Thomas, Kvitek, & Bretz 2003)
Shelduck	35478, 35483, 38405, 38418, 38432, 38441, 38442, 38443, 38444, 38921	Aug - Feb	Densities on estuaries in winter shown to be lower close to footpaths (Burton et al. 2002). Nesting birds prone to desert if disturbed (Crick, Dudley, & Glue 2003)
Teal	38418, 38430, 38921	Sep - Feb	A variety of studies show disturbance impacts to wildfowl (see Kirby *et al.* 2004 for a review) and show behavioural responses to disturbance. Evidence of a behavioural response to disturbance (Pease, Rose, & Butler 2005)
Whimbrel	35480, 38443, 38444	July	Passage migrant, disturbance unlikely to be an issues and little evidence in the literature of disturbance impacts (e.g. Lafferty 2001b)
Wigeon	38419, 38430, 38432	Oct - Mar	Literature includes evidence of impacts from bait digging and angling (Cryer et al. 1987; Townshend & O'Connor 1993; Madsen 1998; Pease et al. 2005).

Summary

4.29 The SPA designation includes a wide range of species, associated with a range of habitats, locations and that occur on the Humber at different times of the year.

4.30 We summarise data relating to the distribution and status of key species, and the maps provide a means of directly comparing access data and bird data. Numbers of wintering birds peak in mid winter, November – January, and this is the time when there may the most competition for resources.

4.31 A number of the interest features of the SPA, including wintering/passage waders, wintering wildfowl, wintering hen harrier and little tern have all shown marked declines within the area. Many of these species are vulnerable to disturbance and there is evidence from other sites showing impacts from disturbance. Little terns are particularly vulnerable as breeding species. Ten species of wintering wildfowl and waders have been highlighted by the BTO through the WeBS alert system.

5. Recreational Use

Overview

5.1 This section focuses on the specific activities that occur on and around the Humber and that may cause disturbance. We group activities under three headings; shore-based, water-based and air-borne activities.

Access Infrastructure

5.2 There is public access to most of the SPA boundary (Map 29) via footpaths and bridleways along the sea wall, access to beaches and saltmarsh. The North Shore has mostly continuous access along the estuary with the only gap at Saltend industrial area. There is public access to most of the South Bank but there are more areas with no access to the foreshore due to industry at Grimsby and Immingham Docks and also due to private landownership from Read's Island round to Alkborough.

5.3 Car parks were identified and mapped (Map 26, Table 5) and provide a useful overview of access to the estuary. Two hundred car parking locations were identified, providing 4,612 spaces. There is more car parking on the north shore (63% of the total spaces identified) with a large capacity of formal car parking around Hull. Informal parking constitutes only 16.5% of the capacity around the whole estuary with three times as many informal parking spaces on the north shore compared to the south bank.

Table 5: Informal and formal parking provision on the Humber North Shore and South Bank

	North Shore		South Bank	
	Total	**Capacity**	**Total**	**Capacity**
Formal car parks	47	2333	32	1520
Informal car parks	72	594	49	165
Total	**119**	**2927**	**81**	**1685**

5.4 Access to the water via jetties and slipways is shown in Map 28. There is a significant concentration of jetties (mainly commercial) around Immingham dock, Hull and in the upper Ouse. Slipways are spread throughout the Humber although only three were identified on the south bank at Humberston, Cleethorpes and New Holland.

5.5 There are a number of key visitor centres situated around the Humber. The most widely publicised is the Waters' Edge Visitor Centre, at Barton upon Humber providing information about the Humber Estuary, its wildlife and the environment and sustainability in general. The park covers 86 acres and provides educational facilities, walks and children's activities. The Humber Bridge Country Park Local Nature Reserve is a 21 ha site located close to Hull and provides nature and sculpture trails, runs events and education. The Deep is a newly opened aquarium visitor attraction in Hull which aims to increase enjoyment and understanding of the world's oceans. The newly refurbished Discovery Centre is situated at Cleethorpes and includes a community gallery with art exhibitions, an observatory, wildlife exhibitions, wildlife watching and a gift shop and cafe. The Fishing

Heritage Centre at Grimsby provides an educational look at the fishing history of the area using interactive displays and a collection of historic vessels in the dock. Far Ings Visitor Centre is situated about one mile west of Barton-upon-Humber and provides education facilities and access to the Far Ings Lincolnshire Wildlife Trust Nature Reserve and offers walks and opportunities to view local wildlife. The RSPB reserve and visitor centre at Blacktoft Sands is popular with bird watchers and the general public. There are 6 hides within the reserve and the RSPB runs guided walks and other activities for visitors.

5.6 Out towards Spurn Head there is Spurn heritage coast visitors centre where there is a small cafe and exhibition. At the entrance Spurn point there is also a small visitor facility at the Observatory providing information on wildlife and selling reports, guides and artwork on the local birdlife.

Visitor Numbers

5.7 There is relatively little information on visitor numbers to sites. One exception is Spurn, where the Yorkshire Wildlife Trust has maintained records of cars back to 1992[4]. Counts are made when the site is staffed and all vehicles driving down the road are charged for entry. Over the winter this is on approximately 22 days per month (November – May). The fee per car was increased in 2005 (from £2.50 to £3.00). Data per month (totals) are summarised in Figure 4. It can be seen that numbers do fluctuate markedly. Part of this fluctuation is attributable to access, as the road is closed occasionally due to storm damage/sand blow (e.g. April 2008, March 2007, March 2006, March 2005, March 2004, March 2001 and March 1996 all saw significant road closures). There appears to be an increase, over time, in the number of cars in September, October and December. By contrast numbers also appear to have decreased over time in August and November.

[4] Raw data provided by A. Gibson (Yorkshire Wildlife Trust)

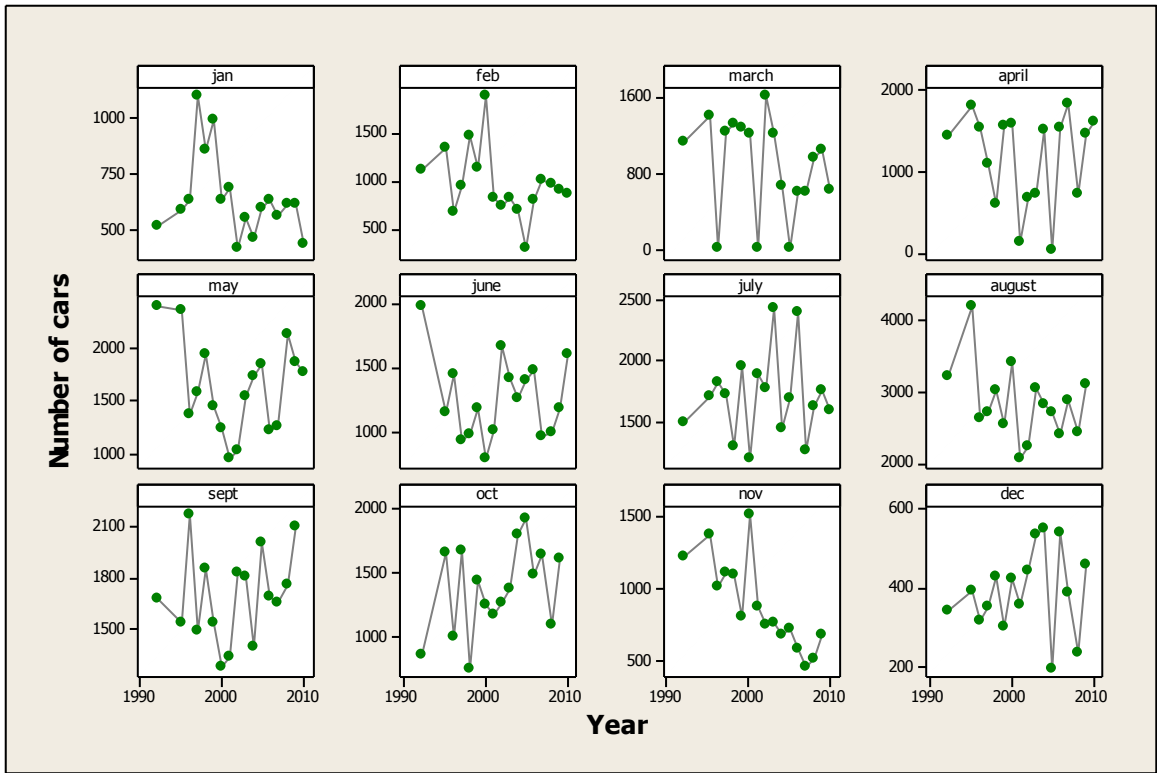

Figure 4: Car totals by month at Spurn. Data provided by A. Gibson (Yorkshire Wildlife Trust). See text for explanation.

5.8 Summarising the car totals at Spurn by month (Figure 5) shows that the site is busiest in the summer, approximately May – September, with a marked peak in August coinciding with the school holidays.

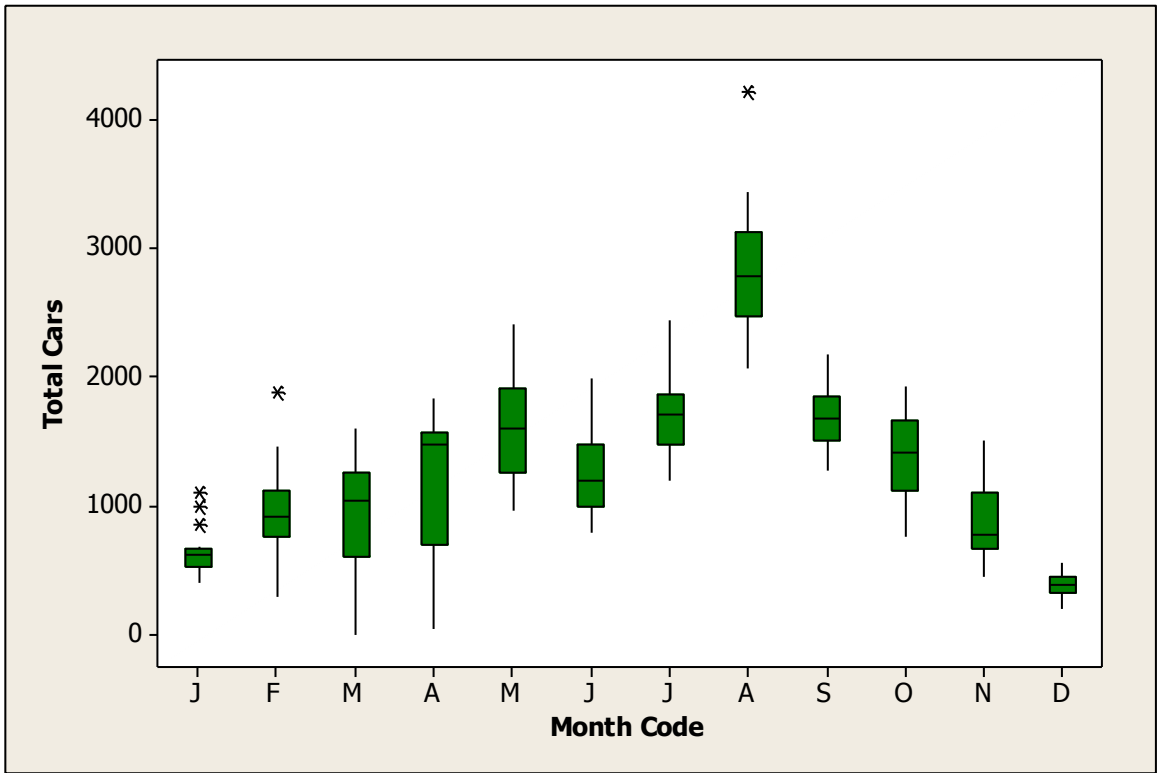

Figure 5: Total cars counted at Spurn (YWT) for the period 1992 – 2010. Data as in Figure 4.

Shore-based activities: Types of activity, levels of use, key locations

5.9 Shore-based activities are largely linked to the larger population centres, wildlife attractions, beaches, car parking and access points. The frequency of shore-based activities derived from the questionnaire consultation show that the main areas are Spurn Head, Cherry Cobb Sands, Killingholme Marshes, Tetney, Humberston Fitties and Donna Nook (Map 35).

Walking

5.10 Walking is a popular pursuit along much of the Humber banks including general walking, dog walking and organised groups which make use of the trails around the estuary. The Trans Pennine Trail, a multiuser trail, developed over the last 10 years runs along a large stretch of the estuary (Hull to Blacktoft). Other popular areas include the areas around the Humber Bridge, and long stretches of clay floodbank with public access on the south bank. The Viking way is a 147 mile walk which starts at the Humber Bridge and heads westwards.

5.11 Walking is clearly a popular activity and walkers (with and without dogs) are likely to constitute the majority of visitors at many locations. For example unpublished visitor data from Spurn[5] collected around 2006 suggests over half the people interviewed were coming to walk. More recent data from Spurn[6] indicates that Spurn, at least, attracts walkers from a considerable distance. Visitor monitoring has been taking place over the summer 2010 and initial results involved a sample of 63 interviews conducted at the site. Of these 24 groups were visiting to walk and the home towns of these 24 groups included York (5

[5] Collected by J. Booth c. 2006; unpublished survey results provided by A. Gibson (Yorkshire Wildlife Trust).
[6] Natalie Welden, unpublished data

groups), Sheffield, Scunthorpe, Buxton, Hull, Lincoln, Grimsby. Relatively few were local (e.g. 2 groups were from Easington).

5.12 Casual walking locations are linked to the centres of population (access of foot) and also locations of formal and informal parking for visitors travelling from further afield. Aside from the location of public access to the SPA (Map 29) and opinions gathered from the questionnaire, we have been unable to describe particular locations for walking. Information has been gathered on dog walking locations using the HMS maps, the site visit to the Humber and discussion with local people (Map 30). Saltfleet to Mablethorpe stands out as a popular location for dog walking and this coincides with a number of formal car parks in the area (Map 26). Furthermore there is a concentration of dog walking locations around Cleethorpes, coinciding with a large provision of formal parking and also locations identified at Paull, Saltend, Humber Bridge, North Ferriby, Brough, Alkborough, Goole and Hook.

5.13 From the questionnaire consultation with local experts and WeBS surveyors, a map of intensity of walking and dog walking has been produced (Map37). The busiest areas for walking and dog walking are Spurn Bight, Theddlethorpe to Saltfleetby, Grainthorpe to Pyewipe and Horseshoe Point to Tetney Haven (Map 37).

Figure 6: Dog walker at Hessle Foreshore

Horse riding

5.14 National and regional routes in the area include the Heritage Ride covering 400km across Lincolnshire, East Yorkshire and North Yorkshire and the Trans Pennine Trail which follows

the north bank of the Humber from Hull heading east. There are two sections east of Goole which are open to horse riding: Barmby on the Marsh to Laxton (8 miles) and Laxton to Broomfleet (8 miles). A series of guides for the horse riding sections of the trail are in production. Literature on riding in the area is produced and made available by the British Horse Society. At current levels the impact of horse riding is relatively low although increased publicity and promotion of routes may lead more horse riders and increased erosion in saltmarsh habitats and noise and visual impacts to birds along the seawall.

5.15 There are a number of riding stables situated around the Humber. Information on stables and riding centres was collected from web searches and seven locations were identified including riding schools and stables (Map 31). It is likely that there are more centres for horse riding in the area and the locations shown are derived from a preliminary search. Additional locations for riding were identified from the HMS recreational activities maps (Map 31). From the questionnaire consultation with local experts and WeBS surveyors, a map of intensity of horse riding has been produced (Map 38). The busiest areas for horse riding are Spurn Head, North Ferriby, Blacktoft Sands, Grimsby, Cleethorpes and Immingham and Saltfleet on the outer estuary (Map 38).

