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Mersey Narrows and North Wirral Foreshore Sites of Special Scientific Interest - Investigation into the impacts of Recreational Disturbance on Bird Declines

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Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

The report was commissioned because a recent report by the British Trust for Ornithology had shown that there have been sharp declines in key species for which the Mersey Narrows and North Wirral Foreshore Sites of Special Scientific Interest (SSSIs) were designated and it was suggested that these declines were caused by site-specific factors. Further to this, another report by the BTO suggested that high levels of recreational disturbance appeared to impacting on bird numbers. We therefore wanted to try to get a better understanding of the causes of the bird declines and find out whether they were in fact caused by high levels of recreational disturbance, in order to improve management of these sites. We will use the results of the study to discuss management options for the site with our partners, in particular Wirral Council, which may include suggestions for new signage and interpretation boards to raise awareness about disturbance to birds from recreational activities amongst the general public.

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Further information
This report can be downloaded from the Natural England website: **www.gov.uk/government/organisations/natural-england**. For information on Natural England publications contact the Natural England Enquiry Service on 0845 600 3078 or e-mail **enquiries@naturalengland.org.uk**.

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For

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1. Summary and Main Recommendations

1.1 Summary

1.1.1 This report investigates the relationship between recreational disturbance at the Mersey Narrows (MN) and North Wirral Foreshore (NWF) Sites of Scientific Interest (SSSI), and a reported decline in bird numbers at these sites. A review of current mitigation measures as they pertain to recreational pressures in relation to bird disturbance has also been undertaken. A discussion of future improvements for monitoring and disturbance strategies is included.

1.1.2 The objectives were achieved through a literature review, stakeholder and visitor questionnaires. These were supplemented by a series of bird and disturbance surveys carried out between December 2014 and February 2015.

1.1.3 Key findings are as follows:

- The literature review revealed that bird disturbance is viewed as an issue by the local authorities, but very few mitigation measures appear to be in place to deal specifically with alleviating disturbance;
- Stakeholders (11 responses) viewed dog walking as the most serious bird disturbance issue;
- 640 on-site public questionnaires were compiled over a total of 19 days. The most popular activities recorded were dog walking and walking. While most visitors have not seen any bird disturbance, a quarter of visitors have seen dogs causing disturbance. Many respondents were also aware of the wildlife status and value of the area;
- All six SSSI qualifying species were recorded. Redshank and turnstone were predominantly found close to the shore, so would be more likely to be subject to disturbance. The other SSSI qualifying species (dunlin, cormorant, knot and bar-tailed godwit) were found further out, and so were perhaps less likely to be disturbed, except when at high tide roosts;
- Walkers outnumbered dog walkers in the spot counts. Dog walking (off lead) was a predominantly intertidal activity, whereas dog walking (on lead) was promenade based. Low tide, when dog walkers frequently accessed the mudflats, appeared to be the period when most disturbance occurred;
- 225 Potential Disturbance Events (PDE) were recorded during the bird surveys. 73 (33%) of these evoked a visible behavioural response. Leasowe had the highest number of PDE and visible behavioural responses. Dogs (off leads) elicited the most responses, and also the more extreme (long-flight) responses. This was to be expected as most PDE involved dog walkers; and
- Whether disturbance has a population-level effect in the MN and NWF cannot be quantified on present knowledge.

1.2 Main Recommendations

1.2.1 The main recommendations are set out below:

- Further monitoring of visitor pressure and bird disturbance should take place. A whole coast survey should encompass where disturbance is at its most prevalent, and focus on disturbance "hotspots". A distinction should be made between high and low tide PDE when surveying and enacting mitigation measures. The parameters necessary for assessing PDE on bird populations should be gathered and collated through further survey. Comparative surveys would be useful in clarifying disturbance effects. The proportion of qualifying SSSI bird species affected by disturbance also requires study.
- Any mitigation measures enacted should be monitored to reveal their effectiveness. Simple signage, aimed at walkers and dog walkers, could be used requesting that they do not enter certain (intertidal) zones, may be a useful first step. Other measures that may be deployed include wardening at vulnerable sites and times, access management, buffer zones, zoning, and perhaps most importantly education.
- Under the Habitats Regulations (2010), Regulation 36, a European Marine Site (EMS) management scheme should be established. An EMS management scheme enables authorities exercising legislative powers to perform these in accordance with the Habitats Directive. As conservation advice has recently been published by Natural England (NE) regarding MN and NWF, this would provide the basis for the management scheme. A management scheme provides a framework for management, encourages input from all stakeholders and promotes cooperation with other relevant authorities.

2. Introduction

2.1 Background

2.1.1 The United Kingdom hosts a great variety and abundance of waterfowl during the winter, with millions of waders and waterfowl arriving from the Arctic and Siberia to overwinter. Waders and waterfowl are generally referred to as waterbirds (Wetlands International, 2015). Many of the sites in which they overwinter at are protected under various European and national directives and legislation. In recent years the role of disturbance on numbers and behaviour of waterbirds at marine and estuary sites has come under increased scrutiny (Prater, 1981; Rehfisch *et al.,* 1991; Holloway *et al.*, 1992; Holloway, 1997). A Department for Environment, Food and Rural Affairs (Defra) strategic review (Coyle & Wiggins, 2010) showed that recreational activities posed a risk to European Marine Sites (EMS) across England. EMS include Special Protection Areas (SPAs) designated under the Wild Birds Directive (European Parliament, 2009), such as the Mersey Narrows (MN) and North Wirral Foreshore (NWF).

2.1.2 The MN and NWF are designated Sites of Special Scientific Interest (SSSIs), because they regularly support bird populations of national and international importance (Natural England (NE), 1986, 2000). The MN and NWF SSSIs are located on the north-west coast of England at the mouths of the Mersey and Dee estuaries (Figure 2.1). MN SSSI comprises intertidal habitats at Egremont foreshore, on the south shore, and man-made lagoons at Seaforth Nature Reserve on the north shore. The extensive intertidal mudflats within the NWF SSSI are found between the outer Dee Estuary and the Mersey Estuary. NWF SSSI supports large numbers of feeding waders at low tide and also includes important high tide roost sites.

2.1.3 NWF SSSI supports nationally important populations of knot *Calidris canutus*, bar-tailed godwit *Limosa lapponica* and dunlin *Calidris alpina*, (NE, 1986) (Table 2.1).

2.1.4 MN SSSI supports internationally important populations of turnstone *Arenaria interpres*, redshank *Tringa totanus* and nationally important populations of cormorant *Phalacrocorax carbo* (NE, 2000a) (Table 2.1).

2.1.5 Sefton SSSI which includes Hightown (the Alt Estuary) and Crosby was designated in 2000 (NE, 2000b). Amongst other reasons for notification the site supports internationally important populations of grey plover *Pluvialis squatarola*, knot, sanderling *Calidris alba* and bar-tailed godwit in winter (Table 2.1). Oystercatcher *Haematopus ostralegus* and dunlin also occur in nationally important numbers (Table 2.1). Hightown and Crosby were included in the survey area as they are important functionally-linked sites for bar-tailed godwit (Kirby *et al.* 1989; Still *et al.*, 2014). The bar-tailed godwits forage on MN and NWF SSSIs at low tide, and roost at Hightown.