Figure 7: Example of horse riders using the beach at Kilnsea

Cycling

5.16 Cycling around the Humber is largely informal and occurs more frequently in the summer months. The Trans Pennine Trail provides a continuous on and off road route following the Humber from Hull to Blacktoft. At the Humber Bridge there is a link to the Sustrans cycling network and there are a number of cycling clubs in the area. From the questionnaire consultation with local experts and WeBS surveyors, a map of intensity of cycling has been produced (Map 39). The busiest areas for cycling are Spurn Head, Hull and Hessle foreshore, Broomfleet, Barton-upon-Humber, Grimsby, Immingham and Cleethorpes (Map 39).

Bird and seal watching

5.17 Donna Nook supports one of the largest grey seal breeding colonies in England and is the most south-easterly breeding colony in the UK. The colony can be accessed at weekends

only from Stonebridge car park. Other seal watching locations include Easington and Cleethorpes.

5.18 The Donna Nook seal colony has increased dramatically in size since 1990 and has become a considerable tourist attraction. In late autumn the NNR car-park and access road can be full and a local farmer has been provided additional parking on a field (Davey *pers. comm.*). Local accommodation tends to be fully booked and during November and December the Lincolnshire WildlifeTrust provides a wardening service to protect the breeding seals and to organise watching facilities for visitors. The impacts of recreation on the seals at the site are reviewed by Lidgard (1996)

5.19 The Humber is renowned for its bird watching and wildlife photography opportunities. Spurn Point, Blacktoft, Tetney, Far Ings Nature Reserves, Welwick, Brough, Donna Nook, Saltfleetby, Killingholme and Easington all are popular locations for birding. At sites such as Blacktoft and Far Ings hides and trails are carefully designed to allow people to get close to wildlife while minimising disturbance. Along the flood banks and sea-walls birders, photographers and others visiting to watch wildlife may have more potential to cause disturbance.

5.20 Unpublished visitor data from Spurn[7] collected around 2006 suggests around a third (28%) were visiting to come bird watching. The relative proportion of birdwatchers at the site will vary markedly, as during high summer (when visitor numbers peak at this site) most of the visitors will be visiting to use the beach, whereas in October (one of the best times for rare birds) many of the visitors will be visiting to see birds.

Beach recreation

5.21 Beach recreation is focussed around Cleethorpes, along the Lincolnshire Coast (around Mablethorpe) and at Spurn. There is significant infrastructure in the Cleethorpes area to cater for visitors including Cleethorpes Pier, Pleasure Island Family Theme Park, Cleethorpes Coast Light Railway and the Discovery Centre. There is a public slipway which is managed by the Beach Safety service. Dogs are not allowed on the main beaches between the North Promenade Slipway and the Cleethorpes Leisure Centre from Good Friday through until 30th September inclusive in any year. Beach wardens patrol and there is clear signposting (Figure 8) relating to visitor activities and zoning.

[7] Collected by J. Booth c. 2006; unpublished survey results provided by A. Gibson (Yorkshire Wildlife Trust).

Figure 8: Beach signpost at Cleethorpes seafront

5.22 At Humberston there is a designated area of beach for power kiting and kite flying. Cleethorpes Local Nature Reserve is adjacent to the beach front and there has been some conflict between nature conservation and recreation in recent years due to the expansion of the saltmarsh habitat towards the beach (Allen et al. 2003). At the Discovery Centre the open grassy areas, cafe and scrub potentially act to buffer the saltmarsh from some of the visitors.

Figure 9: Families accessing the beach at Saltfleet

Wildfowling

5.23 Wildfowling on the Humber dates back centuries and is currently regulated through 13 associations, clubs and syndicates all of whom are affiliated to BASC. Licences are consented by Natural England and managed by the various clubs. Using the most current information available from Natural England there are 9 licence holders covering 27 licensed shooting zones (Map 32).

5.24 The thirteen clubs with wildfowling interests on the estuary are: Hull & East Riding Wildfowlers Association and Holderness and Humber Wildfowlers Association on the North Bank. Alkborough Wildfowlers and Conservationists, Barton on Humber Wildfowlers Club, Gainsborough and District Wildfowling Association, Humber Wildfowlers Association, Keadby, Wildfowling and Conservation Society, Kirk Sandall Wildfowling and Gun Club, North Lincolnshire Wildfowlers Club, Saltfleet and Skidbrooke Wildfowling and Conservation Club, South Yorkshire Wildfowling Association, Thorne and District Wildfowling and Gun Association, and West Riding Wildfowlers on the South Bank. The South Humber Area Joint Council (SHAJC) consists of representatives from eight clubs on the South Bank. The Upper Humber Wildfowling Committee consists of representatives from the SHAJC and the two clubs on the North Bank. All BASC members are obliged to abide by club rules and follow BASC Codes of Conduct. BASC recommends that all wildfowlers abide by the Code of Good Shooting Practice and possess public liability insurance. Insurance cover is provided by BASC and a number of other field sports organisations. Wardens are appointed for both banks of the Humber through the UHWC and SHAJC. The wardens only cover certain areas of the Upper Humber specifically around the statutory refuge (Alkborough out into the Whitton Channel) and only during the wildfowling season. Allied to these wardens each wildfowling permit holder is a warden for the purposes of policing the foreshore.

5.25 BASC provided data on wildfowling visits and bag totals for the Humber between 1999 and 2010 (Figure 10). Since the start of the dataset the mean visit number has been 990 per year with an average bag total of 802. In the period 2009/2010, 845 visits were made to the Humber with a below average combined bag total of 548. Wildfowling visits and bag totals on the south shore have remained relatively constant over the last decade whilst north shore activity has shown a marked decrease over the same period (data for each shore not shown).

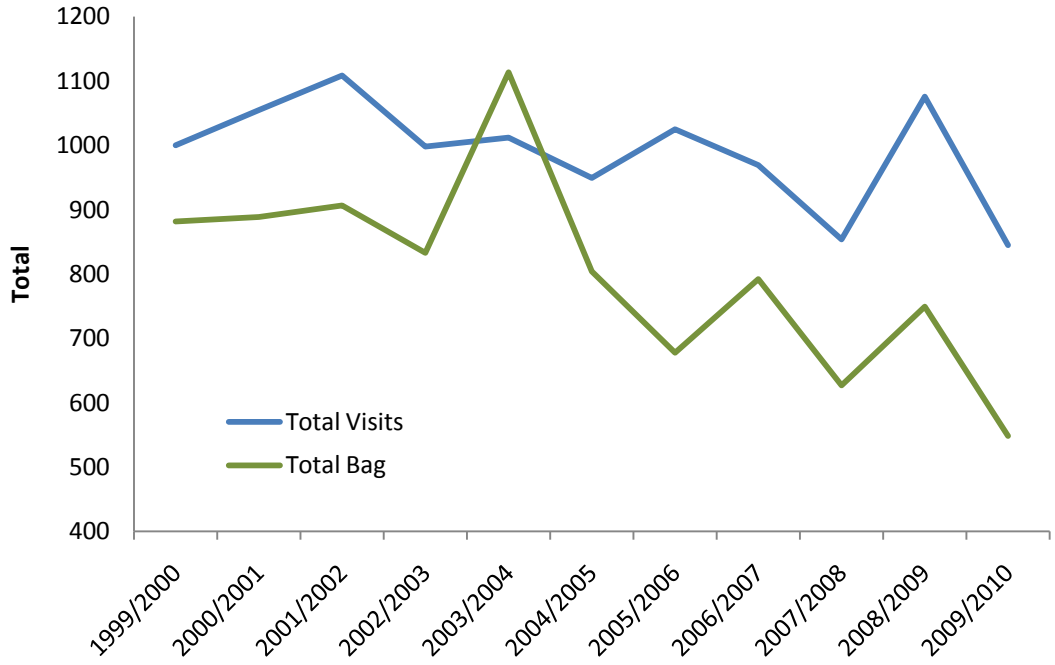

Figure 10: Annual wildfowling visit numbers and bag totals for the Humber 1999-2010.

Motorised access and recreation

5.26 The illegal use of motor vehicles on the foreshore can cause considerable disturbance to wildlife. Vehicles accessing the foreshore include quad bikes, 4WD and motorbikes. The warden of the north bank wildfowling refuge reports frequent issues with off road vehicles in the area. Other locations include South Ferriby, Barton; east of Barton, Blacktoft, Saltfleet, Easington and Welwick- many of which were highlighted in responses to the questionnaire (Map 43).

Samphire picking

5.27 Harvesting samphire for personal use is a traditional longshore activity and occurs mainly between June and September on the south bank in North East Lincolnshire around Cleethorpes, Donna Nook and at Tetney and Saltfleet (see Map 44 generated from questionnaire responses). Spurn is another location where this activity takes place. Impacts of this activity include trampling of the saltmarsh which can lead to erosion and damage to associated invertebrate communities. In addition there are potential negative impacts of removing the plant, particularly at the commercial scale, resulting in restricted recolonisation, damage to associated plant species and loss of feeding areas for birds e.g. geese. There is also the direct effect of people walking on the saltmarsh to collect samphire which can cause disturbance to breeding birds and returning migratory species, particularly if the areas are not usually visited by people.

Angling

5.28 Recreational angling (involving the use of rod and line) takes place around the estuary in restricted locations due to poor access. On the North Shore there is a concentration of activity around Hessle Foreshore, Dunstans Shipyard, Cod Farm waterfront, St. Andrews Quay frontage, Bull nose (Lordline building), Hull Marina entrance, Minerva Pier, Victoria dock frontage (Bellway homes), Hull Docks, Hedon Haven, Paull, Thorngumbald Drain

entrance, Sunk Island, Old Hall, Hawkins Point, Spurn Bight and Spurn Point. On the South Bank popular locations include Barton Foreshore, East Halton Skitter, Killingholme wall, Immingham, Stallingborough wall, Laportes, Grimsby wall and Cleethorpes. There are approximately 20 clubs within the region and a number of clubs and individuals who regularly fish the Humber from boats (October – March). The clubs vary in size with some having over 2000 members and some as small as 100 members. The clubs operate summer and winter leagues. Summer league matches with around 50 anglers spaced by 20ft along the shore can make a visible and audible impact on the estuary. At Spurn angling competitions can result in cars parked along the entirety of the access road (T. Davey *pers. comm.*). Further observations from Spurn include damage to/removal of notices about angling restrictions and codes of conduct and also an increase in summer bass fishing in recent years (A. Gibson *pers. comm.*).

5.29 Recreational fishing also occurs from boats on the Humber. The Humber Cruising Association Boat Fishing Club was created by local boat anglers with 200 anglers fishing from around 100 boats. The boats range from 15ft cuddies to 45ft motor cruisers and the club holds around 19 competitions throughout the year.

5.30 From the questionnaire consultation with local experts and WeBS surveyors, a map of intensity of angling has been produced (Map 45). The busiest areas for angling are Spurn Head and Bight, Cherry Cobb Sands, Hull and Hessle foreshore to North Ferriby, Barton Cliff, Immingham, Pyewipe, Saltfleet (Map 45).

Bait digging

5.31 Bait digging occurs frequently between Grimsby and Cleethorpes and at Tetney on the south bank and at Spurn Bight and Easington Clays on the north bank. Bait diggers mainly target lugworm (*Arenicola* sp.) and ragworm (*Nereis* sp.). Natural England agrees that bait digging, carried out on a small scale by local anglers, is unlikely to cause any damage, however, any commercial bait digging would be a cause of concern.

5.32 The Beach Safety Team polices bait digging at Cleethorpes. A bait digging Code of Conduct is given out on the Humber when people apply for licences in North East Lincolnshire. The code of conduct states that recreational anglers may gather bait but digging is restricted in certain areas. Around Cleethorpes, bait digging is permitted north of Wonderland and south of Cleethorpes Leisure Centre but is not permitted out on the saltmarsh. A licence is required from the Tourist Information Centre to dig bait in the designated areas.

5.33 There are no bylaws restricting bait digging at Spurn with around six to eight groups undertaking commercial trench digging which, due to the lucrative nature of the activity, is very difficult to police (A. Gibson *pers. comm*).

5.34 From the questionnaire consultation with local experts and WeBS surveyors, a map of intensity of bait digging has been produced (Map 46). The busiest areas for bait digging are Spurn Bight, Theddlethorpe to Saltfleetby, Grainthorpe to Pyewipe and Horseshoe Point to Tetney Haven (Map 46).

Water-based activities: Types of activity, levels of use, key locations

5.35 Combining all water-based activities, responses to the questionnaire showed that activities occur throughout the estuary with focal areas around Spurn (summer months), Cherry Cobb Sands to Hull, Alkborough, Killingholme Marshes, Barton, Saltfleet and Theddlethorpe (Map 47).

Motor cruising & personal watercraft

5.36 The majority of motor cruising is located around the marinas at Goole, Hull, Grimsby and Cleethorpes (Map28). No specific information was available on cruising routes. However it can be assumed that cruising occurs throughout the estuary although it is most likely centred around the marinas. There are higher volumes of boats around Spurn during the summer months. There is an opinion from the yachting community that motor cruisers show less regard for the regulations and rules governing use of the estuary.

5.37 Jet skiing takes place at Saltfleet and from the slipway at the Humber Bridge, water skiing taking place at Hessle and canoeing taking place at Grimsby and Cleethorpes Canoe Club at the mouth of River Freshney. Questionnaire responses from local experts and WeBS counters picked up Blacktoft Sands and South Humber inner (off Whitton) as areas with the heaviest motorised boating use (Map 49).

5.38 See kayaking at Spurn has increased in recent years, but kayakers do not tend to land on the spit (A. Gibson *pers. comm.*). Users tend to launch into the sea at Kilnsea and paddle round the spit, into the estuary and back around to Kilnsea. The Spurn wardening staff have been helping the kayakers to land and launch here and there is an informal agreement for them not to land on the spit. This system currently seems to be working well.

Yachting and sailing

5.39 Yachting is a popular recreational activity on the Humber with concentrated activity around Hull Marina, Brough, Goole, Winteringham, Ferriby, Barrow Haven, East Halton, Grimsby and Saltfleet. Sailing tends to be a seasonal activity peaking in summer months but there will be sailing throughout the year at a lower level in the winter with shorter periods of time spent on the water.

5.40 Specific information was available about the Humber Yawl Club. The HYC has 360 members (200 active) and two yachting bases on the upper Humber, at Winteringham Haven, on the south bank, and Brough Haven, on the north bank. They provide berths for around 63 yachts each and the Club is probably the major recreational user of the upper reaches and a significant recreational user of the Humber as a whole. The HYC operates between South Ferriby (on the south bank), Welton (on the north bank) and Trent Falls and this area of the estuary is relatively quiet throughout the year.

5.41 The HYC sailing programme starts at the end of March and extends to the end of October. Races run from Brough Haven every weekend during the sailing season with around ten to twenty yachts out on the water for around 3 hours each. In May they run their four day regatta with 30 to 40 yachts. The activities of larger clubs in the upper reaches of the

Humber is reflected in the questionnaire responses , although regular sailing activities were also noted at Tetney to Humberston Fitties and Saltfleet (Map 50).

Kite surfing and flying

5.42 Kite flying and surfing on water and land using kite buggies is a growing sport in the UK. Two main areas have been identified where this activity takes place- Humberston Beach/Humberston Speed strip and Cleethorpes Beach. The most widely publicised site is Humberston where the kiting zone falls within the Thorpe Park Holiday Camp and the beach can get very busy with visitors in the summer. Humberston is good for kite surfing all year apart from the summer holidays due to the high number of visitors to the beach. The speed strip receives frontal winds which are best for kite surfing when coming from the north, north east, east, south east and north west, with the north westerly being best for speed sailing.

5.43 Local bylaws exist to control activities (zoning) and users are asked to respect codes of conduct. Responses to the questionnaire highlighted Spurn and Theddlethorpe to Mablethorpe North End as the busiest locations.

Air-borne activities: Types of activity, levels of use, key locations

5.44 Airborne recreation is centred around the 13 flying clubs of which, five are located at Humberside International Airport at Kirmington (Map 33). From questionnaire responses, airborne recreation occurs most frequently at Somercotes to Donna Nook, Tetney, Killingholme, Goxhill and New Holland to Barrow (Map 51). The questionnaire data also shows that disturbance from airborne recreation has been witnessed, to some extent, across the whole estuary due to the nature of the activity (Map 52). However, there are concentrations of disturbance around Cherry Cobb Sands and Read's Island (Map 52). This activity is largely unregulated and it is difficult to get information to private pilots. Recreational flying is likely to increase with economic growth and the associated increase in leisure time. A parasailing club was operating out of Hull Marina offering trips for up to eight passengers including tailored wildlife trips around Read's Island. However this company is no longer operating in the area.

Pleasure aircraft

5.45 The key areas for pleasure aircraft that were identified from questionnaire responses include Goxhill, Faxfleet to Brough Haven on the North Shore, Barton and Blacktoft Sands (Map 53).

Microlights

5.46 Microlights were frequently mentioned by respondents to the questionnaire as being a particular issue causing disturbance to birds. The centres of activity overlap closely with pleasure aircraft but there is also regular activity at Mablethorpe and Saltfleetby (Map 54).

Summary

5.47 There are a wide range of activities that take place around the Humber, and we provide some detail on 14 separate activities, summarised in Table 6. We have mapped most activities according to scores generated through the questionnaires and supplemented by additional information. Many of the activities occur outside user groups, clubs or any form

of regulation and gaining a systematic, comprehensive assessment of each activity at an estuary-wide level, let alone any estimate of total visitor numbers to the estuary, is beyond the scope of this study. It is clear that the range of activities together provide a complex mix of use, involving local people, tourists, and day trippers coming from varying distances and with a wide variation in temporal use, spatial use and intensity. On site visitor counts and detailed survey work is required to fully understand visitor patterns and this information is not available.

Table 6: Summary of access types discussed

Activity	Description
Walking	Walking and dog walking takes place at all areas where there is access to the shore around the Humber with a focus on the larger settlements of Hull, Grimsby and Cleethorpes.
Horse riding	A popular activity around the Humber, focussed around long distance trails and beach riding.
Cycling	An informal activity on the Humber, users make use of the Trans Pennine trail on the north shore.
Bird and seal watching	A popular activity on the Humber often resulting in large numbers of visitors to see rare birds and the seals at Donna Nook
Beach recreation	Large numbers of visitors are present in the summer at Cleethorpes and further down the North East Lincolnshire coast.
Wildfowling	Licensed at around 27 locations on the estuary. Managed by 13 associations, clubs and syndicates- all of whom are affiliated to BASC.
Motorised access	Motorised access and recreation has increased on the beaches and intertidal habitats with the use of quad bikes, 4WD vehicles and motorbikes causing disturbance to birds.
Samphire collection	Collection of samphire for personal use from the saltmarsh occurs at Cleethorpes, Donna Nook, Tetney and Saltfleet on the south bank and Spurn on the north bank. There is some concern that commercial harvesting could increase the number of people in quieter areas of the SPA.
Angling	Angling takes place from the shores of the Humber with a concentration of activity around the Humber Bridge. There are more than 20 angling clubs which operate summer and winter competitions with around 50 anglers competing. Numbers for some competitions/locations can be particularly high.
Bait digging	Bait digging for recreational fishing purposes occurs around Cleethorpes on the south bank and Spurn and Easington on the north shore. There is some concern that bait digging is increasing.
Motor cruising & personal watercraft	Activity is mainly centred around the main marinas and slipways (for smaller craft). The estuary is busier in the summer and the activities, particularly jet skiing, are difficult to regulate.
Yachting and sailing	Yachting is a popular recreational activity on the Humber with concentrated activity around Hull Marina, Brough, Goole, Winteringham, Ferriby, Barrow Haven, East Halton, Grimsby and Saltfleet.
Kite surfing	Kite surfing is an increasing activity on the Humber and there are currently two focal areas at Humberston Beach/Humberston Speed strip and Cleethorpes.
Air-borne recreation	Flying pleasure aircraft, microlights and paragliders is popular and increasing around the Humber. Most activity is based around the 13 flying clubs and Humberside International Airport.

6. Identifying when and where disturbance occurs

Results of questionnaires

6.1 By August 9th questionnaires had been received from 17 local experts and four WeBS counters providing information on 37 sectors out of 39. Results received from WeBS counters and local experts have been described together. The maximum number of responses received on an individual WeBS sector was four for Killingholme Marshes (38406) and Barton Haven to Chowder Ness (38415).

6.2 The data collected from questionnaire responses have been presented in a series of maps showing the frequency of occurrence of activities and also the frequency of the activities being perceived to cause disturbance to birds (Maps 35-54). The data were collected from a relatively small sample and are based on the opinions of interested individuals. At this stage this is the only quantitative and geographical data (i.e. scored by WeBS sectors) available for a range of activities across the whole estuary. A caveat to be noted is that the scores for individual activities (Maps 37-46, 49, 50, 53, 54) are an average of the respondents scores and the resulting mean will not reflect the range of opinions (or level of knowledge) on the extent of activities in a particular WeBS sector. The number of people who commented on each activity is variable and therefore the ranges displayed on the maps represent the lower, middle and upper third of the ranges to show low, medium and high levels of activity and occurrence of disturbance. The respondents know the estuary very well but the subjective nature of the data collection further enforces the need for a standardised study into recreational activities.

6.3 Respondents were asked to score the Humber in terms of how often different activities take place and whether or not they have seen activities causing disturbance in each webs sector that they were familiar with. The list of activities, total score and frequency of observed disturbance are shown in Table 7. Across the estuary, the most commonly occurring activity was people walking along the flood bank followed by bird watching. Other frequent activities include dogs off lead on the intertidal, people walking along the shore, motorbikes on the floodbanks/seawall, photographers, bike riding, shipping and pleasure aircraft. The most frequently noted activity deemed to cause disturbance to birds was also people walking along the flood bank followed by bird watching and dogs off the lead on the intertidal areas (Table 7).

6.4 Looking across the WeBS sectors it is clear that some particular activities cause disturbance at many locations around the SPA. These include dogs off the lead on the intertidal, the presence of people walking along the shore and birdwatchers (Table 8). Furthermore there are particular clusters of WeBS sectors which can be identified as having the greatest range of disturbance causing activities. Specifically, the sectors from Theddlethorpe up to Donna Nook and along to Grimsby experience a range of disturbance causing activities as this area attracts high numbers of visitors for wildlife and beach recreation purposes. Furthermore a wide range of activities were recorded to cause disturbance between New Holland and Alkborough including an increase in water-based activities, which, have a greater impact where the estuary is narrower and sheltered and therefore more suitable for certain activities e.g. canoeing, RIBs and jet skis.

6.5 The sectors east of Hull and out to Spurn Head also receive significant pressure and there was a diverse range of disturbance causing activities reported by questionnaire respondents (Table 8). Like the north east Lincolnshire coast, this area is most likely used by the residents of the nearest large settlements (Hull and Hessle) for day trips. Spurn Head is within 45 minutes to an hour's drive and provides a particularly attractive beach destination.

6.6 Annual changes in the occurrence of some activities were detectable from the questionnaire responses (Table 9). Typically water based activities and beach recreation peak predictably in the summer months e.g. Jet skis, canoeing, wind surfing etc. Furthermore most of the motorised access activities tend to peak in the summer months e.g. 4WD vehicles on the mudflats. Similarly air-borne activities are more pronounced in the summer months due to the weather conditions. Conversely the presence of large numbers of waterbirds in the winter means that bird watching and photography tend to peak in the winter months and for similar reasons the wildfowling shows up as being linked to the open seasons. It should be noted that wildfowling scores may be unrepresentative as this activity takes place at dawn and dusk and therefore may not be observed by all respondents, although it is possible that respondents will be aware of wildfowling in the area despite not actually observing it. There are, however, a number of activities which seem to occur consistently across the year including people and dog walkers along the floodbank, shore and intertidal areas.

Table 7: Total scores for frequency of activity ratings and frequency of responses where activities are perceived to be causing disturbance to birds. The data are derived from 21 questionnaire responses from WeBS counters and local experts (red, orange, yellow and white indicate the quartiles of the ranges of scores with red being the highest and white being the lowest).

Activity	Total frequency of occurrence score	Frequency of activities perceived to be causing disturbance to birds
Shore-based		
Dogs off lead on intertidal	234	35
People walking dogs along shore	205	32
People walking along shore	260	33
People walking along flood bank	352	39
Beach recreation (e.g. bathing, donkey rides etc)	76	7
Quads on sandy beaches	59	12
Quads on intertidal (e.g mud flat, saltmarsh)	65	8
Quads on flood banks	82	10
Motor bikes on sandy beaches	50	17
Motor bikes on intertidal (e.g mud flat, saltmarsh)	78	14
Motor bikes on flood banks/seawalls	158	18
4X4 on sandy beaches	37	11
4x4 on flood banks/seawalls	70	13
4x4 on intertidal (e.g mud flat, saltmarsh)	56	4
Bait Digging	90	14
Crab tiling	30	0
Angling (individuals)	139	13
Angling (competitions)	44	6
Launch sites e.g. slip ways	75	4
Kite flying / Sand buggies with kites	50	7
Birdwatchers	331	35
Seal watchers	58	4
Photographers	176	18
Wildfowling	134	17
Horse riding	117	7
Bicycle riding	174	11
Samphire collection	64	3
Shore based industrial activity	85	8
Military firing	10	2
Water-based		
Shell fishing	46	2
Kite Surfing	36	2
Windsurfing	46	3
Kayaking / Canoeing	48	4
RIBs / small powerboats	97	14
Jet skis	72	10
Yachts and sail boats	138	4
Other Boats (cargo, ferries, etc)	172	7
Rowing boats	22	1
Water based industrial activity	60	6
Air-borne		
Commercial aircraft (including rescue aircraft)	128	19
Pleasure aircraft (small planes)	153	15
Paragliders / parasailers	55	7
Microlights	121	12
Military aircraft	18	3
Low helicopter	11	1

Table 8: WeBS sectors where questionnaire respondents have witnessed activities causing disturbance to birds.

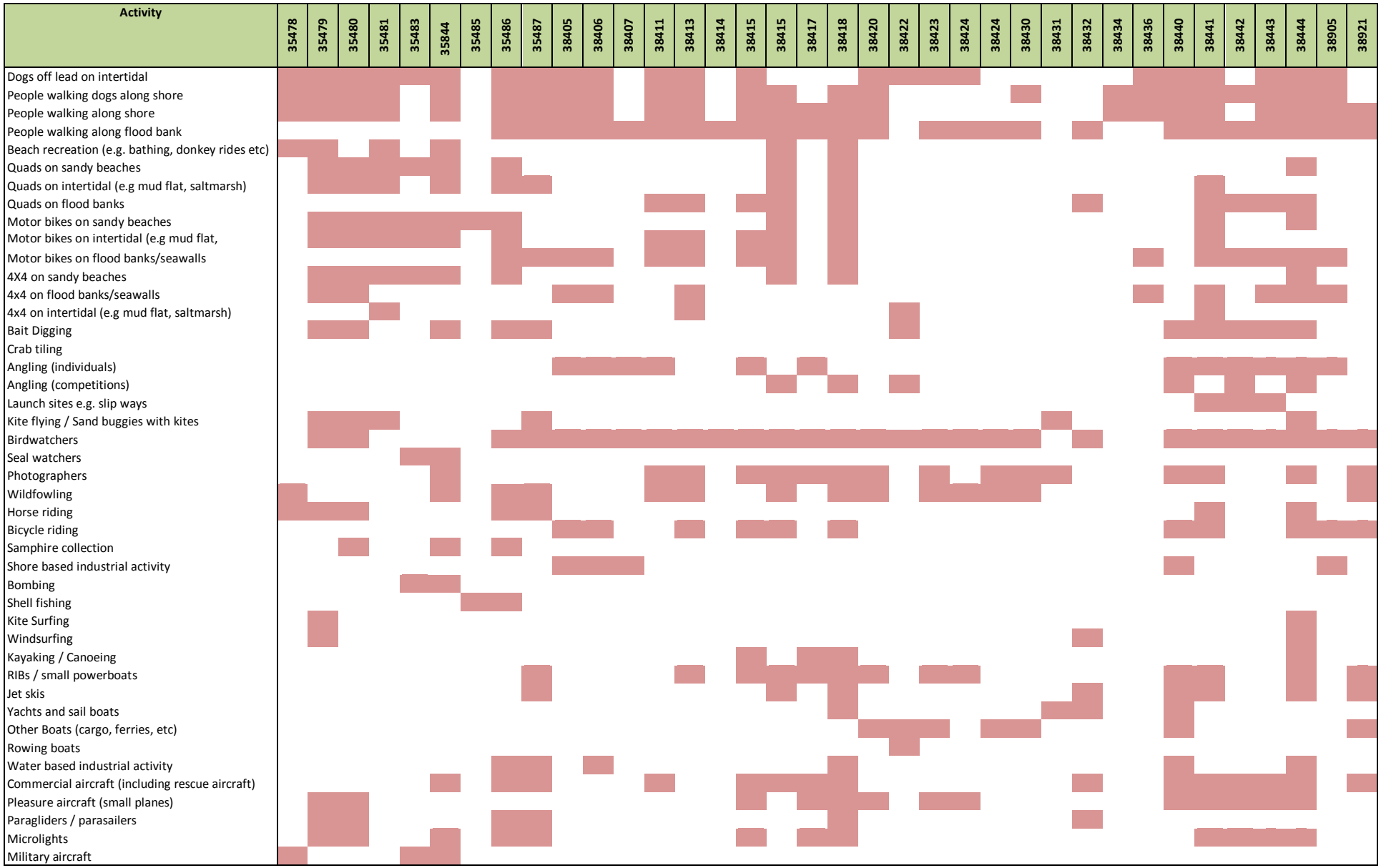

Table 9: Patterns of recreational disturbance through the year totalled across the whole estuary and derived from questionnaire data (17 responses). Each category of disturbance (shore, water and air) is sorted according to the total score for the year and the colours indicate the frequency of disturbance as perceived by the respondents (white= 0-5, yellow= 6-20, orange=21-30, red=31-39).