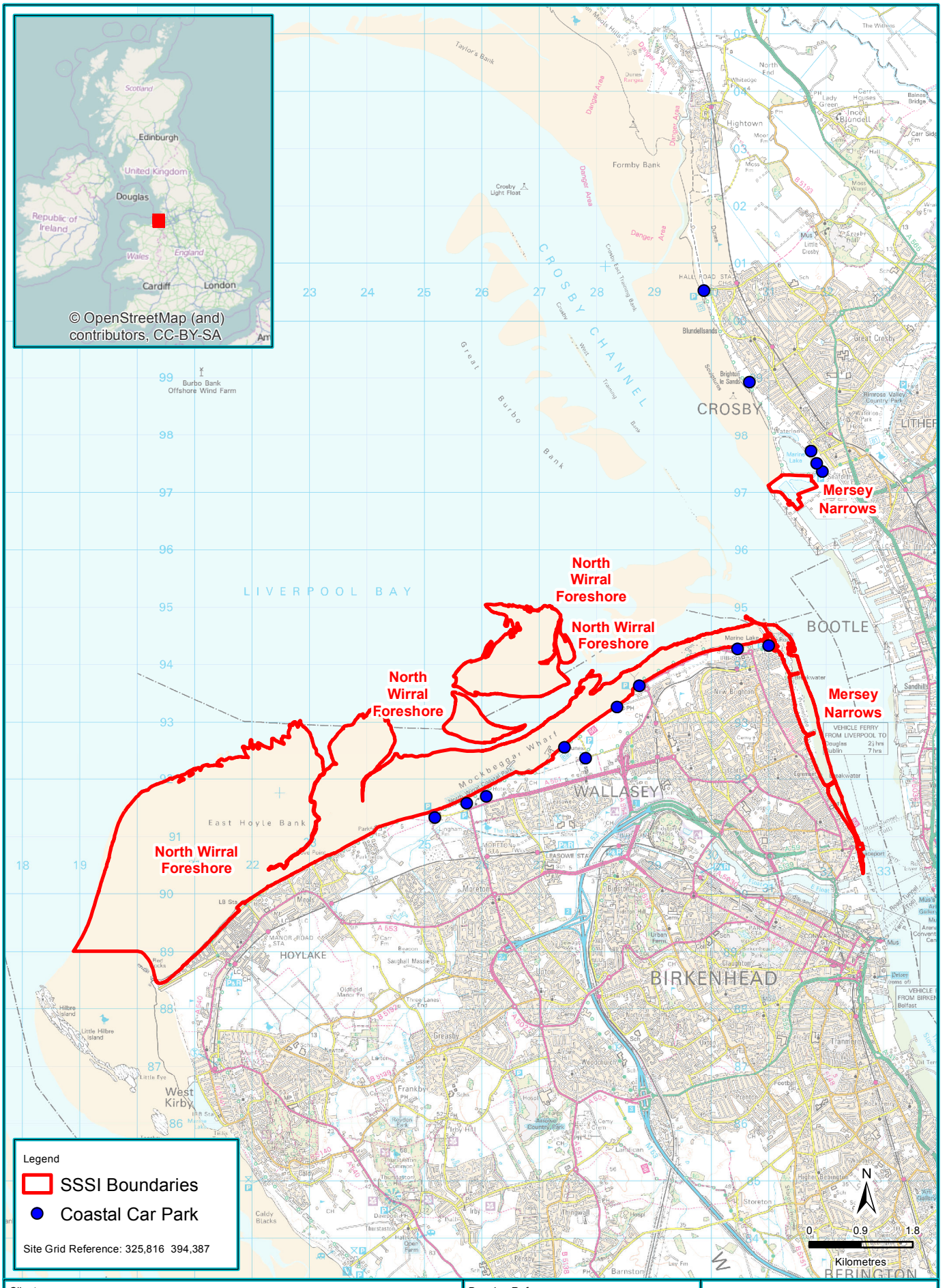

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Table 2.1 The SSSIs in the survey area and their important wintering bird populations

SSSI	Nationally important bird populations	Internationally important bird populations
Mersey Narrows	Cormorant	Turnstone Redshank
North Wirral Foreshore	Knot Bar-tailed godwit Dunlin	
Sefton Coast	Oystercatcher Dunlin	Grey plover Knot Sanderling Bar-tailed godwit

2.1.6 SPAs are strictly protected sites classified in accordance with Article 4 of the Wild Birds Directive (European Parliament, 2009), which came into force in April 1979. They are classified as SPAs to protect rare and vulnerable birds (as listed on Annex I of the Directive), and also for regularly occurring migratory species. MN and NWF SPA was designated in July 2013, and is the most recent SPA to be designated in England (NE, 2013).

2.1.7 The MN and NWF qualifies as a SPA by supporting significant numbers of overwintering bar-tailed godwit and knot, as well as passage little gull *Hydrocoelus minutus* and breeding common tern *Sterna hirundo* in the summer and autumn (NE, 2013). The MN and NWF SPA qualifies by regularly supporting at least 20,000 waterbirds in the non-breeding season, including dunlin, knot, bar-tailed godwit, grey plover, oystercatcher, sanderling, redshank and cormorant (NE, 2013). It has also been designated a Ramsar site (Ramsar, 2014), the latter because it supports more than 20,000 waterbirds, including 2.4% of the knot *Calidris canutus islandica* non-breeding European population and 2.8% of the Western Europe/North-west African bar-tailed godwit population. Crosby and Hightown are in the Ribble and Alt Estuaries SPA.

2.1.8 Ross-Smith *et al.* (2013) analysed waterbird population trends on the MN and NWF SSSIs and found sharp declines in key species for which the site was designated for, differing from regional trends and indicating that site-specific factors were influencing bird numbers. Still *et al.* (2014) also suggested that high levels of recreational activity appeared to be impacting on MN and NWF SPA bird numbers. Hightown (which included Crosby) and Hoylake were noted as having the highest disturbance levels. Ross *et al.* (2014) found that the MN and NWF SPA was one of the two SPAs (out of 27 SPAs analysed in England) where future development and associated

recreational pressure may be of the most concern. Access and ease of accessibility were also seen as significant contributors to this issue. NE (NE) (2014) has recently issued conservation advice regarding the MN and NWF SPA which includes minimising disturbance in reference to bar-tailed godwit, knot and the waterbird assemblage present.

2.1.9 Ross & Liley (2014) summarised the impacts of disturbance (which includes some aspects of recreational activities) to wintering and passage waterfowl as being:

- A reduction in the time spent feeding due to repeated flushing/increased vigilance (Fitzpatrick & Bouchez, 1998; Stillman & Goss-Custard, 2002; Bright *et al.*, 2003; Thomas *et al.*, 2003; Yasué, 2005);
- Increased energetic costs (Stock & Hofeditz, 1997; Nolet *et al.*, 2002) due to birds taking flight and changes in behaviour;
- Avoidance of areas of otherwise suitable habitat, potentially using poorer quality feeding/roosting sites instead (Cryer *et al.*, 1987; Gill, 1996; Burton *et al.*, 1996; Burton, *et al.*, 2002); and
- Increased stress (Regel & Putz, 1997; Weimerskirch *et al.*, 2002; Walker *et al.*, 2006; Thiel *et al.*, 2011).

2.1.10 A recent study commissioned by NE recommended the establishment of long-term monitoring programmes to investigate the impacts of recreational activities (Simpson, 2011). The focus of this study is to establish a baseline dataset regarding disturbance on the MN and NWF SSSIs. Similar studies have recently been undertaken on the Humber (Cruickshanks *et al.*, 2010; Ross & Liley, 2014), Poole Harbour (Liley & Fearnley, 2011), the Solent (Liley *et al.*, 2011; Clarke *et al.*, 2012) and Teesmouth and Cleveland Coast (Linaker, 2013). This study aims to extend this work to gain greater insight to the wider impacts of recreational disturbance on birds.

2.2 The Brief and Objectives

2.2.1 NE commissioned Thomson Ecology on 17th December 2014 to establish a baseline dataset regarding disturbance on the MN and NWF SSSIs. The aims and objectives were as follows:

- To gather baseline data for recreational use of the MN and NWF SSSIs with the aim of increasing understanding of the relationship between recreational disturbance and the decline in bird numbers on the MN and NWF SSSIs, as well as the Crosby Beach to Hightown area, as this has been identified as an important functionally linked area for bar-tailed godwit (Still *et al.*, 2014).
- To review current management measures which address recreational pressures and their effectiveness and to suggest improvements where necessary.
- Literature review to collate existing data on the distribution of housing, human activities and public access points around the MN and NWF SSSIs, and Crosby to Hightown, and map relevant data (e.g. literature source for housing data – Ross *et al.*, 2014).
- Assess public opinion on the range of recreational activities which could cause disturbance to birds through on-site questionnaires. Map the distribution of these activities.

- Collate data on bird distribution and abundance around the MN and NWF SSSIs and behaviour to disturbance events through on-site survey.
- Outline the range of mitigation measures that are currently implemented on the MN and NWF SSSIs, and Crosby to Hightown, through literature review and stakeholder engagement. Review their effectiveness and suggest improvements where required.
- Present the access infrastructure and visitor activity data in a suitable format such that, should it be required, they can be used for further work such as individual base modelling.

2.3 Limitations

2.3.1 As the survey did not commence until the last week of December 2014, visitor questionnaires were not prepared and agreed with NE until January 2015. No visitor surveys could be carried out until the questionnaires had been approved and agreed with NE.

2.3.2 Regarding the General Stakeholder Questionnaire, stakeholder responses were limited because only a few respondents were able to participate, and some responses were perhaps influenced by their role at the locality.

2.3.3 Some of the bird survey data was not ideal for non-parametric tests, both because there were several different variables that required simultaneous examination, and also because of the multiple zero values (non-parametric tests are problematic when there are many ties in the ranking). Additionally, a semiparametric analysis of zero-inflated count data would be required to deal with the many zeros in the dataset (Lam *et al.*, 2006).

2.3.4 The bird counts do not give a true representation of actual bird numbers present in the wider SSSI/SPA area, as they only included a small part of the estuary. The mudflats at low tide may be over 2km in distance, with birds out at the water's edge. The bird counts gave a comparative context to the number of birds that may have been potentially disturbed within each survey area.

3. Literature Review

3.1 Brief and Objectives

3.1.1 NE commissioned Thomson Ecology on 17th December 2014 to investigate the impacts of recreational disturbance on bird declines in the MN and NWF SSSIs. The brief was to:

- Collate existing data on the distribution of housing, human activities and public access points around the MN and NWF SSSIs, and Crosby to Hightown, and map relevant data (e.g. literature source for housing data – Ross *et al.*, 2014) with the aim of increasing understanding of the relationship between recreational disturbance and the decline in bird numbers in the area;
- Outline the range of mitigation measures that are currently implemented on the MN and NWF SSSIs, and Crosby to Hightown, through literature review and stakeholder engagement; and,
- Review their effectiveness and suggest improvements where required.

3.2 Methodology

3.2.1 A desk-based literature review investigating the effect of recreational disturbance on bird population declines within the MN and NWF SSSIs and European SPAs located along the coastline of north-west England was conducted on 28th January 2015.

3.2.2 The current management measures which address recreational pressures and their effectiveness were reviewed.

3.3 Background

3.3.1 Responsibilities in relation to SSSIs are set out in the Wildlife and Countryside Act (1981) (HMSO, 1981) as amended by subsequent legislation. Owners and occupiers of land designated as a SSSI must obtain consent for undertaking any operations that may damage the site and manage the site in a way that maintains its natural features. SPAs are protected under the Conservation of Habitats and Species Regulations 2010 (HMSO, 2010). Landowners and occupiers of land protected under these regulations are prevented from carrying out potentially damaging operations without prior consent from the relevant country agency (e.g. NE). With respect to marine environments, the Regulations also enable management schemes to be established and byelaws to be passed by the relevant authorities for the management and protection of European marine sites.

3.3.2 Waterbirds are significantly declining within the MN and NWF SSSIs (Ross-Smith *et al.*, 2013). Birds from the MN and NWF SSSIs were also observed using alternative SSSIs within the area (Ross-Smith *et al.*, 2013).

3.3.3 Simpson (2011) suggests that there is strong evidence that high levels of development and recreational activities can have a negative effect on coastal sites and the wildlife present and on

waterfowl in particular. However, it is often difficult to determine the cause and effect relationship of recreational pressures resulting in bird declines, as species susceptibility, local variations and tolerances vary greatly (Linaker, 2013).

3.3.4 By assessing housing density, ease of access and human activities around nearby coastal areas, a number of previous studies have found it is possible to quantify the level of disturbance exerted by recreational pressures (Still *et al.*, 2014).

3.3.5 Recent studies have shown there are high levels of housing around the shoreline at the MN and NWF SSSIs and Ribble and Alt Estuaries SPA (Crosby and Hightown) (Still *et al.*, 2014). Numerous carpark facilities make the shoreline easily accessible to the local residents and visiting public, with the Mersey Estuary and the MN and NWF and Crosby to Hightown coastline also providing locations for a wide range of recreational activities and events which draw in high numbers of visitors throughout the year. Long-term studies such as the Wetland Bird Survey (WeBS) have been undertaken, although a limited number of studies systematically monitoring visitor pressure and recreational access have been carried out within the study area.

3.4 Declining Bird Species at Risk from Recreational Disturbance

3.4.1 Both the MN and NWF SSSIs comprise extensive intertidal habitats and mudflats supporting bird numbers of national and international importance (NE, 1986, 2000). The intertidal mudflats support more than 20,000 waterbirds including internationally important populations of knot and bar-tailed godwit (Ramsar, 2014). The Ramsar (2014) citation specifically mentions intensive levels of recreational activities including walking, fishing and cycling, as being the most pertinent to recreational disturbance.

3.4.2 The WeBS is a long running survey assessing the population trends of waterbird species at monthly intervals. This is a joint scheme between the British Trust for Ornithology (BTO), Royal Society for the Protection of Birds (RSPB), and Joint Nature Conservation Committee (JNCC), in association with the Wildfowl and Wetlands Trust (WWT). Counts of waterbird species have been recorded regularly across the Mersey Estuary SPA and MN and NWF SPA since 1969 (Prater, 1971).

3.4.3 Widespread declines in waders and waterfowl numbers have recently been recorded, with notable declines observed within the Mersey SPA (Ross-Smith *et al.*, 2013). Waterfowl were found to be declining to a greater extent, but conversely, the numbers of terns and gulls were increasing. Evidence of movement was also discovered. Birds from the Mersey SPA were found to be using the Ribble and Alt Estuaries SPA and the MN and NWF SPA.

3.4.4 Ross-Smith *et al.* (2013) recently undertook a study analysing waterbird population trends on the MN and NWF SSSIs which concluded that key species, (i.e. the special interest features, those linked to the site's designated status), were significantly declining. Site-specific population trends unlike those observed in other regions were also observed.