Activity		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total score
Shore-based	People walking along flood bank	36	36	34	31	32	32	32	35	39	39	38	36	420
	Birdwatchers	28	28	27	26	27	27	27	25	31	31	31	30	338
	Dogs off lead on intertidal	27	27	26	25	25	26	26	27	28	27	27	27	318
	People walking dogs along shore	23	23	22	23	23	24	24	24	25	23	23	23	280
	People walking along shore	21	21	20	22	23	23	23	23	24	22	21	21	264
	Photographers	18	16	16	15	15	15	15	16	18	19	25	24	212
	Wildfowling	29	26	5	2	2	2	2	3	26	28	29	28	182
	Horse riding	14	14	14	13	13	13	13	14	14	14	14	14	164
	Bicycle riding	12	12	13	12	12	12	12	13	13	12	12	12	147
	Bait Digging	12	12	12	11	11	11	11	12	12	12	12	12	140
	Angling (individuals)	12	12	15	7	7	8	8	11	14	13	14	14	135
	Motor bikes on intertidal (e.g. mud flat, saltmarsh)	10	10	13	13	13	12	9	10	11	10	10	10	131
	Motor bikes on flood banks/seawalls	10	10	13	13	13	13	10	11	11	8	8	8	128
	Quads on intertidal (e.g. mud flat, saltmarsh)	10	10	10	11	11	11	11	11	12	10	10	10	127
	Quads on sandy beaches	9	9	12	12	12	11	8	8	9	9	9	9	117
	Motor bikes on sandy beaches	9	9	12	12	12	11	8	8	9	9	9	9	117
	Launch sites e.g. slip ways	6	6	10	10	11	12	12	13	13	8	6	6	113
	4x4 on flood banks/seawalls	9	9	9	9	9	9	9	10	10	9	9	9	110
	Beach recreation (e.g. bathing, donkey rides etc)	4	4	4	5	12	15	16	16	15	6	4	4	105
	Quads on flood banks	8	8	11	10	10	10	7	8	8	8	8	8	104
	Kite flying / Sand buggies with kites	7	7	10	9	9	10	10	10	10	7	7	7	103
	4X4 on sandy beaches	6	6	6	6	7	9	9	9	7	6	6	6	83
	Angling (competitions)	7	7	7	5	5	5	5	5	5	5	7	7	70
	Seal watchers	8	4	3	3	3	2	2	3	3	9	13	13	66
	4x4 on intertidal (e.g. mud flat, saltmarsh)	4	4	4	5	5	7	7	7	6	4	4	4	61
	Shore based industrial activity	5	5	5	4	4	4	4	5	5	5	5	5	56
	Samphire collection	2	2	2	2	3	7	10	12	9	2	2	2	55
	Crab tiling	3	3	3	3	3	3	3	3	3	3	3	3	36
Water-based	Yachts and sail boats	12	9	15	16	16	17	17	18	20	17	13	12	182
	RIBs / small powerboats	10	10	10	12	14	16	16	17	17	14	10	10	156
	Other Boats (cargo, ferries, etc)	15	15	9	8	8	8	8	9	15	15	15	12	137
	Jet skis	5	5	5	8	11	13	14	14	12	10	5	5	107
	Kite Surfing	5	3	5	6	6	7	7	7	6	5	5	5	67
	Kayaking / Canoeing	3	3	3	6	8	8	8	8	8	3	3	3	64
	Windsurfing	4	4	4	5	5	5	6	6	5	4	4	4	56
	Water based industrial activity	3	3	3	3	3	3	3	3	3	3	3	3	36
	Shell fishing	3	3	2	2	2	2	2	2	2	2	2	3	27
	Rowing boats	0	0	0	3	3	3	3	3	3	0	0	0	18
Air-borne	Pleasure aircraft (small planes)	20	18	20	20	20	20	20	21	22	20	20	20	241
	Microlights	14	11	16	21	21	21	21	22	22	16	14	14	213
	Commercial aircraft (including rescue aircraft)	16	16	15	14	14	14	14	15	17	17	17	16	185
	Paragliders / parasailers	4	4	6	8	8	8	8	9	9	6	4	4	78

Anecdotal information from questionnaires

6.8 All of the comments in this section have been collated from free text questions asked in the questionnaire.

Comments on recreational disturbance threats and how they have changed over time

6.9 The most commonly described threat was dog walking and walking. A large number of people and their dogs visit the foreshore on a daily basis with a large concentration on weekends and particularly in good weather during the summer (outside of closed areas in summer months). Dog walking was described as having a particularly noticeable effect on areas close to holiday resorts i.e. north of Mablethorpe. The foreshore (especially sandy beaches) experience the greatest levels of disturbance and although these areas are not always favoured by feeding birds, the activities can coincide with roost locations. People and dogs probably cause significant levels of disturbance to breeding redshank in area of saltmarsh nearest to Humberston Fitties between April and July. Fortunately the difficult terrain prevents many people from penetrating into the centre of the marsh at present. Also ground nesting ringed plovers and occasional little terns along foreshore at Northcotes Point are very susceptible to disturbance from people and dogs. The general opinion is that dog walking and walking around the Humber has increased over recent years. Goxhill Haven to East Halton Skitter was identified as a very quiet area and the birds tend to congregate in the middle of the stretch where people are less likely to reach them on foot due to the positioning of car parking. There is a noticeable increase in the number of people moving along the outer estuary from Humberston towards Tetney due to the increase in the number of people living at Humberston but also due to an increase in the number of caravans and holiday accommodation in the area.

6.10 Bird watching and photography are also perceived to have increased dramatically over the last 30 years and it is possible that many people don't realise the level of disturbance that they might cause particularly since they stay in the same place for long periods of time. However one respondent felt that bird watchers don't cause disturbance even at Barton-upon-Humber as long as the birds can move 200m either side. At Saltfleetby and Donna Nook visitor numbers are far higher than 10 years ago as people now come to see the grey seals. It is likely that more people visit the area as a result of the seals as they now know that the area exists.

6.11 Respondents remarked that there has been an increase in air traffic over the last few years with helicopters from off shore industry flying over more frequently. There has also been an increase in the number of small low flying pleasure aircraft including micro lights which have been frequently described as one of the most disturbing activities. This is an increasing issue at Alkborough Flats with micro lights and hang gliders causing high disturbance even when they are a mile away and not flying over the Humber. The birds tend to hear the aircraft and move away for a long period of time (i.e. a more permanent disturbance). Aircraft numbers are higher at the weekends. Disturbance by private/commercial Helicopter can also from time to time be a problem as they often fly lower than the recommended height and they are difficult to trace. This problem has increased recently as Doncaster airport has expanded. They often disturb birds over a large

area in all seasons although effects seem more pronounced in the winter particularly with the large numbers of roosting plover and duck. The high tide wader roost at Horseshoe Point can be in quite a small discreet area on larger tides and can be easily disturbed by walkers and low flying pleasure aircraft from adjacent airfield at Northcotes.

6.12 There were some conflicting comments on the impacts of bait digging. The trenching method is perceived to have increased over the last 5 years with a negative impact on the bird populations. Although it was felt that in some areas of the Humber Estuary there are high intensities of bait collection but disturbance to birds appears minimal and both activities appear to coexist without too many difficulties.

6.13 Most respondents felt that commercial shipping, industrial developments and commercial fishing from boats have no effect on birds as they have remained consistent for many years with little or no fluctuation. Indeed the reliance of commercial water-based activities on the tides and channels prevents them from impacting too heavily on feeding birds. Wave wash from commercial shipping is tide dependent but most often this causes a temporary disturbance. No specific examples were provided to show exacerbation of recreational disturbance by commercial activity but some people felt that the combined effects of the two factors were difficult to pick apart without intensive study.

6.14 Many respondents felt that water based recreational activity appears to have increased over recent years especially around the inner estuary and the islands in particular e.g. Read's island and Whitton sands. This is a potential issue during the breeding season for species such as avocet and during the passage and winter months for waders and large flocks of pink footed geese which use the islands. In particular it was felt that fast RIBs, jet skis and noisy power boats had increased dramatically over the last 5 years causing a lot of disturbance to birds. The Slipway at Hessle was mentioned as a particular problem area where the launching of jet skis and powerboats has increased recently. For most of the year this activity is not a problem but in late August and early September there is a large waterfowl group e.g. 2000 teal, which rest around the Humber Bridge on the south bank and are particularly prone to disturbance at high tide. Recreational activity at the Humber Bridge is already extensive with residential development and a concentration of visitor infrastructure including car parks, a Country Park and a large water-side pub, all directly adjacent to the estuary with access onto the shore.

6.15 Disturbance at Read's Island from boats is perceived to be relatively minimal even considering the recent rescue incidents. In fact the greatest disturbance in this area would be from a flapping sail or someone making a lot of noise or movement on the deck of a yacht. The main threats on Read's Island are disturbance both in the summer and winter from people who are unaware of the affect that their usage and close approach or landing on the island is disturbing both breeding and roosting birds on the island, this can also include low flying helicopters that fly over the island. Many people felt that canoes can cause a very significant disturbance response.

6.16 One comment was received stating that the largest threat to the SPA waterbirds is habitat loss to reed beds and that recreational disturbance and shipping etc are minor in comparison. This issue is exacerbated by exceptionally high tides and disturbance risk

appears greatest on areas with narrow intertidal areas or where birds have limited opportunities for feeding and roosting. Where there are greater opportunities to start with larger groups of birds appear to exploit the safest i.e. least disturbed resources first.

6.17 Sea angling- this activity is perceived to be increasing all the time and although it is commonly a high tide activity, anglers are increasingly present 3 hours either side of high tide particularly at Killingholme and East Halton. There is also high angling activity between Immingham dock and Pyewipe. All angling is dependent on locations for car parking and access.

6.18 Comments on wildfowling were also conflicting with some people believing that this activity causes regular and long standing disturbance to birds and others who feel that wildfowling is not a problem and that wildfowlers act responsibly. Respondents are willing to describe specific examples of wildfowling causing disturbance e.g. Pink footed geese react to wildfowling in the same way at their inland feeding locations as they do on the estuary. Furthermore at Alkborough the wigeon do not feed on the saltmarsh and foreshore during the wildfowling season but after the wildfowling season i.e. from mid February they move on to the saltmarsh. It is unclear what disturbance is caused by wildfowling around the reserve at Blacktoft but observations of birds moving over to the site can be linked to shooting at Alkborough Flats and the Broomfleet wildfowl refuge.

6.19 Comments were received on the impacts of bombing at Donna Nook where the range operates Monday-Friday for aerial bombing activity (jets and, more recently, helicopters).

6.20 Comments were received on the impacts of fireworks from villages and towns on the north bank. This activity is particularly pronounced around 5th November but generally continues throughout the year. For example, pink footed geese and wild duck are particularly affected often leaving the area for several days after 5th November.

6.21 Overall respondents commented that with the increase in tourism and disposable income all recreational activities seem to increase each year. There was a consistent theme that the public lacks understanding of designations, the right to roam and the introduction of a coastal path. Other themes include a general feeling of uncertainty over the impacts of recreational disturbance and a suspicion that the effects may have been underestimated e.g. Saltfleetby-Theddlethorpe NNR where the little tern nested during the foot and mouth outbreak but deserted the site once the restrictions were lifted. Conservation practitioners commented on the complexity of the situation and the presence of many interacting variables (biological, physical and human-induced) which can affect the fitness of the birds and their response to disturbance.

Suggestions for managing problematic disturbance

6.22 Management suggestions from questionnaire responses are displayed by activity in Table 10. Overall respondents felt that unregulated recreational disturbance is increasing on the Humber due to access which is set to increase in response to the coastal access improvements. There were many suggestions on methods to control access but conflicts of interest and resistance to change will always need close attention. Most activities are deemed to be hard to police therefore careful management of access points and education

were frequently suggested as the way forward. Interpretation boards targeted to help people understand the problems that their presence and activities may cause.

6.23 It was felt that there are highly disturbed areas of the estuary which will always be hard to control e.g. Hessle foreshore. Whereas due to limited access (car parking in particular), there are good areas with low disturbance such as Goxhill Haven therefore access to sensitive areas should be restricted whilst promoting it at busier locations.

6.24 There was one respondent who felt that there was no need for any management of recreational activities on the Humber and that the main problem is habitat loss.

Table 10: Management suggestions received from WeBS counters and local experts for different activities on the Humber.

Activity	Management suggestions
Access in general	Zoning of recreational activity, promotion of busy areas and retain low access to sensitive areas, promotion and enforcement of bylaws to ensure people can be held responsible (not necessarily fined) for repeated or reckless disturbance, seasonal ban on access to the foreshore/saltmarsh in areas with high public access where habitat is suitable for breeding birds (little tern for the North Lincs coast), collective effort brought together through the management scheme to tackle issues which are relevant to the whole estuary but affect different stakeholders in different ways, design access around managed realignment sites and wetland mitigation sites so as to minimise disturbance
Flying, aircraft	Minimum flight heights for craft over roost and feeding areas, Liaising with airfields to ensure pilots are informed of their legal duties in respect to the SSSI and SPA. It was suggested (from direct observation) that only planes and craft below 700ft caused disturbance and therefore this represented a suitable minimum height (A. Gibson *pers. comm.*).
Dog walking	Dog exclusion areas, dogs to be kept on leads during sensitive periods at those sites important for feeding, roosting or nesting, programme for walkers and dog owners, similar to the one recently trialled on the North Norfolk coast
Bait digging	Ban on trench bait digging, agreed bait digging locations and methods
Cycling	Anti bike fencing on sections of the river bank to minimise the distribution of disturbance
Bird watching / photography	Pay and book system for birdwatchers and photographers
Wildfowling	Evidence-based restrictions on wildfowling and other regulated activities, ensuring wildfowling clubs continue to operate sensible shooting policy, resolve conflicts between wildfowlers and birdwatchers at Alkborough regarding access to the foreshore
Motorised vehicle access	Targeted police action at regular motorbike/quad sites, access points only allowing people on foot onto the flood bank, and certainly no access for quads etc
Parking	Do not improve parking in sensitive areas
Boating etc	Ensure craft such as Jet ski's etc do not start any regular use in the area by zoning it as a conservation area, Zoned/marked (with buoys) recreational usage of the estuary
Outreach / education	Greater communication with user groups – e.g promotion of existing signage, Codes of Conduct, proactive engagement with user groups and rescue teams etc, feed into coastal access exercises, Target information/Education as appropriate to anglers, aircraft pilots etc, clear guidelines as to how not to disturb wildlife, Better education in terms of their responsibilities within the SSSI and SPA particularly for regular recreational users
Other- further studies	Need to get a better understanding as to the levels of disturbance and where they are coming from , further scientific long term study to reach sound conclusions on the issues which appear most relevant to the Humber

Information on disturbance on the Humber from other sources

6.25 The roost survey of the Humber (Mander et al. 2006) identifies a small number of roosts where disturbance is an issue or where the use of the site by birds can be influenced by disturbance (Table 11).

Table 11: Roost sites where disturbance has been identified as an issue

Roost Number and Description	Species	Activities
5 Fields around Kilnsea	Golden plover, curlew, redshank	
12 End of Saltmarsh at Hawkins's Point	Redshank, curlew	Dog walkers, fishermen
15 Fields on Skunk Island	Golden plover, lapwing	
18 Paull Holme Strays	Golden plover, lapwing, black-tailed godwit, shelduck, teal, mallard, wigeon	Dog walkers, motorcycles
22 and 23 Dock defence structures along the Hull frontage	Turnstone, ringed plover	
44 Cleethorpes/Humberston Roost	Knot, dunlin, bar-tailed godwit, oystercatcher, grey plover, sanderling	

6.26 On the south bank of the Humber (around East Halton/Immingham) regular bird surveys have been conducted by G. Catley to inform the south bank development. These have been written up as a series of weekly and annual reports covering the period January 2007 – March 2010. The reports contain some anecdotal accounts of recreational use and disturbance events.

6.27 The 2007 report (Catley 2007) states that the section between E. Halton Skitters and North Killingholme Haven is "frequently subjected to disturbance from sea anglers during the winter months as there is open vehicular access to the concrete embankment". One of the flooded fields near East Halton (referred to in the reports as field 42, GR: TA149198) has a public footpath running down the southern edge which "seems to be used by a regular movement of dog walkers during the day" and "once disturbance from the field waders and wildfowl seem reluctant to return to the site for long periods". The 2007 reports also documents disturbance from aircraft, for example an instance in March when a flock of 76 birds feeding in pasture were flushed.

6.28 In the report from 2008, (Catley 2008) sea angling, wildfowling and dog walking are identified as the main activities causing disturbance. Sea angling was identified as an issue between November and mid February s between East Halton Skitter and the old seaplane jetty, north of North Killingholme Haven. Anglers were suggested to be a source of frequent disturbance to the adjacent fields and also to the inter-tidal. Anglers apparently drive to their chosen locations but then appear on the highly exposed embankment typically wearing high visibility clothing which makes them particularly obvious to roosting

waders. Catley states that "the disturbance of the inter-tidal areas also reduces the potential feeding areas for waders which is particularly relevant in the short winter days and probably also restricts the number of waders which would roost on the adjacent fields if they had been feeding on that inter-tidal area at low water".