3.4.5 Ruddock & Whitfield (2007) documented birds retreating from areas with encroaching recreation and activities affecting feeding success, range use, reproduction and survival of bird species. Borgmann (2012) also discovered migrant species and waterbirds display much greater

vulnerability to the effects of disturbance. However, all species varied in their tolerance according to a range of factors such as flock size, body condition, food availability, frequency and quantity of disturbance, body size, speed of disturbance, type of disturbance and weather. Due to such a range of factors and their potential to occur simultaneously, Ruddock & Whitfield (2007) concluded the direct cause and effect relationship of disturbance is often difficult to detect.

3.4.6 Stillman *et al.* (2009) attributed declining bird numbers on the MN and NWF SSSIs to high levels of recreational activity in the north and west of Liverpool City. Similarly, Ross *et al.* (2014) found that the MN and NWF SSSIs had a high vulnerability ranking to the impacts from recreation relating to development.

3.5 Housing, Human Activities and Public Access Points

3.5.1 Several studies have concluded that the spatial distribution of housing is likely to have a direct influence on the number of visitors drawn to the coastline, the number of access points and consequential disturbance on bird populations (Clarke *et al.*, 2012). Similarly, the distance of a sensitive habitat or species to a carpark is a key factor in determining the level of ecological disturbance that will be recorded (SNH, 2006).

3.5.2 Stillman *et al.* (2009) highlighted the importance of understanding access patterns, housing density and human activities when predicting and monitoring disturbance to bird species due to increasing recreational pressure on features of the Solent SPA.

3.5.3 It is expected that more than 11,000 net dwellings will be delivered across Sefton by 2030 (Sefton Council, 2015a). This has the potential to significantly impact on the MN and NWF SPA through increased recreation. With an aging population which is expected to rise by 2030, the pressures from recreation could be exacerbated through increased leisure time available to the ageing population (VisitEngland, 2013).

3.5.4 Recreational activities have also been recorded having indirect impacts on bird population trends altering feeding opportunities. Recreational activities and social and economic pressures can reduce the sedimentation of the foreshore reducing the available low tide feeding habitat and impacts on vegetation succession (Ramsar, 2014).

3.6 Human Recreational Pressures and Bird Disturbance

Housing density

3.6.1 According to the Core Strategy for the Wirral (WBC, 2012), within the borough of Wirral almost two thirds of the population live within an urban area to the east of the M53 Motorway. Birkenhead is the largest town in the borough. The coastal town of Seacombe contains the majority of higher density terraced housing.

3.6.2 Ross *et al.* (2014) studied data from all English SPA sites with intertidal habitats with wintering waterfowl interest. Housing levels, changes in housing, access infrastructure and habitat type were analysed against waterbird population trends. MN and NWF SPA, alongside Portsmouth

Harbour SPA, were ranked as sites with the highest values of mean housing access and relatively high levels of housing with only a small proportion of the shorelines having little or no access. Overall the SPAs studied had an average 8.8% increase in housing within a 10km radius over a twelve-year period (Ross *et al.*, 2014). The total number of houses within a 30km buffer of the Mersey Estuary amounted to 1,261,079 and 1,068,527 houses for MN and NWF SPA. Housing change was calculated comparing housing levels in 2001 and 2013: during this period housing levels within MN and NWF SPA increased by 4.7%.

3.6.3 All sites studied were accessible across at least 50% of their shoreline. The number of carparks within each site also correlated with housing pressure for all sites. However, compared to other sites, MN and NWF SPA had relatively high values for the number of carparks per km of shoreline compared to the other 35 SPA sites in England.

3.6.4 Ross *et al.* (2014) ranked all English SPA and SSSI sites according to their overall vulnerability to recreational disturbance by combining weighted housing pressure; number of carparks per km of shoreline; proportion of shoreline with access; total mudflat area; proportion of mudflats considered 'disturbable' and the percentage of sand in the mudflats. MN and NWF SPA ranked within the top five most vulnerable sites in terms of vulnerability to recreational impacts. Results of the Wirral Visitor Research Study (IpsoMori, 2011) indicated that six million visitors access the Wirral's parks, beaches and countryside annually. Visitors typically travel up to an hour to visit the Wirral and 57% of visitors are aged 55 and above.

Human activities

3.6.5 Linaker (2013) examined the significance of different types of human activities occurring on coastlines and the level of bird disturbance. Linaker (2013) stated, '*as the footprint of human activity increases, there is an urgent call to manage and quantify disturbance for the establishment of monitoring schemes'*. By quantifying recreational disturbance and investigating its impact on waterbird populations across six sites along the Teesmouth and Cleveland Coast, Linaker (2013) discovered over 28% of all activities recorded resulted in disturbance. The degree of disturbance varied across sites. The activity with the greater number of disturbance events was bait digging for fishing. Dog walkers and kite surfers caused the greatest mean disturbance response, in terms of strength of response by the birds.

3.6.6 A study by Scottish National Heritage (SNH) (Ruddock & Whitfield, 2007) supported this, concluding dog walking is a major impact, stating '*It is generally accepted that dogs should be kept on a lead in sensitive areas*'. Taylor *et al.* (2005) found where dogs were managed within a beach environment, there was a significant increase in the breeding success of birds.

3.6.7 The Mersey Estuary Management Plan (MEMP, 2007) was in place for 25 years and it identified a vast number of recreational activities undertaken across the estuary describing the coastline as a major attraction, popular with water-sports enthusiasts, mariners of all kinds, anglers and wildfowlers (MEMP, 2007). It also aimed to improve public access and to invest in infrastructure, giving priority to informal activities such as walking or picnicking.

3.6.8 NWF in particular provides a number of recreational activity opportunities including cycling, picnicking, walking, ball games, fishing, canoeing, swimming, jogging, bird watching and horse

riding, some of which is carried out at intensive levels. It is one of the country's top sites for visiting migrant winter birds (Ramsar, 2014).

3.6.9 An additional study, the Wirral Parks Survey (WBC, 2012a), was undertaken in 2012. Two-thirds of people use a park, beach or open space more than once a week in spring and summer. Half of people use a park, beach or open space more than once a week in autumn and winter. Around two thirds of the Wirral population use parks, beaches and open spaces for walking and exercise.

3.6.10 Areas nearby may also contribute to visitor pressure. The Sefton Local Plan Habitats Regulation Assessment (2015) evaluated a England Leisure Day Visits Survey which stated the Mersey Estuary SPA typically receives visitors who travel 25.5km to the coast for the day and concluded visitors from the town of Sefton are unlikely to make a significant contribution to visitor pressure as other estuaries provide easy access and are much more likely to draw visitor from Sefton instead.

Access Points

3.6.11 The NWF SSSI comprises a four mile long coastline providing public open space, common land and sand dunes. Along its length, a total of eight carparks are present with a network of footpaths and public bridleways (Figure 2.1). Three toilet blocks and two refreshment areas are also present in addition to a pitch and putt course and bathing beaches (WBC, 2015).

3.6.12 MN is located at the mouth of the Mersey Estuary comprising two separate areas known as Seaforth and Egremont Foreshore. Together they comprise saltmarsh, grassland and two lagoons. The areas immediately south of the MN and NWF shoreline are comprised of golf courses and extensive areas of terrestrial habitat (AECOM, 2012a). To the south and west of these areas lies residential land with railway and areas of parkland and recreational sports (WBC, 2015).

3.6.13 The area of coastline encompassing Crosby and Hightown is part of the Sefton Coast SSSI which extends for over 20km. This comprises intertidal mudflats, sandflats, mobile dunes and small areas of saltmarsh. The coastline is a popular holiday destination, with the soft coast areas including sand dunes primarily used as recreation (Sefton Coast Partnership, 2014). Vehicle access to the foreshore is restricted in certain areas for health and safety reasons and to prevent erosion of the dune ridges (Sefton Coast Partnership, 2014).

3.7 Mitigation Measures

Background

3.7.1 Mitigation measures to reduce bird disturbance (Batey, 2013) may include:

- Habitat management, including man-made roosts;
- Human access management, including buffer zones, zoning, path design and management; screening and dog control orders; and

- Education, including codes of conduct, signage, leaflets, visitor boards and enforcement.

3.7.2 Wirral Borough Council (WBC) (WBC, 2012c) has carried out an Appropriate Assessment (AA) concerning the effects of direct disturbance of qualifying bird species and habitat damage on the MN and NWF SPA. Recreational uses that may cause disturbance include dog walkers, jet-skis, walking, horse riding, use of motorcycles, sand yachts and bait digging. Increased recreation has the potential to have an adverse effect through physical damage to sensitive habitats and direct disturbance to birds on the MN and NWF SPA.

3.7.3 Proposed developments along other coastlines in the area including within Cheshire West and Chester, north Wales and other parts of Merseyside could result in greater detrimental impacts on qualifying bird species due to increased levels of disturbance; or disturbance of previously undisturbed areas due to residential/industrial development and/or improved opportunities for recreation. All relevant local authorities should be required to work in coordination during production of their development plan documents to limit any potential for detrimental impacts on qualifying species due to disturbance of important roosting/feeding areas along the coast (WBC, 2012c).

3.7.4 In the AA, it is considered that the amendments that WBC has made to Policies CS2, CS30 and CS33 would provide an adequate policy framework to protect the MN and NWF SPA/Ramsar site (WBC, 2012c). However, these appear to refer to habitat management rather than any measures aimed at reducing disturbance (WBC, 2012c). WBC has management responsibility for NWF and can help to set a framework for improved habitat management by promoting cross-authority collaboration and funding of habitat management.

3.7.5 MN is managed by WBC except at the restricted access site at Seaforth where responsibility is split between Mersey Docks and Harbour Company and the Lancashire Wildlife Trust. Wirral Ranger Service has a team of rangers with responsibility for the management of the coastal area, including the North Wirral Coastal Park. They are also involved in a more strategic role on all of Wirral's Coast from the Mersey to the Dee, particularly on conservation and recreation issues (WBC, 2015c).

Current Mitigation Measures in Place

3.7.6 Issues which could affect birds by disturbance include vehicle access to the foreshore, boat launching and sand yachting and para-karting.

3.7.7 A foreshore permit is required to take a vehicle onto the foreshore for any other purpose or to launch a boat around the Wirral coast. The Wirral Ranger Service is aware of the issue of bird disturbance, and is particularly concerned with aerial disturbance. Voluntary wardens also patrol Wirral Coast high tide roosts to ensure no disturbance occurs.

3.7.8 Sand yachting & para-karting (kite buggying) takes place on the beach under agreement between the Metropolitan Borough of Wirral and Wirral Sand Yacht Club. This agreement is currently subject to approval by NE.

3.7.9 Two offshore breakwaters were installed at Leasowe between 1980 and 1982 (AECOM, 2012) to reduce shoreline erosion. These are used by many waders, especially oystercatchers and knots. There appear to be no other educational or preventative measures in place, which would restrict or modify human access and behaviour in proximity to birds present on the tidal mudflats. However, there is limited signage along the Wirral coast, including visitor boards at some points (Leasowe and North Mersey, for instance), which aim to educate visitors in the wildlife present along the coast.

3.7.10 The Mersey Estuary Management Plan (MEMP, 2007) is a framework coordinated among the local authorities and interest groups, which encompasses the MN and NWF SSSIs, and Hightown to Crosby shoreline, amongst other sites. It provides 'best practice' in understanding human influence in the area. The plan states partners will have to carefully monitor visitor numbers, the distribution of leisure activities and the impact of an increase in visitor numbers. The MEMP addresses recreation, but in the context of encouraging more visitors and increasing the facilities (access, carparks, footpaths, interpretative services). There is brief mention of the need for careful planning to avoid damage to the environment.

3.7.11 The Green Space and Recreation Study (Sefton Council, 2009) was undertaken in line with Planning Policy Guidance Note 17 (PPG17) 'Planning for open space, sport and recreation' (ODPM, 2002) to inform a green space strategy for the Sefton Coastline, including the Crosby to Hightown foreshore.

3.7.12 There are some measures in force (foreshore vehicle and boat permits, visitor boards), but none which appear to directly address bird disturbance issues on the MN and NWF SSSIs, or Crosby and Hightown areas. Indeed, access and enjoyment of the foreshore are actively promoted by the various borough councils, as shown by the many access points, carparks and visitor attractions on the foreshore e.g. Anthony Gormley's statue art installation "Another Place" on Crosby foreshore.

Proposed Mitigation Measures

3.7.13 The following paragraphs outline the strategies and plans adopted by Sefton Council to manage the Sefton Coast for the benefit of all stakeholders, and to mitigate against adverse effects to wildlife. These measures could also be adopted by WBC.

3.7.14 The Integrated Coastal Management Zone (ICMZ) has been drawn up along the Sefton Coast, which also incorporates the Crosby and Hightown coastline (SCP, 2006). The Sefton Coast Partnership (SCP) is an informal association of land managers, land owners, community groups and relevant Council Departments. The key functions of the ICMZ are to achieve sustainable tourism, beach land and shoreline management. Sefton Council plan to designate the Hightown Dunes and Meadow nature reserve, which provides access to the foreshore, as a Local Nature Reserve in the future.

3.7.15 A specific issue recognised by the SCP (2008) which affects the Sefton coast is disturbance. Access is an important feature of the coast and the need to find the right balance between this and wildlife is recognised by the Sefton Coast Partnership (SCP, 2008). The SCP (2008) addresses the direct and indirect impacts of large local population and high visitor numbers. Visitor usage may increase to levels which become detrimental to conservation interests. A

specific target is to ensure that "*All factors which could affect the interest, especially recreational disturbance, are under control*". This can be achieved through overall coordination within Sefton through the mechanism of the Beach Management Plan (BMP). Related to this is the preparation of codes of conduct for beach users to reduce disturbance to birds along the whole Sefton Coast and the preparation of an annual report on bird counts, movements and trends for dissemination through the BMP.

3.7.16 A Habitats Regulation Assessment (HRA) of the Sefton Local Plan (Sefton Council, 2015) recommended that the Sefton Local Plan makes a clear commitment to the future delivery of the required BMP (specifically as it relates to recreation management). It also recommended that housing developments that have the potential to lead to increased recreational pressure should provide a project-specific HRA. Planning applications should minimise recreational pressure on the coast and address any likely significant effects upon these habitats as a result of the individual project alone. The size of the local coastal area means that site-specific solutions could be sought.

3.7.17 The following policies in the Sefton Local Plan (2015) provide a basis for avoidance or mitigation of adverse effects that may arise through recreational pressure on the coast:

- NH2: Protection and Enhancement of Nature Sites, Priority Habitats and Species. "*Development which may result in a likely significant effect on an internationally important site must be accompanied by sufficient evidence to enable the Council to make a HRA*"
- NH4: "*The Sefton Coast and Development 'Development will be permitted in principle where it is demonstrated that the proposals will not adversely affect the integrity of sites of international nature conservation importance"*.