6.29 With respect to dog walking, Catley (2008) believes that this activity has increased dramatically in the East Halton Marshes area and also along the sea embankment at North Killingholme, such that, at East Halton Marshes at least, the number of dog walkers are estimated to average between 5 and 10 people per hour. Catley suggests that the majority of walkers follow roads and the sea embankments and the presence of people in raised positions, such as on the sea embankment "is likely to be seen as a threat to roosting and birds feeding in fields adjacent to the bank which are lower in elevation." Apparently one favoured route that has developed follows the minor road to Winter's pits then on the seawall to East Halton Skitter and back along Skitter road, a route which produces disturbance of many of the key wader roost areas in the marsh.

6.30 Catley (2008) states that during the shooting season (September 1st to February 1st) the smaller of the two pits at East Halton was almost constantly disturbed by shooting in the early mornings and evenings. This "had a marked effect upon the number and variety of waterfowl which used the site during this period. Disturbance was at such a high level that even Coots and Moorhen were particularly skittish and would fly at the first sight of a human being in the adjacent fields." Catley goes on to state that "This level of persecution is clearly having a detrimental effect upon what could be a notable wintering wildfowl locality. The almost immediate increase in waterfowl numbers and variety after the close of the season was testament to the level of disturbance which had prevailed".

Summary

6.31 Questionnaire responses were received from 17 local experts and four WeBS counters providing information on the frequency of different activities and whether they cause disturbance to birds in 37 WeBS sectors out of 39. The quantitative data on frequency of occurrence of activities has been used to create a series of maps to indicate the busiest areas for shore-based, water-based and air-borne activities.

6.32 Overall the busiest areas and the locations where disturbance to birds has been observed are those which provide a particular feature like Spurn Head and Donna Nook for the wildlife and beach recreation. Additionally, parts of the SPA adjacent to the larger settlements of Hull, Grimsby and Cleethorpes are busy in terms of recreation due to the local visitor pressure.

6.33 The range of activities and events that are seen to cause disturbance is considerable, from fireworks to birdwatchers, from military training to microlights. The questionnaire results provide a useful summary and overview of the issues and locations. However it is likely that the different activities all act in synergy and that 'disturbance' needs to be viewed as a compound effect of multiple activities occurring across the whole estuary.

7. Issues relating to Disturbance on the Humber

The Regulatory Framework

7.1 European sites are protected through the provisions of the Conservation of Natural Habitats and Species Regulations 2010 (SI no. 490), which transpose the requirements both the Habitats Directive (Council Directive 92/43/EEC) and the Wild Birds Directive (Council Directive 79/409/EEC) into UK law.

7.2 Regulation 61 implements the provisions of Article 6(3) of the Habitats Directive and ensures that competent authorities can only agree to a plan or project which is likely to have a significant effect (alone or in-combination) after having ascertained that it will not adversely affect the integrity of any European site (subject to imperative reasons of over-riding public interest and consideration of alternative solutions). Impacts associated with recreational activities that can be linked to plans or projects should therefore be avoided through the correct application of Regulation 61 by competent authorities. Regulation 61 applies to all European sites and therefore covers both SACs and SPAs (listed Ramsar features are also protected as a matter of government policy).

7.3 Article 6(1) of the Habitats Directive relates to SACs only. In respect of SPAs, Article 4(1) of the Birds Directive requires that Annex I species "be subject to special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution".

7.4 Article 6(2) of the Habitats Directive relates to both SACs and SPAs (through the provisions of Article 7) and requires Member States to take appropriate steps to avoid, in the SACs and SPAs, the deterioration of natural habitats and the habitats of species as well as disturbance of the species for which the areas have been designated, in so far as the disturbance could be significant in relation to the objectives of the Directives.

7.5 Article 6(2) states that "member states shall take appropriate steps to avoid ....deterioration of natural habitats.... as well as disturbance of the species..."; the wording therefore puts a responsibility on the member state to address such issues where they arise. Article 6(3) ensures that the implementation of plans or projects will not result in such deterioration or disturbance; as such the Article 6(2) obligations on the member state must be limited to deterioration and disturbance that cannot be attributed to the implementation of any plan or project. It is acknowledged that in some cases the difference between what needs to be done to manage disturbance under Article 6(2), and what needs to be done to avoid further disturbance under Article 6(3) will be difficult to distinguish. Nevertheless, in principle, it is appropriate that obligations to tackle disturbance associated with a plan or project are separated from those to tackle other disturbance issues, to which a link to specific plan(s) or project(s) cannot reasonably be established.

7.6 When considering impacts associated with recreational activities, it is therefore important to appreciate the difference between impacts that can be associated with a plan or project (as referred to in Article 6(3) of the Habitats Directive and regulation 61 of the Habitats

Regulations), and impacts that cannot reasonably be associated with a plan or project which should be addressed either through 'necessary conservation measures' as required by Article 6(1) or 'appropriate steps' as required by Article 6(2). 'General' impacts arising from recreational use which cannot be reasonably linked to 'plans or projects' considered under Article 6(3) should be addressed through the provisions of Articles 6(1) and (2).

Defining Likely Significant Effect and Adverse Effect on Integrity

7.7 In relation to new plans or projects, the Habitats Regulations 2010 state that a competent authority may only agree to a plan, project or land use plan once they have ascertained that it will not adversely affect the integrity of the European site. A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan, project or land use plan, which is likely to have a significant effect on a European site, to undertake an appropriate assessment of the implications for the European site (Regulation 61 for plans and projects and Regulation 102 for land use plans).

7.8 There are two important terms within these parts of the Habitats Regulations; likely significant effect and adverse effect upon integrity. Both of which require a judgement to be made, based upon information available, that then informs the conclusion as to whether a plan, project or land use plan is in accordance with the Habitats Regulations legislation, or contrary to it.

The likelihood of significant effects is now widely considered to be defined by the landmark 'Waddenzee Judgment' made in 2004 by the European Court of Justice Case C-172/02. Paragraph 44 of that Judgment states that:

"*In the light, in particular, of the precautionary principle... and by reference to which the Habitats Directive must be interpreted, such a risk exists if it cannot be excluded on the basis of objective information that the plan or project will have significant effects on the site concerned*."

7.9 Practitioners now commonly refer to the initial likely significant effect test as the 'filter' or 'screening' through which all necessary plans, projects or land use plans are taken. Where objective information clearly demonstrates that significant effects upon a European site are not likely, they can be quickly removed or 'filtered out' or 'screened out' from the assessment process. However, where significant effects are likely, and most importantly, where the likelihood of significant effects cannot be excluded, there is a requirement for further and more detailed assessment.

7.10 The definition of adverse effect upon integrity is more complex, but clearly relates to the ecological dynamics of the species or habitat in question. The Managing Natura 2000 sites guidance produced by the EC (European Communities 2000) defines integrity (at section 4.6.3) as 'the coherence of the site's ecological structure and function, across its whole area, or the habitats'. The guidance advises that the integrity of the site relates to its conservation objectives, and this is logical, because a site achieving its conservation objectives is one that is ecologically successful. Any impact that affects the achievement of conservation objectives will affect the ecological success of the species or habitat.

7.11 The maintenance of the integrity of a European site is essentially based upon its ecological functioning. The resilience of the interest feature, its genetic quality, its ability to successfully survive in the long term, its robustness and ability to adapt or evolve in accordance with its environment are all key elements of ecological integrity. Factors that impair the ecological functioning of a site include a direct reduction in the interest features, degradation of habitat supporting interest features (habitat for feeding, resting, breeding etc), negative changes to species or habitat distribution across the site and changes to processes on which the feature relies. The intensity, duration, frequency and proximity of the impact will all determine whether an adverse effect upon integrity will occur as a result of the impact.

7.12 Natural England (Countryside Council for Wales for Welsh European Sites and Scottish Natural Heritage for Scottish European sites) is the only statutory consultee referred to within the Habitats Regulations for the assessment of plans, projects and land use plans. However, conclusions regarding what constitutes an adverse effect upon ecological integrity are often made with a consensus of expert ecological opinion. It is common practice for Natural England, the RSPB, Environment Agency and other specialist bodies to share information and research, in order to draw scientifically sound conclusions. As the statutory consultee, Natural England will advise where Habitats Regulations Assessments are not in accordance with their scientific understanding of how a site may be affected, or where, in the absence of information to demonstrate that ecological integrity will not be adversely affected, the precautionary principle has not been applied.

Locations and circumstances where recreation may currently be an issue

7.13 Disturbance therefore needs to be considered in light of the conservation objectives and the ability of the site to support the designated interest features.

7.14 Guidance from the EC (European Communities 2000, section 3.6.2) indicates that disturbance "is often limited in time (noise, source of light, etc.). The intensity, duration and frequency of repetition of disturbance are therefore important parameters". In order to assess whether disturbance is significant "reference can be made to the definition of the favourable conservation status of a species". In reporting on Favourable Conservation Status, account is taken both of habitat condition and the status of the birds within the SPA. Annual counts (WeBS data), in the context of five year peak means for qualifying species, are used together with available information on population and distribution trends, to assess whether an SPA is continuing to make an appropriate contribution to the Favourable Conservation Status of a species. Favourable condition for the SPA interest features are defined in original guidance from English Nature (English Nature 2003). This states that the target, in relation disturbance (and both the Annex I species and the waterfowl assemblage) is "No significant reduction in bird numbers and productivity or displacement of birds attributable to human disturbance from an established baseline, subject to natural change."

7.15 The evidence presented so far within this report would indicate that disturbance could be causing a reduction in bird numbers, productivity and displacement. However the issues are complex and it is not possible at this stage to identify the extent to which disturbance

is, or could be, having an adverse effect. Disturbance on the Humber needs to be considered at an estuary wide level and in context with other factors; this perspective cannot be achieved from current information sources.

7.16 The Humber is a very large estuary (see Table 2), and most of the SPA's area is located well away from public footpaths and the shore. At low tide particularly there is a very large area of habitat that the birds can exploit, and therefore it is likely to be possible that birds can redistribute themselves according to where disturbance is occurring and that undisturbed sites will occur.

7.17 The issue is complex because there are a range of species, all with different ecological requirements and life histories. There is a range of access types and activities, all of which occur at varying levels of intensity at different locations. Added to this is the complex range of substrates, habitat types and prey availability, all of which will influence the range of sites and food available to birds at any one time. Furthermore there are a range of other factors that may affect the ability of the estuary to support the bird interest, for example industrial disturbance (Burton *et al.* 2002; Burton *et al.* 2002; Burton 2007), water quality (Cabral *et al.* 1999; Lewis & Kelly 2001), habitat quality (Stillman *et al.* 2005; West *et al.* 2007) and weather (Clark *et al.* 1993; Goss-Custard *et al.* 2006).

7.18 A good example of how disturbance may interact with other factors comes from modelling work in the Baie de Somme in France by Goss-Custard *et al.* (2006). Disturbance can cause birds to spend energy flying away and to lose feeding time while relocating to different feeding areas, where the increased bird densities may intensify competition from interference and, if of sufficient duration, from prey depletion. Disturbance at the Baie de Somme was such that oystercatchers were disturbed up to 1.73 times per daylight hour. Modelling shows that the birds can be disturbed up to 1.0–1.5 times per hour before their fitness is reduced in winters with good feeding conditions (abundant cockles *Cerastoderma edule* and mild weather) but only up to 0.2–0.5 times/h when feeding conditions are poor (scarce cockles and severe winter weather). Hence the impact of disturbance is particularly severe when bad weather, limited food availability and disturbance all coincide.

7.19 There are relatively few studies that provide this level of detail as few have explored how disturbance interacts with other factors and the information is certainly not available for the Humber. Our existing understanding of the Humber estuary and its ability to support the populations of key wader species comes from the individual-based model produced by Stillman *et al.* (2005). Stillman *et al.* assessed the quality of the Humber for 9 shorebirds; dunlin, ringed plover, knot, redshank, grey plover, black-tailed godwit, bar-tailed godwit, oystercatcher and curlew. The model predicts over winter survival and predicts the shorebird distribution and the diets of each species. Predicted survival rates were highest in dunlin and ringed plovers, the smallest species, and in oystercatchers, which consumed larger prey than the other species. The model shows that the over winter survival was most strongly influenced by the biomass densities of annelid worms, and the bivalve molluscs *Cerastoderma edule* and *Macoma balthica*. A 2 to 8% reduction in intertidal area was predicted to decrease predicted survival rates of all species except the dunlin, ringed plover, knot and oystercatcher. Disturbance can operate in a similar fashion to habitat

loss, as the avoidance of areas of high disturbance is essentially equivalent to those areas not being available to the birds at all (but see West *et al.* 2002). The results from the Humber models, if disturbance is considered to have a similar impact to habitat loss, would suggest that relatively small areas of the estuary need to be disturbed for the over winter survival of some key species to be affected. The modelling may also suggest that dunlin, ringed plover, knot and oystercatcher may be the species most able to cope with increased levels of disturbance on the Humber.

7.20 With a recognition that, at this stage, we do not have the full understanding of the Humber as a system and how disturbance may interact with other factors, is it possible to identify locations and types of access where disturbance may have an impact? From the evidence presented in sections 3 – 6 we can highlight the following:

- A number of the interest features of the SPA, including wintering/passage waders, wintering wildfowl, wintering hen harrier and little tern have all shown marked declines within the area. Many of these species are vulnerable to disturbance and there is evidence from other sites showing impacts from disturbance.
- Little terns are particularly vulnerable as breeding species. Of the waders, ringed plover, dunlin, oystercatcher and knot may be the more robust species.
- There is evidence that dog walking, wildfowling, angling, microlights, aircraft, bait digging, jet skis, powerboats, walkers and the presence of people (especially bird watchers) on embankments can cause disturbance on the Humber.
- Jet skis, kite surfing and other types of water-based sports appear to be increasing and have perhaps, until now, occurred at relatively low levels
- Dog walking, angling and some other shore based activities have possibly increased. Dog walkers will walk out on intertidal habitats that are sandy but on much of the estuary dog walkers and other shorebased activities are largely focused on the embankments and sea walls.
- Disturbance outside the SPA can also have an impact, as birds may use fields and other areas as high tide roost and additional feeding areas.

Housing and development pressure in the future

7.21 The SPA and Ramsar site is bounded by five local planning authorities; East Riding of Yorkshire Council and Kingston upon Hull City Council on the northern bank, and North Lincolnshire Council, North East Lincolnshire Council and East Lindsey District Council on the southern bank. Four of the five local planning authorities bounding the Humber fall within the Yorkshire and Humber Region, with the exception of East Lindsey District Council, which falls within the East Midlands Region and bounds the most southerly part of the south bank of the Humber, at the estuary mouth.

7.22 On 22nd July 2010, the Secretary of State for Communities and Local Government announced that the regional level of government would be abolished, thus removing the Regional level of spatial planning documents from the planning system. At the time of writing this report, the loss of the regional tier of government and planning documents has currently left local planning authorities in a state of flux. The Regional Spatial Strategies gave clear direction to local planning authorities, particularly in relation to housing and

economic development. Local Planning Authorities are awaiting further direction from Central Government in order to proceed with spatial planning at the local level.

7.23 It is important to note that, whilst the Regional Spatial Strategies have been withdrawn, the wealth of background material and evidence base for each regional spatial strategy remains, and this will continue to inform and steer spatial planning at a local level. Additionally, local development framework documents have proceeded with their regional housing allocations and it is therefore assumed that those housing figures will be carried forward, unless Central Government advises otherwise. For the purposes of this report, the regional housing figures currently set out within each local development framework are assumed to represent the proposed housing increases to 2026.

7.24 The Yorkshire and Humber Regional Spatial Strategy was published by the Secretary of State for Communities and Local Government in May 2008. The Strategy advises that the sub area has a population of 785,000, split between 473,000 on the north bank and 312,000 on the south bank. The strategy pays particular importance to the role of the Humber Ports in accessing national and international markets, and proposes that further development of the Humber Ports should be realised. The strategy does caveat this approach in its introductory sections, with the requirement for more detailed strategies, policies and proposals to be assessed under the provisions of the Habitats Regulations.