3.7.18 Current mitigation measures which may indirectly reduce disturbance include zonation, whereby concentrating facilities (such as laid-out carparks, boardwalks to the beach, fencing to protect dune habitats, trails, information boards, toilets and food and drink outlets) to a few areas could be deployed, and the use of permit access. It is assumed that the levels of recreational interventions required to effectively manage additional recreational pressure resulting from future development within Sefton will need to be above the level that is happening now and will mitigate to appropriate levels.

3.7.19 New measures for reducing disturbance such as temporary footpath/access closures during sensitive periods, rerouting of footpaths away from key hotspots, introducing improved signage which direct visitors away from sensitive areas and Test of Likely Significant Effects of key locations for recreational activity (Sefton Council, 2015) could be introduced and these measures could be implemented by existing wardens.

3.7.20 An Access Strategy has been developed for the Sefton Coast and this proposes a zoning framework. The strategy was finalised in 2007 and the Sefton Coast Partnership confirmed a zoning framework which took into consideration nature conservation interests and the current zoning arrangements of the BMP.

3.7.21 The Access Strategy aims to enhance opportunities for access through the provision and management of paths, cycle-routes and riding routes, for local communities and visitors, and to manage access in ways which contribute to the sustainable management of landscapes, wildlife, coastal defences and land uses. There is no conflict between the broad aims of the nature conservation and access strategies within the ICZM principles adopted by the Sefton Coast Partnership.

3.7.22 Issues to be addressed include;

- Developing the zoning framework for the benefit of both users and wildlife;
- Identifying opportunities for encouraging access to the nature reserves;
- Understanding where habitats and species are sensitive to recreational disturbance; and,
- Monitoring of the impact of recreational use on wildlife.

3.7.23 The SCP (2008) also discusses education in the context of birdlife and other key themes. The monitoring of recreational and tourism use of the coast should include information on total numbers, levels of erosion and damage, and areas of conflict, which could include disturbance.

3.7.24 Sefton coast is managed by the Coast and Countryside Service, which provides a beach patrol and lifeguard unit, beach cleansing, coast and countryside rangers, and volunteers. Sefton Council (2015) believe that their service is the only integrated local authority coast management service in England. The scheme in Sefton has expanded to include access to the beach and limitations upon the use of cars on the beach. Controlling access to the beach has had demonstrable effects upon wildlife in the area (ELDC, 2015).

3.8 Summary

3.8.1 Studies have shown waders and waterfowl are affected by recreational activities. There is evidence to suggest housing density, human activities and access within coastal areas play a significant role in determining the level of disturbance received.

3.8.2 The review found that MN and NWF SSSIs are easily accessible areas with promenades, carparks and coastline amenities. Numerous recreational activities are recorded in the area and housing density was high compared to other SPAs and SSSIs in England.

3.8.3 Currently, MN and NWF SSSIs are managed by Wirral Council, except at the restricted access site at Seaforth where responsibility is split between Mersey Docks and Harbour Company and the Lancashire Wildlife Trust. Several partnerships are present providing management to the area. Previous visitor surveys have proved successful in allowing an understanding of the level of recreational pressure an area receives. Appropriate Assessment (AA) and HRA have been made of Wirral and Sefton Local Plans and Strategies, and mention made of bird disturbance, and the need to install mitigation measures. The Sefton BMP also addresses these issues.

3.8.4 There are some limited measures in force on the Wirral, but very few of these appear to be directly aimed at reducing bird disturbance or modifying visitor behaviour. Restriction of sand yachting, aerial disturbance and disturbance of high tide roosts are seen as the most pressing

issues. Visitors are actively encouraged to access the foreshore and tidal mudflats, with multiple access points available at most locations (WBC, 2015).

3.8.5 On the Sefton Coast (Hightown and Crosby) disturbance appears to be recognised as an issue, and the SCP (2008) aims to monitor and control disturbance. The mechanisms through which this has been done are however unclear, and their effectiveness does not appear to have been researched.

4. Recreational Activities Assessment

4.1 General Stakeholder Questionnaire Methodology

4.1.1 The study area was MN and NWF SSSIs, and the Crosby to Hightown foreshore (Figure 2.1), with the latter site included as a result of its functional linkage to the MN and NWF SSSIs (see section 2.15).

4.1.2 A short questionnaire (Appendix 1) was sent to local WeBS counters and other relevant local experts (e.g. Wirral Bird Club, BTO Regional Representatives) and relevant site managers. A total of 25 questionnaires were sent out.

4.1.3 The questionnaire asked, amongst other questions (see Appendix 1 for a complete list of questions):

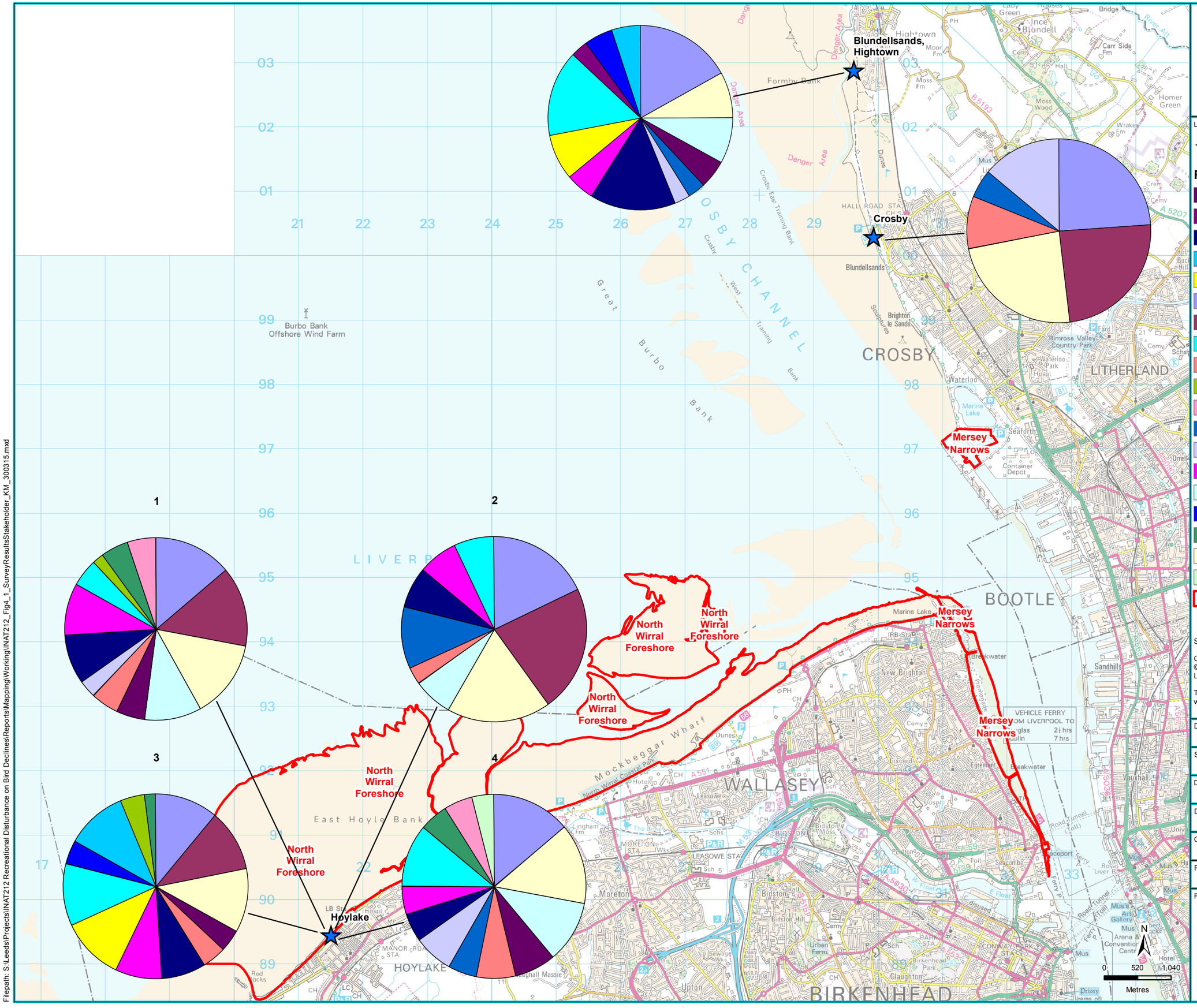
- Where are the main access points for the public across the site;
- Which recreational activities cause disturbance; and,
- Free text questions regarding any other issues and suggestions for managing problematic disturbance were also included.