7.25 Policy HE1 Humber Estuary sub area policy of the Regional Spatial Strategy states that plans, strategies, investment decisions and programmes for the Humber Estuary sub area should maximise opportunities around and close to the ports and the deep water channel for estuary-related uses. Improving transport connections, with a particular focus upon the A63 road and rail links is a regional priority. The ports are highlighted as significant economic drivers, and the strategy sets an annual job growth target for the Humber sub region of 2,920, which is approximately 0.8% per year from the 2006 baseline of 373,540.

7.26 The regional spatial strategy states that the provision and distribution of housing in the Yorkshire and Humber Region should take account of the drive for strong economic growth in the Humber sub area. Within the sub area, the strategy gives clear priority to the development of Hull as a regional city, and a focus upon housing growth in the Hull housing market area. Housing figures are presented for the regional plan period up to 2026, and have been taken forward into the local development framework documents accordingly.

7.27 East Lindsey District Council is the one authority bounding the Humber that lies within the East Midlands Region. The Regional Spatial Strategy for the East Midlands was published by the Secretary of State for Communities and Local Government in March 2009. With a small proportion of the region bounding the Humber, the economic importance of the Humber area is not a key focus of the strategy. Housing provision in coastal Lincolnshire, including East Lindsey District, is restricted within the published Regional Spatial Strategy, pending the development of a Lincolnshire coastal strategy.

7.28 Table 12 provides an estimation of the percentage increase in housing numbers up to 2026 within the local authorities that bound the Humber Estuary. Numbers of new houses are taken from the regional and local planning documents. The Regional Spatial Strategy for

the East Midlands sets housing figures from 2006 to 2026, whereas the Yorkshire and Humber Regional Spatial Strategy split its allocations between 2004-2008 and then 2008-2026. Estimates have therefore been made for East Lindsey District to provide a comarative2008-2026 figure. The number of households in 2008 has been added in order to give a 2008 baseline from which a percentage increase in houses could be calculated. The 2008 baseline figure should be taken as an estimate only, as household numbers have been derived from a variety of sources such as the 2001 census, local development framework documents and evidence base and local authority websites, and where the data year was before or after 2008, estimates to provide a 2008 figure have been made.

7.29 Table 12 indicates that across the majority of the Humber area, the number of households is proposed to increase by approximately 15%. This is based upon the assumption that the housing figures from the revoked regional spatial strategies will continue to be taken forward within local spatial planning documents.

Table 12: Approximate percentage increases in dwellings up to 2026

Yorkshire and Humber				
LPA	**RSS annual increase from 2004-2008**	**RSS annual increase from 2008-2026**	**Estimate of 2008 baseline number of households**	**Approximate % increase in houses 2008-2026**
East Riding of Yorkshire	1150 (40% to be within Hull housing market area)	1150 (20,700 in total) (40% to be within Hull housing market area)	**139,134** *131,084 households in 2001 census*	15%
Kingston upon Hull	280	880 (15,840 in total)	**113,240** *115,000 based upon LPA website info 2010.* *104,288 households in 2001 census*	14%
North East Lincolnshire	310	510 (9,100 in total)	**70,000** *Core Strategy Revised Preferred Options 2008*	13%
North Lincolnshire	550	750 (13,500 in total)	68,275 *68,000 households in 2006 North Lincolnshire housing needs and market assessment*	20%
Humber sub area total	**2290**	**3290 (59,220 in total)**	**390,649**	**15%**
East Midlands				
LPA	**RSS total increase from 2006-2026**	**2008-2026 total increase estimate**	**Estimate of 2008 baseline number of households**	**Approximate % increase in houses 2008-2026**
East Lindsey District	6,000	5400	65,117 *65,717 from LPA website 2010*	8%

Summary

The evidence presented so far would indicate that there could be likely significant effects, however the issues are complex and it is not possible at this stage to identify the extent to which disturbance is, or could be, having an adverse effect. Disturbance on the Humber needs to be considered at an estuary wide level and in context with other factors, this perspective cannot be achieved from current information sources.

8. Recommendations for short term management solutions

8.1 A range of different general measures are possible to reduce or limit the impacts of disturbance, a summary is provided in Table 13.

Table 13: Management measures to minimise disturbance on coastal sites. Adapted from Stillman *et al.* (2009).

Management measure	Notes / description
Off site	
Provision of alternative sites	Currently little evidence has been collated to demonstrate effectiveness. Provision may need to be combined with other measures such as education and on-site management on the designated site. Likely to need to be carefully designed and targeted so as to provide a viable alternative. Targeting for dog walkers would need to ensure dog friendliness (Edwards & Knight 2006) and suitable routes (e.g. Liley, Jackson, & Underhill-Day 2006; Clarke, Sharp, & Liley 2008). For water-based activities gravel pits or similar may need careful landscaping and particular types of infrastructure.
Education	Potential to promote non-designated sites, for example through web / leaflets listing dog friendly sites. Local media, papers etc can provide a means to highlight conservation importance of sites and encourage responsible access. Tailored leaflets/websites etc. can be produced and targeted at each user group (e.g. cyclists, horse riders, anglers etc). Direct work with local clubs, groups and bodies may be effective and web-based forums and discussion groups can provide an way of contacting different users.
Changing by-laws at particular locations	Allowing dogs off leads etc in particular locations that are not sensitive for nature conservation or other reasons may increase their attractiveness to dog walkers.
Review of parking charges	Cheap or free parking at particular locations may encourage visitors and therefore help to redistribute access away from areas important for birds. Reduced parking fees in the early morning may be particularly effective in encouraging dog walkers.
On site, shore-based	
Wardening	Wardens can provide face to face contact and can directly intervene when they observe particular activities (such as dogs off the lead on mudflats). They can have an educational role, showing people wildlife etc.
On-site education	Ensuring visitors are aware of the conservation importance of sites should help encourage responsible access.
Landscape design and careful design of routes	Planting, screening, careful routing, provision of access infrastructure (boardwalks, marked paths, steps etc) can all influence visitor flows within sites and the potential of people to cause disturbance. Subtly directing people along the inside of borrow-dykes or below seawalls can mean they are invisible to birds on the mudflats. There is evidence that roosting waders will continue to use roosts where barriers exist to keep people back or at least keep people walking along a regular route (Swann 2007).
Control of parking	Limiting car-park spaces or closing car-parks in particular locations is likely to be contentious, but is likely to be effective in reducing visitor numbers in the long-term (Beunen, Jaarsma, & Regnerus 2006).
Modification of parking charges	Changing parking charges to reflect a higher cost during particular times of year or times of day may encourage people to choose alternative locations. Some suggestion that may only be effective in the short-term (Beunen et al. 2006).

Management measure	Notes / description
By-laws	Bans on dogs, the requirement for dogs to be on leads or fines for dog fouling may encourage dog walkers not to use particular areas.
On site, water-based	
Careful provision of facilities	Provision of public slipways, trailer & vehicle access to shore etc. in predetermined locations where boat access is likely to be away from bird interest.
Pro-active work with clubs and groups	Self-policing is ideal as it is low cost and self regulating – example would be water-skiing club revoking membership for anyone caught speeding (defra 2004).
Education	Information on access points, speed limits, zoning etc easily accessible to all, through leaflets, web etc. Reasons for zoning etc should be carefully explained.
Zoning	Designated areas for particular activities.
Permits / vessel registration	System of permits or similar to limit numbers and maintain records. Should enable a mailing list of particular users to be maintained.
Policing	Policing of watercraft zoning, speed limits etc, with fines or other penalties for infringement
Bylaws	Bylaws to control particular activities and set speed limits

8.2 At this stage we can highlight areas and activities where disturbance is potentially an issue, and we can also suggest possible measures that could be effective in reducing the disturbance impact.

8.3 In many cases much more detailed work is necessary to inform what will actually work, how measures should be designed and how they should be implemented. Measures such as car-park closures or changing parking can evoke considerable hostility from existing users[8] and may not work if considered in isolation to other factors (e.g. Regnerus, Beunen, & Jaarsma 2007). Local residents can often feel particularly aggrieved if they feel their access is being limited (e.g. Holding & Kreutner 1998) and it is also not always easy to predict how people will respond to particular initiatives (e.g. Daniels 1986). Prior to any measures being put in place it is usually necessary to talk to users and detailed visitor surveys may be required to understand the target users, their motivation for visiting sites (e.g. Kramer *et al.* 2004) and their response to possible management measures.

8.4 We therefore, with caution, suggest the following as possible short-term measures that could be explored in more detail:

- Measures to control vehicle access onto seawalls (e.g. concrete embankment around East Halton). Possible methods include bollards, locked gates, permit systems, policing or signage.

[8] see for example http://www.newforestnpa.gov.uk/dog_walking_statement and http://www.newforestdog.org.uk/parkingthecar.html

- Measures to limit impacts of disturbance at realignment sites such as Paull through screening, routing of paths around the base of the embankment on the inland side etc.
- Direct contact with flying clubs and other airborne user groups to limit flights over/adjacent to the SPA or ensuring that use is well above 700ft.
- Promotion of dog friendly sites at a strategic, Humber wide scale to promote dog friendly areas and highlight areas where dogs can be detrimental to local wildlife. Web sites with coloured symbols to indicate dog friendly sites have been used in other areas and could provide a suitable model[9].
- Detailed work at Spurn and possibly other sites to record trench bait digging and explore potential measures to control it. Trench bait digging contravenes the codes of conduct but still occurs. By-laws and policing may be necessary. Direct contact with tackle shops may also be effective.
- Infrastructure installed on seawalls to prevent easy access for cyclists and quad bikes etc. along footpaths
- Direct liason with police to ensure enforcement where illegal motor vehicle use occurs
- Given the decline in little tern numbers and the evidence that fencing, signage and wardening are effective measures (e.g. Medeirosa *et al.* 2007), additional fencing, signage and disturbance free zones would be desirable.

[9] e.g. http://www.dorsetdogs.org.uk/

9. Recommendations for further research and full study

Recognising a need for further work

9.1 We have so far highlighted that:

- There are a wide range of recreational activities that occur around the estuary, occurring at different intensities at different locations
- There is no systematic and robust recording of access and recreational use. While we have tried to provide an estuary-wide perspective, this has largely been based on opinion and anecdotal accounts.
- Many of these activities have been seen to cause disturbance, for example causing birds to take flight.
- There have been marked declines for many of the SPA interest features on the Humber, yet we do not know to what extent disturbance may be contributing to these declines
- There are statutory obligations relating to preventing deterioration of habitats and avoiding disturbance within Natura 2000 sites
- In order to understand disturbance it is necessary to consider it a site level, and in context with factors such as tidal coverage, prey abundance etc. Simple studies recording whether birds fly away or not may provide misleading results

9.2 The clear gaps in our current understanding are:

- What is the spatial distribution and numbers of visitors undertaking different activities around the estuary?
- How will visitor number change in the future?
- Which activities and in which circumstances cause disturbance?
- Does disturbance currently affect the population size / ability of the estuary to support the populations of key species?
- Will increases in disturbance have population consequences for the birds?
- Is there a need to manage visitors / control access?
- What options are there to manage visitors?

9.3 We do have a good existing understanding of the numbers of birds across the whole estuary (from WeBS). There is some data on prey abundance, tidal flow and an existing model that looks at the whole estuary system.

9.4 A visitor survey will provide answers to bullet 2 (above) and will partly answer bullet points 1, 3, 6 and 7. Visitor counts (similar to WeBS for birds) will address bullet point 1 and will partly address bullet 6. Detailed ornithological work would address bullet point 3. The only way to address bullet 4 (which is potentially the most important) is through detailed modelling, which would also provide answers to bullets 5, 6 and 7.

9.5 There is little merit in doing ornithological fieldwork in isolation – i.e. without being able to place the results in context with prey abundance, tidal variation etc and to look at disturbance at an estuary-wide level. Any ornithological fieldwork needs to generate

accurate counts, estimates of distances at which birds respond and should determine the time and energetic consequences of disturbance. There are numerous studies that show birds fly away when disturbed, there's little point adding to this literature – simply showing that birds fly away more often when there is a dog on the mudflats compared to a person on a seawall tells us nothing about whether disturbance is an issue on the Humber.

9.6 With a minimal budget the most useful information would therefore be the visitor survey work. This would provide baseline, accurate information on the levels of activities, where they occur, which have the potential to cause disturbance and would provide information on how access could be managed and potential disturbance reduced.

9.7 In order to progress things further it would be necessary to undertake ornithological fieldwork and modelling. As the conservation objectives for coastal birds are determined in terms of population size (e.g. population size present at time of SPA designation), the overall objective for a model would be to predict whether current or future levels of disturbance will reduce the population size of birds that can be supported by the Humber estuary. To achieve this, we recommend adapting the existing model of the estuary (Stillman *et al.* 2005) that incorporates the behavioural responses of the birds to disturbance. The model will also incorporate the food available to the birds and its exposure through the tidal cycle. The model can incorporate the negative effects of disturbance on the birds, but can also allow the birds to compensate for disturbance, for example by feeding for longer or moving to less disturbed locations. Such approach provides a mean of considering disturbance on an estuary wide basis and in context with the habitats, prey abundance and species present.

9.8 While a model already exists, additional research is designed to provide the parameters required by this model. A pragmatic approach would involve using original data on invertebrate food supply, but ideally a comprehensive approach would involve an invertebrate survey of the entire estuary. Full details of the different elements are set out below.

Visitor Survey and Monitoring

9.9 Visitor survey work is necessary to:

- Gain accurate information on visitor numbers in a systematic way for the entire SPA
- Compare different activities and identify which occur at the greatest intensity and in the areas most important for birds
- Gain detailed information on how far people undertaking different activities roam on the intertidal and identify which activities take place on embankments
- Understand more about the types of people undertaking each activity, why they visit, etc.
- Understand how management measures may work and be effective
- Provide information necessary to incorporate disturbance in the individuals based model

9.10 In order to determine visitor numbers for the entire estuary a series of direct counts are required. These should take simultaneously (in a similar fashion to WeBS counts) and

record the number of parked cars in all car-parks, the number of craft on the water and the number of people visible (e.g. water craft/boats, people on intertidal, people on embankments etc). These counts will require a team of people who visit a range of different vantage points and record the information for each patch of the estuary. With the open nature of the coast it should be possible for a relatively small team to cover the estuary, and for counts to be made over a wide area from a single vantage point. The counts should be simple snapshots – and should cover a range of dates across the winter, a range of tide heights, weather conditions and times of day.

9.11 At a selection of locations, ideally corresponding to the bird survey locations, more detailed survey work is necessary. Counts / interviews should be conducted at the sample points, which will be carefully selected so as to capture the range of recreational use believed to occur within each patch. The survey location will typically be at access points, such as car-parks. Footprint Ecology use a standard method which we have refined over a number of years and that has been widely adopted. Surveys are split into two-hour sessions, spread over a day (for the winter these four sessions would be: 07:30 – 09:30; 10:00-12:00; 12:30-14:30; 15:00-17:00), to provide eight hours of survey on each day. This ensures coverage from dawn until dusk, allows direct comparison between survey locations and also provide the surveyor with breaks.