4.1.4 The questionnaire was used to gather preliminary data on the extent and frequency of recreational activity within each WeBS sector and which of these activities, the stakeholders believe, are responsible for bird disturbance, as well as an indication of the number of years that the activity may have been undertaken at that locality. Survey participants were asked to consider shore-based, water-based and air-borne activities and frequency scores on a simple seven-point scale for each of the winter months. They were also asked to respond to several targeted questions on bird behaviour using standard WeBS activity and response categories. Respondents also commented on the current status of the disturbance mitigation measures that are in place within the survey area, whether there was scope for improvement, and what this might entail.

4.1.5 Respondents scored the types of recreational activity and disturbance in each WeBS 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 MN and NWF SSSIs and the Crosby to Hightown foreshore.

4.2 Results

4.2.1 There were eleven responses received, which included six questionnaires returned from the study areas (Appendix 1, Table 1). Two returned questionnaires were from outside the study area, and three responses were acknowledgements indicating that they were unable to assist with the survey. From the six questionnaires received, eighteen recreational activities were scored, with dog walking (on and off lead) and walking scoring highly at Hoylake, Crosby, and Hightown (Appendix 1, Table 2; Fig. 4.1). Four respondents from Hoylake (NWF) regarded bird disturbance as an important issue, with dog walkers the main issue, and aircraft (light aircraft, microlight aircraft and drones) also mentioned. In terms of mitigation, voluntary dog wardens occasionally patrol the high tide roost at Hoylake to ensure there is no disturbance. A few



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Site Grid Reference: 325,719 396,162

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Figure Number	4.1
Figure Title	Survey Results – Stakeholder Questionnaires

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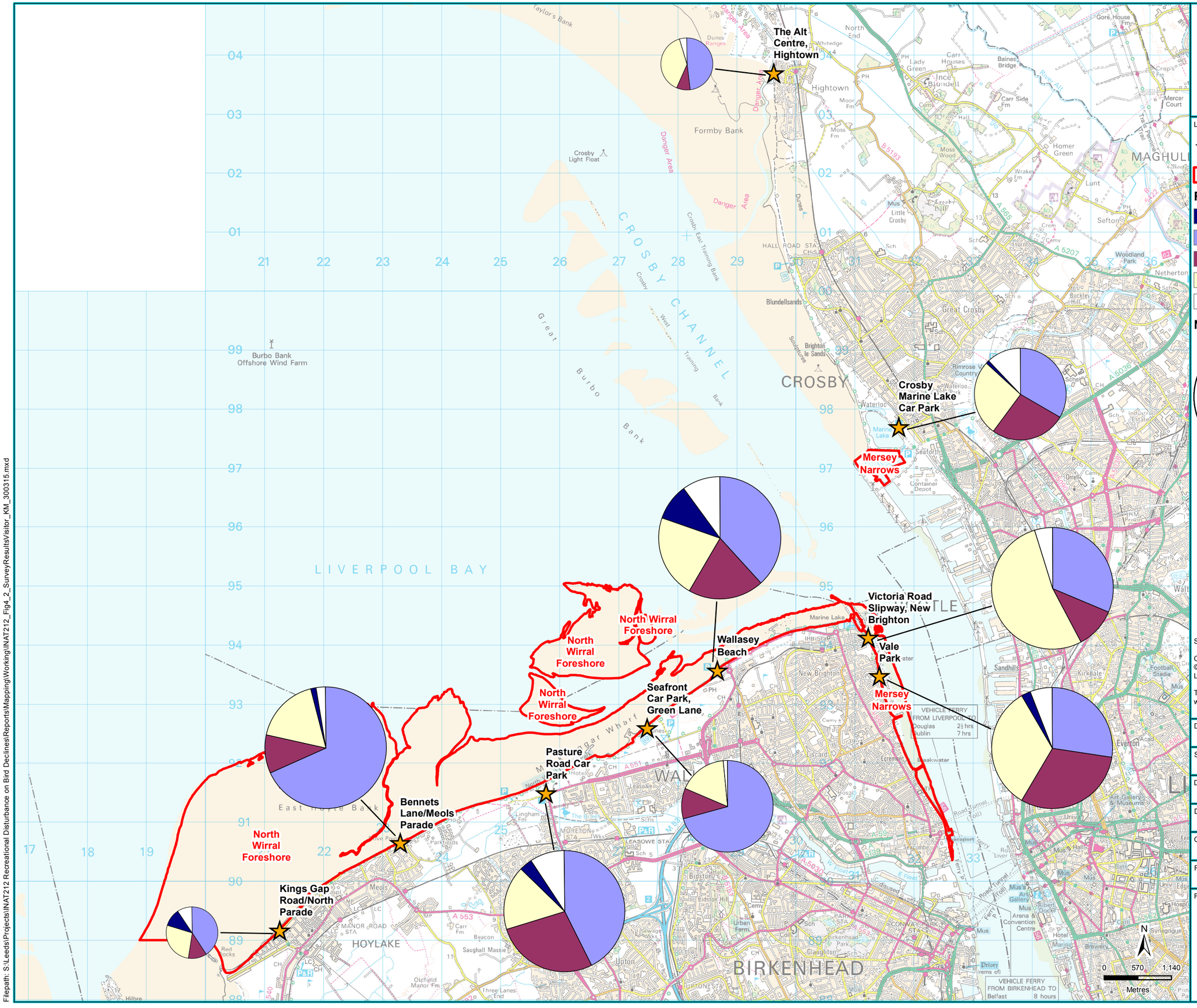

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Legend

- Visitor Survey Access Points
- SSSI Boundaries

Recreational Activity

- Birdwatching
- Dog walking (off lead)
- Dog walking (on lead)
- Walking
- Other

Number of People Questioned

- 76 - 100
- 51 - 75
- > 50

Site Grid Reference: 326,723 396,414

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Date: 30/03/2015	Date: 30/03/2015
Client	Natural England
Figure Number	4.2
Figure Title	Survey Results – Visitor Questionnaires

notices concerning disturbance to birds are also placed on the promenade. Official wardening was considered to be more appropriate, along with additional resourcing. The key access points to each site are shown in Table 4.1 and on Fig. 4.1.

Table 4.1 Site grid references of the sites from which stakeholder questionnaires returned.