9.12 During each two hour period the surveyor records the numbers of people (and the number of groups) passing them (i.e. entering and leaving if at an access point). Separate totals should be recorded for entering and leaving. Numbers of dogs should also be counted. As many people leaving as possible are interviewed. The sample of people interviewed can be randomised by the surveyor approaching all people leaving (as long as they are not already interviewing others). Only one person (selected at random) from each group / party should be interviewed and a standard survey protocol followed, e.g.:

- Surveyors will be usually be based at their car at an access point, and will have a large poster with logos highlighting that they are undertaking a visitor survey.
- Surveyors should carry photo ID and wear high visibility jackets.
- No unaccompanied minors should be approached or interviewed.
- Surveyors will carry business cards that can be handed out to anyone wanting to check their identity.
- Surveyors should be polite and courteous at all times.
- Surveyors need to be trained in the questionnaire and interview approach, ensuring standard sampling

9.13 The questionnaire should be reasonably brief, and depending on the format / questions asked, the data can be collected using PDAs in the field, to ensure accuracy and minimise further data entry. The questionnaire should include questions relating to:

- Transport used to reach the site
- Activities undertaken
- Access points used

- Other parts of the area visited
- Visitor profile: age, employment status etc.
- Home postcode and whether a local resident or visiting tourist
- Opinions of management issues and potential changes
- Route travelled on site

9.14 The home postcode data can be used to determine distance travelled.

9.15 Route data can be collected by giving a sample of people GPS units and by asking the rest to plot their route on a map. Footprint Ecology have been using small, relatively cheap GPS units that are widely available[10]. These are thumb sized, waterproof and robust, and are designed specifically for recording route data. They work well where the surveyor is surveying at access points and can be sure the person/group would be returning the same way (for example because their car was parked at the access point). The units are suitable for use on the water as well as on land. The alternative approach is to use paper maps to record routes. When asking for people's routes the surveyor needs to ensure they refer to landmarks and have a range of aerial photographs and maps available. Some users such as cyclists may have covered a considerable distance and it can be difficult to accurately record such routes, the surveyors therefore must be aware of the geography of the area, key landmarks etc and should ensure accurate information is recorded. The route data can be summarised as the distance travelled on site, the length in different habitats (e.g. distance travelled on mud flats) and the distance travelled away from the shoreline (i.e. inland).

Long-term visitor monitoring

9.16 The direct counts of visitors and car-park counts provide the information for the model, and can also be used as the basis for establishing a long term monitoring programme. Repeated counts, at a sample of locations or across the estuary, can be conducted at regular intervals to provide an indication of changes in access levels. The output of the modelling would indicate which activities, locations etc. are of critical importance and how much of an issue disturbance is. This will then help focus the long-term monitoring.

9.17 In addition to the repeated counts, a network of automated counters would be ideal. Automated counters, such as pressure pads on shore paths provide a cost effective means of getting large, continuous data sets, allowing change over time to be determined. Such methods are however crude in that it is difficult to separate individual types of access (such as the relative proportions of dog walkers, walkers, joggers etc). They therefore neatly compliment direct counts.

Predicting the consequences of disturbance for population size

9.18 There is no guarantee that the behavioural responses of birds to disturbance (e.g. flight distance or time spent disturbed) are related to the population consequences, for example measured in terms of increased mortality (Gill, Sutherland, & Watkinson 1996; Gill, Norris, & Sutherland 2001b). For example, birds that show a large behavioural response to disturbance may do so simply because they have alternative feeding sites to move to. The

[10] http://www.maplin.co.uk/Module.aspx?ModuleNo=227620

impact of disturbance needs to be measured in terms of its effect on population size (or a determinant of population size), rather than simply in terms of behaviour (Gill et al. 2001b). In migratory shorebirds (such as those of interest in the Humber Estuary), population size depends on (i) the mortality and reproductive rates in the breeding ranges and (ii) the mortality rate in the non-breeding range, including migratory routes (Sutherland 1996). Therefore, the best measure of the impact of disturbance on population size is one which, directly or indirectly, determines these demographic rates . For migratory shorebirds during the non-breeding season, this means that the impact of disturbance should be measured in terms of its effect on: (i) the storage of fat reserves needed to fuel migration in spring and to breed successfully after the birds have reached the breeding grounds and (ii) the number of birds that die during the non-breeding season (Goss-Custard *et al.* 2002).

Using individual-based models to predict the consequences of disturbance

9.19 Individual-based models (IBMs) (e.g. Grimm & Railsback 2005) are a means of predicting whether disturbance is likely to be increasing the mortality rate or decreasing the fat reserves of birds. These models track the decisions, behaviour and locations of all animals within a population, and derive demographic rates, such as mortality, from the fates of all individuals. Animals in these models behave according to the same rules as real animals (e.g. they feed in the locations that have the highest density of their preferred prey, but avoid potential threats such as disturbance). Model animals therefore respond to changes in their environment (e.g. increased disturbance) in the same way that real animals would. Such IBMs have been used to address a wide range of shorebird conservation issues including human disturbance (e.g. West et al. 2002), habitat loss (e.g. Stillman *et al.* 2005), habitat creation (e.g. dit Durell *et al.* 2005) and shellfishing (e.g. Stillman *et al.* 2003). These models are the best approach currently available to predict the population consequences of disturbance.

Existing individual-based model for shorebirds in the Humber Estuary

9.20 Our proposal is to extend an existing IBM of shorebirds in the Humber estuary (Stillman et al. 2005). This model was used to assess the quality of the Humber estuary for 9 shorebird species (dunlin, ringed plover, knot, redshank, grey plover, black-tailed godwit, bar-tailed godwit, oystercatcher and curlew) and is discussed in paragraph 7.19. Site quality was predicted as overwinter survival. The model accurately predicted the observed shorebird distribution, and the diets of most species. Predicted survival rates were highest in dunlin and ringed plover, the smallest species, and in oystercatcher, which consumed larger prey than the other species. A 2 to 8% reduction in intertidal area (the magnitude expected through sea level rise and industrial developments) decreased predicted survival rates of all species except dunlin, ringed plover, knot and oystercatcher.

Adapting the Humber model to incorporate disturbance

9.21 The existing Humber model was designed to predict the effect of habitat loss on the birds and so does not incorporate the effect of human disturbance. However, similar IBMs have been used to predict the effect of disturbance (West *et al.* 2002; Stillman *et al.* 2007) and the technique for doing this is well established. The required data are the distances and times over / for which birds are affected by disturbance sources, and the frequency of

these disturbances. The proposed research aims to collect these data throughout the Humber. Within the model, disturbance will act to reduce the feeding area available to the birds, reduce the time birds have available for feeding and increase their energy demands (by causing them to take flight). This will influence the places that the model birds choose to feed and their feeding rate and energy requirements while on a feeding location. Birds will attempt to compensate by feeding in less disturbed locations or feeding for longer. Any birds that cannot compensate will draw on their fat reserves or die of starvation if these fat reserves are exhausted. This approach follows that when IBMs have been used to predict the effect of disturbance on the mortality rate of shorebirds in other sites.

9.22 The modelling approach provides the potential to explore disturbance in combination with other factors such as habitat loss, habitat creation, changes in prey abundance or changes in tidal flow.

Involvement of Associated British Ports Marine Environmental Research

9.23 The Humber model was developed by Richard Stillman under contract to Associated British Ports Marine Environmental Research (ABPmer) who own the invertebrate food supply data and tidal model that were used to parameterise the model. ABPmer would therefore need to be involved in any future project. They have indicated that they would be willing to be involved in such a project, but would need to be contacted directly by HMS to discuss details and costs. Richard Stillman has access to the Humber model itself.

Structure of the new model and definition of 'patches'

9.24 The new model will divide the Humber Estuary into a number of patches. These patches will correspond to those used to monitor visitor numbers and record the response of birds to disturbance (see below). We suggest that the patches correspond to existing WeBS sectors but they should be carefully assessed so that, ideally, each patch is comprised of relatively uniform habitat and is relatively discrete in terms of access (e.g. does not have a car-park on the patch boundary). There are currently 39 WeBS sections so there would be at least 39 patches within the model.

9.25 The model will simulate an overwinter period between September and March, and divide time into one hour time steps. The ABPmer tidal model will be used to predict the area of each patch exposed during each one hour time step assuming tidal exposure varies through an average spring-neap cycle. The model will incorporate changes in day length and so each time step will occur either during daylight or the night. The start-of-winter food supply available within each patch will be determined from either existing ABPmer data or newly collected data (see below). The food supply available within each patch will decrease due to depletion by the birds and other sources of prey mortality. The amount of human activity within / along the coast of each patch will be determined by newly collected visitor data (see below) and from predicted changes in visitor numbers (see below). The behavioural responses of the birds to disturbance (e.g. distance at which birds are disturbed and time to resume feeding after disturbance) will be determined from newly collected data (see below). The observed population size of each species will be introduced into the model at the start of winter. During each hour time step, each bird will move to the patch on which it is able to assimilate energy at the highest rate, taking into

account the negative effects of disturbance. If all patches are covered by the tide, birds will roost. Birds that are unable to meet their energy demands will lose mass, and will die of starvation if their energy reserves fall to zero. The model will predict the proportion of birds that survive to the end of winter and the body mass of the surviving birds. The influence of differing amounts of disturbance will be determined by changes in the proportion of birds that survive and the body mass of surviving birds.

Example simulations of the new model

9.26 The exact simulations to be run will be determined in consultation with HMS but to give an indication, some examples are given here. The effect of existing levels of disturbance on shorebirds could be determined by running simulations either with or without disturbance. If simulations without disturbance predict higher survival rates than simulations with existing levels of disturbance, this will be evidence that disturbance is currently having an adverse effect on the birds. Possible future levels of disturbance and the distribution of disturbance throughout the estuary will be predicted from the visitor surveys proposed within the project (see below). Simulations could be run to determine whether these increased levels of disturbance would adversely affect the birds. This would be determined by comparing predicted survival with increased disturbance to the predicted survival with present day disturbance. The relative influence of different types of human activity could be tested by running simulations in which different activities were removed and noting changes in the predicted survival rate. The effect of disturbance in different parts of the estuary could be tested by varying the level / type of disturbance in different model patches.

New research required to develop the model

9.27 The main data required to parameterise the model are: (i) the population sizes of shorebirds in the estuary; (ii) the tidal exposure of the invertebrate food supply; (iii) the biomass of the invertebrate food supply throughout the estuary; (iv) the frequency and types of human activities throughout the estuary; (v) expected future changes in the frequency and types of human activities throughout the estuary; and (vi) the response of birds to human disturbance throughout the estuary. Shorebird population sizes are available from the Wetland Bird Survey (WeBS) data and it has been assumed that these data will be available for the project. The tidal exposure of patches will be determined from the existing tidal model owned by ABPmer. Two options exist for quantifying the biomass of food throughout the estuary, either the use of the existing data (owned by ABPmer) or the undertaking of a new survey. New research will be required to estimate visitor numbers (both present day and in the future) and the response of birds to this disturbance. The following sections propose research to measure the invertebrate food supply, the present day and future levels of human activity, and the response of birds to disturbance.

Invertebrate food supply

9.28 The ABPmer invertebrate data were collected during 1999 and 2000, and so describe the food supply available to birds 10 years ago. Invertebrate populations vary through time and so ideally more up to date survey data would be used as a basis for the model. Such invertebrate surveys involve taking sediment cores throughout a site and identifying the

invertebrates contained within the core. In order to estimate variation in invertebrate populations throughout a site it is important that samples be distributed throughout the site rather than being restricted to a few locations. Options to be considered are the number and distribution of sampling locations throughout a site, and the number of core samples taken at each location. Common Standards Monitoring protocols are available for such invertebrate surveys. It is proposed that the sampling procedure at each sampling station should follow the standard methodologies defined in the JNCC Marine Monitoring Handbook[11]. It is proposed that PG 3-6 be adopted for the survey – this approach both quantifies the bird food and provides an overall assessment of the biotope condition at each sampling location. PG 3-6 requires 5 invertebrate samples to be collected from each sampling station. As subsequent processing of samples is a time consuming process, reducing the number of samples is one way of reducing costs and options are given below. Options are also given for the total number of sampling stations within the site – of these 100 samples is considered to be a minimum for a site the size of the Humber Estuary. Following PG 3-6 the following methodology is proposed.

(1) *Extent of habitat*. The extent of the intertidal habitat should be assessed using a combination of aerial photographs maps provided and field observation, which should be incorporated in to GIS to compare with archived information.

(2) *Survey design*. The location and number of sampling stations should be determined by dividing the intertidal area into either a 500 m (approximately 1,505 sampling stations) or 1 km (approximately 375 sampling stations) grid based on the National Grid. Sampling stations should be visited at low tide. It is assumed in the costs below that transport between sampling stations will be by hovercraft, and that the survey will be conducted by two people, in addition to the hovercraft pilot. Experience has shown that two people are required to efficiently collect the data required from each sampling station. Steps 3 to 6 (see below) should be conducted at each sampling station.

(3) *Summary of the sampling station*. Obtain a visual estimate of the habitat surrounding the sampling station (e.g. sediment type, sediment structure, percentage cover of algae, other features), as described in PG 3-6. Take digital photographs of the sampling station. Note the position of any transitional biotope features and other notable and relevant information for subsequent mapping.

(4) *Invertebrate sampling*. Obtain 3 or 5 (see options in costs) x 0.01m2 cores to a depth of 15cm. For larger invertebrates (e.g. worms (*Nereis virens*) and molluscs (*Mya arenaria*)), dig 3 25x25 cm patches to a depth of 30cm, sort large fauna on site and retain. The procedure for larger invertebrates is an adaptation of PG 3-6.

(5) *Measuring invertebrate mass*. Ideally, the survey should measure the relationships between the length of intertidal invertebrates and their ash-free dry mass (i.e. the mass of organic matter within the invertebrate). This is because the food value of invertebrates to birds depends on the amount of mass (energy) they contain. 30-50 invertebrates of each species should be collected during the survey from a range of sampling stations throughout

[11] http://www.jncc.gov.uk/page-2430

the overall study area. In the laboratory both the length and ash-free dry mass of each individual invertebrate, or several individuals for very small species, should be obtained. These data are used to generate relationships between the length and mass of different species. Measurement ash-free dry mass required both a drying oven and a muffle furnace.

(6) *Sediment sampling*. Sediment samples should be obtained with a 50mm diameter core at each station.

(7) *Laboratory work*. All laboratory processing should be conducted as per CORE Methods (PG 3-6). In short, the samples should be sieved as soon as possible after collection, and the invertebrates within each core preserved. Sieved and preserved samples are processed in the laboratory to identify each invertebrate to species and measure its length. For abundant small invertebrates, measurement may not be possible. Measurement of length is required as different bird species consumed different sizes of invertebrates, and so size-specific information is required to assess the food supplies of different species.

9.29 Costs have been derived assuming that a survey grid size of 500m or 1km, and that either 3 or 5 cores are collected per sampling station. The number of stations visited per tide (day) has been assumed to be 12. Based on previous experience it has been assumed that 3 cores can be processed per day. Daily rates for surveying and laboratory work have been assumed to be £300. Based on previous experience, the daily rate for hovercraft (and pilot) hire has been set to be £800. Costs have been directly estimated for ash-free dry mass and sediment processing.

Response of shorebirds to human activities

9.30 In order to understand the response of birds to human activity ornithological fieldwork is necessary and should involve recording what activities occur, the behavioural response of the birds and the relevant distances. It is important to record which activities result in no response from the birds and important to record the distance at which birds stop feeding, become vigilant, take flight etc. Ideally for each disturbance event the time the birds spend in flight and the distance flushed should also be recorded. The methods are based on work Footprint Ecology are currently undertaking on the Exe Estuary and along the Solent. We therefore know that this way of recording works and is feasible for a single, competent observer.

9.31 We suggest fieldwork locations are selected to ensure even geographic coverage and therefore patches are selected to give even spacing around the estuary. We suggest 25 locations, but this could be scaled down if necessary depending on available budget. This would mean (depending on the size of the patches – see paragraph 9.24) that every other patch or possibly even every patch was included. Once the patches have been selected, a suitable (and representative) viewpoint should be determined that allows a clear view of a discrete section of the SPA within the patch.

9.32 Each section should then be visited through the winter, following the Solent work we suggest four visits per month over the core winter period (i.e. December – February). We suggest two hours per visit (although on the Exe Estuary survey visits have been one hour rather than two). This would therefore mean twelve visits were made to each section (and

therefore, with 25 sections and 2 hours per visit, a total of 600 hours fieldwork). Ideally visits would be stratified to ensure temporal coverage (e.g. one weekend visit per month) and good coverage of the tidal cycle (such that visits are made to encompass the tidal cycle.

9.33 Each count will involve the following elements:

- Two counts of birds, recording the number of birds at different distance bands from the shore. One count at start and one at end of survey period.
- An initial map of all recreational activity
- A diary of all potential disturbance events observed during the following 1 hour and 45 minutes
- A record of the response of selected bird species to each of the potential disturbance events recorded in the 'diary'
- Additional information

9.34 These different elements are described in more detail below.

Bird count

9.35 At the start of each two hour survey, a count of the birds is required. The count only records the birds present within a pre-defined study area that extends to a maximum of 500m from the watch point. This area needs to be carefully mapped for each location, using aerial photographs and following initial site visits. The mapped area should only include areas where there is a clear sight line and all areas (within 500m) are visible to the recorder from the fixed watch point. At each location this mapped area will vary in size, and the aerial photos can be printed for field use, providing an important element in the fieldwork.

9.36 For all species the count is total number of birds within the study area (as defined above) and should also be broken down into different distance bands running parallel to the shore. These bands reflect the distance from MHWM, rather than the distance from the recording location. The bands can be plotted on the aerials, allowing a useful reference to the surveyor of the layout of the area and the distribution of birds at the start of the count. The count should be repeated at the end of each visit.

Initial map of all recreational activity

9.37 After the birds have been counted, all people and recreational activity should be mapped. This map will be a 'snapshot' recording all people and activities visible at a single point in time. The mapping will extend well beyond the bird recording zone, and the exact recording area will differ between locations. Most people would be mapped as a single point (i.e. a cross) with a label (a single letter or combination of letters i.e. A, B, C and then if necessary once 26 observations are reached AA, AB, AC etc). This letter should cross reference to the diary (see below). These maps provide a useful overview of how people use the site and how far out onto the intertidal different activities can take place.

9.38 As far as possible, all activities should be recorded as point data, allowing data to be easily digitised. In some cases it may be necessary to indicate a cluster of activity with a circle – for example a distant group of kite surfers moving fast across a discrete area. This snapshot mapping should take around 5 minutes and the intention is to document the broad locations of people around the bird recording area. Locations will be approximate where people / activities are distant.

Diary

9.39 All potential disturbance events during the following 1 hour and 45 minutes should then be recorded, in a diary form. This diary will record all new recreational activities and all activities originally mapped (see above). The diary should be set up as a recording form, with each row in the 'diary' corresponding to an activity/event and assigned a unique code – e.g. letters, "A", "B" etc. These same codes can be used as labels on the map and also as a cross-reference for the bird disturbance. All potential disturbance events (i.e industrial, recreation, military etc) need to be recorded, categorised according to the primary type of activity, and the location recorded (mudflat / below sea wall, water or shore). The diary will record for each activity the duration in the area, group size, number of dogs etc. The diary information therefore provides, in itself, a comparable record of activity levels at each survey point.

Disturbance

9.40 For each potential disturbance event in the diary the response of birds will be recorded on a separate sheet, where there are birds within 300m. It is important to ensure that activities/events that result in no response are also recorded – i.e. if the birds are not disturbed. The recording system therefore has to document, for each event, what birds were present and ensure that events where no birds were present can be separated from events where birds were present but not disturbed. Each event in the diary will therefore correspond with a row in the disturbance recording sheet, if there are birds present. The disturbance data will record the number of birds within 200m of the potential source of disturbance and the behaviour. Behaviour can be categorised (potentially relatively simply e.g. feeding (F) or roosting / preening / loafing (R)). The response of the birds is be recorded– whether the birds stop feeding, whether they take flight etc. For each activity/event where disturbance occurs the maximum distance from the birds to the event needs to be recorded, as the straight line distance from the source of disturbance to the birds. If there is no response from the birds then the minimum distance from each species present to the disturbance event should be ascertained (i.e. how close the disturbance event was to the birds). If the birds are in a tight flock or an individual then this distance is relatively easy to measure. If the birds are scattered over a wide area and all are disturbed, then the distance will be the approximate range within which the birds were feeding (i.e. 20m – 50m). In all cases distances will be estimated to the nearest 5m. In order to ensure consistency in recording distances it is necessary to:

- Ensure accurate aerial photographs, with distance bands plotted, are available to all surveyors for each location. Where blown up and printed on good quality paper, with distance bands overlaid, such images show creeks, buoys, marker posts and landmarks

clearly. We have found these invaluable for checking the locations of birds in relation to the shore in other studies.

- Use laser rangefinders to determine the distance to key landmarks/features and the birds
- Triangulate or pace out some of the distances at the end of the survey – this can be helpful where the distances were hard to estimate during the survey period (for example due to the angles between the observer, source of disturbance and the birds).
- Ensure observers are trained and occasionally do counts together to check that the data are collected in a standard fashion

9.41 Once surveyors are used to the system and familiar with the approach it is possible to collect data for multiple species and different activities at once.

9.42 Additional Information such as tide coverage and weather are important and also need to be collected at each visit.

Estimated costs and options for future research

9.43 The following is a summary of the estimated costs for the separate components and options of the proposed research. Where we give day rates these are ones we consider typical for the work, and are based on the skills required for the work, likely time of day, equipment required etc. The costs are intended simply as indicative guidance and, depending on how such work is commissioned it may well be possible to reduce the costs.

Visitor Fieldwork

9.44 Some initial work is required to cost the visitor counts across the whole estuary, as it is necessary to ascertain how many vantage points and people would be required. There are 40 WeBS counters. As people are easier to count than birds it may well be possible for visitor surveyors to cover 3 WeBS sections, and therefore 14 surveyors would be required. If 3 hours are allocated for each survey (at £75 per surveyor), then each visitor survey would cost £1,050. If the counts were conducted on 15 days over a winter, then the estimated cost of the fieldwork to gain count data from the entire estuary would be £15,750. Ten visits would be £10,050.

9.45 The questionnaire work would involve 16 hours at each survey point, essentially 2 long days of fieldwork per location. At £250 per fieldwork day this would cost £12,500 for 25 sites and £10,000 for 20 sites. There would be additional capital costs of £500 (10 GPS units at £50 each).

9.46 The write-up and collation of the data would be in the region of £6,250, estimated on the basis of 5 days data entry (5 days at £200, £1000) and 15 days report writing and analysis (15 days at £350, £5,250).

Invertebrate survey

9.47 Costs would range from £145,000 to £860,000 (Table 14).

Table 14: Estimated costs for invertebrate surveys

	500 m grid 5 cores per station	1 km grid 5 cores per station	500 m grid 3 cores per station	1 km grid 3 cores per station
Number of sampling stations	1505	375	1505	375
Total number of samples	7525	1875	4515	1125
Number of days to complete survey (no. stations / 12)	125	31	125	31
Number of days to process samples (no. samples / 3)	2508	625	1505	375
Cost of survey (no. days x £800) + (2 x £300)	£100,933	£25,600	£100,933	£25,600
Cost of processing invertebrate samples (no. days x £300)	£752,500	£187,500	£451,500	£112,500

Cost of processing ash-free dry mass samples	£5000	£5000	£5000	£5000
Cost of processing sediment cores	£2000	£2000	£2000	£2000
TOTAL	£860,433	£220,100	£559,433	£145,100

Involvement of ABPmer

9.48 ABPmer own the existing invertebrate data and the tidal model that will be needed to predict the exposure of the intertidal feeding grounds of the birds. ABPmer have indicated that they are interested in being involved in any future project, but would like to be contacted directly by HMS to discuss details and costs.

Ornithological Fieldwork

9.49 We have suggested twelve visits to each section (4 per month, 3 months), with visits lasting two hours. We assume that a surveyor in the winter could do on average 2.5 visits per day (it will depend on the travel distance between survey locations). If the fieldwork is costed at £250 per day (included travel costs) then if the survey included 25 sections it would therefore involve 120 days of fieldwork (£30,000) and if this was reduced to 20 sections it would involve 96 days of fieldwork (£24,000). We assume 5 days of data entry (£200 per day) and 20 days for survey design, coordination and report writing (£350 per day) the total cost would be c.£32,000 (20 survey locations) or £38,000 (25 survey locations).

Shorebird individual-based model

9.50 Combined cost for (i) adding disturbance to the existing model, (ii) altering the number of patches in the model to those used in the visitor and bird surveys, (iii) parameterising model with new invertebrate and tidal exposure data, (iv) testing model for present day situation and (v) running simulations to predict the effect on the birds of present day and future levels of disturbance, £25000.

Timing

9.51 The visitor fieldwork and bird fieldwork would take place over a single winter – we have suggested December – February for bird fieldwork to coincide with the period when bird numbers peak. The subsequent building of the model and testing of scenarios would take a few months and potentially be completed in the summer following the fieldwork.

Summary

9.52 We have out a research programme that would provide an estuary-wide perspective on the impacts of disturbance and would allow the impacts of disturbance to be assessed in a range of different scenarios.

9.53 The work is complex, involving a number of different work areas, systematic fieldwork over a wide geographical area and the need to piece together visitor data, bird data, invertebrate data and tidal data within a single model. Each of which will have a stand-alone merit and can be produced as a single report/study. Summary costs for the work as a whole are set out below. The total estimated costs are in the region of £100,000

(without a new invertebrate survey), and are intended to provide a means of developing an overall budget for further work. There may be ways to reduce these costs, depending on the involvement of ABPMer, the availability of local surveyors etc.

Table 15: Summary of overall costs for further research

Work area	Minimum cost	Maximum cost	Notes
Estuary wide invertebrate survey	£145,000	£860,000	Required to underpin the model. Existing data is 10 years old but could be used.
Involvement of ABPMer	£10,000 ?	£10,000 ?	Cost pure speculation. ABPMer own the existing invertebrate data and the tidal model.
Ornithological fieldwork	£32,000	£38,000	Detailed work to ascertain how birds respond to different activities and to obtain crucial, site-specific parameters for the model
Visitor counts	£10,050	£15,750	Simultaneous counts of whole estuary, similar to WeBS for birds. Provides data for model and comparative data for whole estuary
Visitor questionnaire work	£16,720	£19,250	Detailed on site visitor survey, with questionnaires to determine views about management, routes on site, home postcodes etc. in a systematic fashion around entire estuary. Locations linked to bird survey locations.
Shorebird individual based model	£25,000	£25,000	Development of model and testing different scenarios, levels of disturbance etc.
Total without invertebrate survey	£93,770	£108,000	
Total with invertebrate survey	£238,770	£968,000	

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Appendix 1

Table 16: WeBS count data, maximum counts per section, 1998 – 2009. Red shading indicates counts that are in the top 10% of the data range for each species.

WeBS Section	Bar-tailed Godwit	Bittern	Black-tailed Godwit	Cormorant	Curlew	Dark-bellied Brent Goose	Dunlin	Golden Plover	Goldeneye	Grey Plover	Knot	Lapwing	Little Tern	Mallard	Oystercatcher	Pochard	Redshank	Ringed Plover	Sanderling	Shelduck	Teal	Whimbrel	Wigeon
35478	388	0	4	21	181	460	1312	1480		575	4500	5000		96	2050		265	234	188	464	140	16	256
35479	35	0	4	31	316	4	456	82	7	63	400	670	3	18	48		231	236	442	34	6	4	114
35480	131	0	15	151	597	330	1066	3170	4	134	1000	2000	18	54	188	1	458	267	152	343	850	69	624
35481	213	0	17	38	320	1350	2500	4500	22	287	4200	3000	24	26	1522		347	60	65	434	70	17	156
35483	82	1	5	88	155	950	518	4000	2	220	3400	900	2	26	573	2	346	101	145	458	186	9	22
35484	146	0	5	28	110	1120	1550	2650	1	250	6200	1150	14	160	1300		360	184	350	417	220	36	141
35485	330	0	23	9	481	2660	1400	3960	0	610	7850	1150	8	18	2510		697	54	54	270	35	5	112
35486	270	0	0	35	96	1250	420	5000	0	150	3100	5000	3	100	240	0	120	110	200	161	20	4	33
35487	828	0	0	26	60	800	1584	3560	1	800	7000	1300	0	60	549	0	441	60	142	276	76	11	80
38201	4	0	4150	3	24	0	1510	185	0	22	15	1805	0	130	4	11	1720	7		24	137	1	0
38401	900	0	4	26	141	184	4900	4000	1	1030	12000	760	8	70	910	0	470	400	990	286	36	6	9
38403	0	0	0	0	0	0	0	0	0	0	0	0	0	13	4	0	1	2	41	0			0
38405	58	0	1300	11	495	0	2400	4050	0	76	51	2900	0	171	46	0	655	119	7	760	7	7	8
38406	0	0	145	2	92	0	298	0	1	0	7	525	0	52	7	22	127	11	0	26	41	0	6
38407	0	0	41	10	72	0	246	1941	0	3	1	2025	0	52	5	42	105	33	0	20	13	1	0
38409	18	2	26	12	40	0	590	380	16	1	1	260	0	58	5	49	228	155	1	95	114		46
38411	30	0	230	4	700	15	423	8500	260	5	30	5620	0	350	2	115	160	66	35	38	600	4	96
38412	9	0	88	6	110	1	700	4200	586	2	4	3800	0	380	5	265	102	9	0	24	51	1	289
38413	4	0	6	5	42	0	326	166	1		7	320	0	263	4	126	250	3		23	17	1	35

38414	8	2	105	27	80	0	490	120	75	0	11	787	0	475	6	173	152	26		23	58	24	298
38415	0	2	0	16	51	0	267	180	15	0	0	600	0	130	8	153	56	60	0	140	35	0	80
38417	4	0	0	12	58	0	1079	1120		12	0	530	0	55	31	0	122	66		38	312		270
38418	77	0	104	30	1122	0	4553	9000	3	81	24	4500	0	292	46	4	619	700	5	1033	2500	8	1100
38419	0	0	0	4	109	0	400	256	0	0	0	620	0	77	2		17	45		130	156		1800
38423	1	0	102	26	180	0	340	2000	0	3	0	1800	0	90	13	2	64	29		352	670	0	220
38424	0	0	0	1	115	0	129	1500	0	1	0	668	0	10	2	0	14	19		99	161		360
38430	3	2	309	22	96	0	700	18000	7	1	1	7500	0	540	4	42	233	160	2	64	2225	3	1120
38432	70	0	19	11	300	0	1241	10840	25	4	11	12250	2	340	12	16	158	274	0	1657	794	4	3660
38433	7	1	27	27	145	0	461	1800	23	1	2	930	0	156	9	258	114	71		101	153	0	108
38434	11	0	0	1	13	0	73	0	0	0	0	45	0	72	7	3	55	42		8	2	0	0
38436	6	0	0	5	25	0	800	0	0	1	0	260	0	34	4		150	50		20		1	1
38440	235	0	696	16	468	0	6447	22559	0	16	888	4120	0	391	24	0	1151	325		240	756	1	0
38441	1066	0	665	20	1310	18	7150	26260	0	1790	2275	14488	0	1238	96	0	2345	627	13	2153	766	11	674
38442	5900	0	415	15	1269	220	5443	6380	1	1550	10072	5245	1	527	212	1	1563	325	373	3300	259	4	731
38443	2000	0	126	12	3000	317	15000	14500	9	5000	22500	1000	2	260	773	2	1500	17	200	4000	34	150	183
38444	900	0	196	55	549	588	14981	5062	11	851	35004	2200	57	125	2500	15	5400	653	701	700	114	106	260
38905	1	0	291	28	83	0	780	0	0	1	25	205	0	114	4		663	131	0	106	115	0	0
38907	0	0	0	30	2	0	0	3000	0	15	0	1350	0	127	3		45			2	24		94
38921	1	0	7	0	292	0	438	6000	0	4	15	986	0	190	39		37	100	0	827	860	1	350