Site	Site Grid Reference	Key Access Points	Access Point Grid Reference
Crosby	SD 29933 00294	Crosby Coastal Park	SD 29933 00294
Blundellsands, Hightown	SD 29623 02877	Hightown shoreline	SD 29623 02877
Hoylake	SJ 21505 89447	Hoylake shore	SJ 21505 89447

4.3 Discussion

4.3.1 In general, stakeholders perceived dog walking to be the most frequent recreational activity at their site, followed by walking. Dog walking was considered to be the activity causing most disturbance.

4.3.2 In other studies, stakeholders have been interviewed to obtain their views on the role and nature of recreational activities at various coastal localities such as Exmouth and Teesside (Liley *et al.*, 2011; Simpson, 2012). We received responses from eleven respondents, the majority of which were concerned with the birds within the MN and NWF SSSIs in some capacity. No questionnaires were received from "official" bodies in this study, outlining their viewpoints and any mitigation measures in place, which would provide an alternative insight, into the legal issues and public demand for resolution of any disturbance issues raised. Our survey differed from other surveys in requesting the perception of the level of specific activities, which gave an overview over time which is not possible from a brief study.

4.4 On-Site Public Questionnaire Methodology

4.4.1 Nine access points to the coast within MN and NWF SSSIs, and at Crosby and Hightown (Table 4.2; Figure 4.2) were surveyed over the core winter months. The access points were selected for survey to represent the broad geographical spread of the survey area; a larger sample of access points also generated larger variation in the data collected across all study sites. Due to the late finalisation of the project, December visitor surveys could not be carried out, so the survey months comprised January and February (two surveys) (Table 4.2). Each site was surveyed once during the week and once on the weekend. Data collection sessions were divided into four two hour intervals: 7:30 – 9:30, 10:00-12:00, 12:30-15:00 and 15:00-17:30 per survey day; to provide eight hours of survey on each day. This ensured coverage from dawn until dusk, allowed direct comparison between survey locations and also provided the surveyor with breaks.

4.4.2 During each survey session, count data collected included vehicles, visitors (visitors entering and leaving were recorded as two separate data sets), dogs, horses, cyclists and people

undertaking other activities, e.g. angling. Additional data recorded included weather conditions and access point description.

4.4.3 Within each session as many people as possible (but restricted to one adult per group) who were leaving the site were approached and asked to respond to a multiple choice visitor questionnaire comprising sixteen questions. The content of the questionnaire was agreed with a NE project officer. The survey questions are shown in Appendix 2.

4.4.4 Each questionnaire response was recorded using a *Trimble Juno* T41 handheld computer with GPS and 3G capability. The same methodology was applied on each survey date to enable consistent comparison of the visitor patterns recorded over the survey period.

4.5 Results

4.5.1 The sites were visited during 17th -19th January (two surveyors), 6th - 8th February (three surveyors), and 24th - 25th February (two surveyors) (Table 4.2). This totalled nineteen eight-hour days. A total of 640 questionnaires were completed. The site with the most questionnaires completed was Wallasey Beach, followed by Pasture Road Carpark, Vale Park and Victoria Road Slipway. The site with the least completed questionnaires was the Alt Centre, Hightown (Table 4.2).

4.5.2 Overall the most popular activity recorded was dog walking (off lead) (44%), followed by walking (27%) and dog walking (on lead) (19%). Bird watching comprised 3% of the activities reported with other activities (photography, angling, cycling, running, games, bait digging, outdoor gym, scooter and model plane flying/kite flying) comprising the remaining 7% of the total. The individual frequencies for each activity at each site are shown on Figure 4.2. At most sites dog walking (off lead) was the most popular activity (35 – 69%), except for Victoria Road Slipway where walking (54%) was most popular activity, and Vale Park where dog walking (on lead) (31%) was most popular activity (Figure 4.2). Dog walking (on and off lead) was particularly prevalent at the NWF access points (Figure 4.2). The average group size was 1.69 persons (Figure 4.3), and the number of dogs per dog walking group was 1.54 (Figure 4.4).

4.5.3 Respondents were predominantly local middle-aged (36-50), and the activities they engaged in were spread out throughout the day, with a slight bias to the morning. They were attracted primarily by the scenery to the site they were visiting. They had mostly travelled less than 5 miles (75%), by foot (33%) or car (64%). The activity engaged in usually took 30 – 60 minutes. They stated they visit frequently, daily or more than twice a week, perhaps linked in with their being local residents and dog walkers. A majority of the respondents were aware of the MN and NWF's importance and statutory designations. Most respondents thought that management changes were not necessary. Most respondents did not notice any bird disturbance. Those that did (25%) considered dog walking a cause of disturbance. Dog related measures ranked very low as a management option (Figures 4.5 - 4.15).

Table 4.2 Visitor survey sites, site grid references, dates surveyed and number of visitors surveyed.

Site	Grid reference	Weekday surveys	Weekend surveys	Number of visitors surveyed
Bennets Lane/Meols Parade	SJ 23312 90676	19 January	7 February	78
Kings Gap Road/ North Parade	SJ 21260 89181	24 February	7 February	44
Pasture Road Carpark	SJ 25735 91620	19 January	7 February	87
Victoria Road Slipway, New Brighton	SJ 31221 94119	6 February	17 January	83
Wallasey Beach	SJ 28713 93537	6 February	18 January	91
Vale Park, South Mersey	SJ 31422 93496	6 February	17 January	84
Seafront Carpark, Green Lane	SJ 27383 92496	4 February	18 January	75
Crosby Marine Lake Carpark	SJ 31726 97730	25 February	8 February	75
The Alt Centre, Hightown	SD 29361 03704	5 February	8 February	23
Total				640

Figure 4.3 The number of individuals in each group.

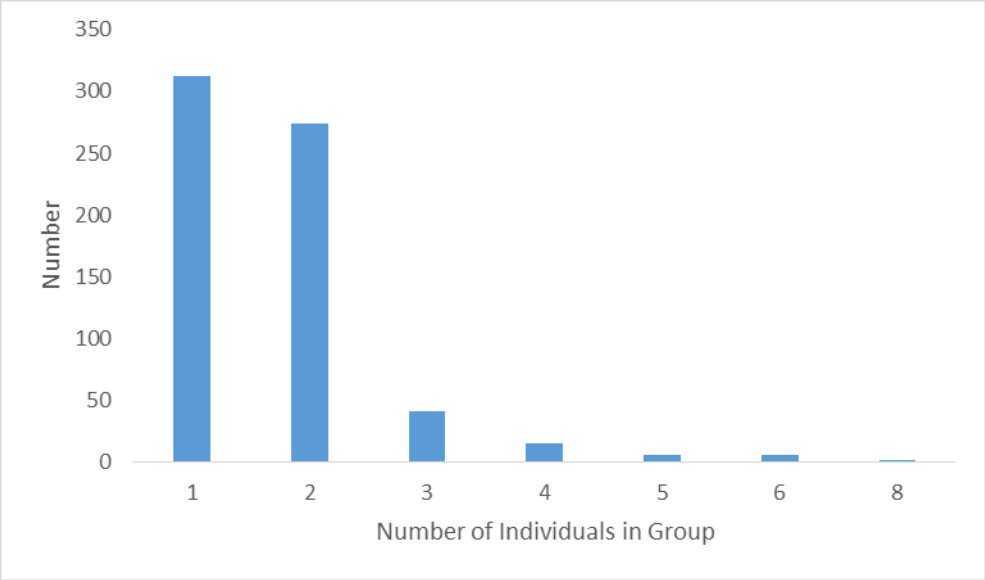


Figure 4.4: The number of dogs per group of dog walkers.

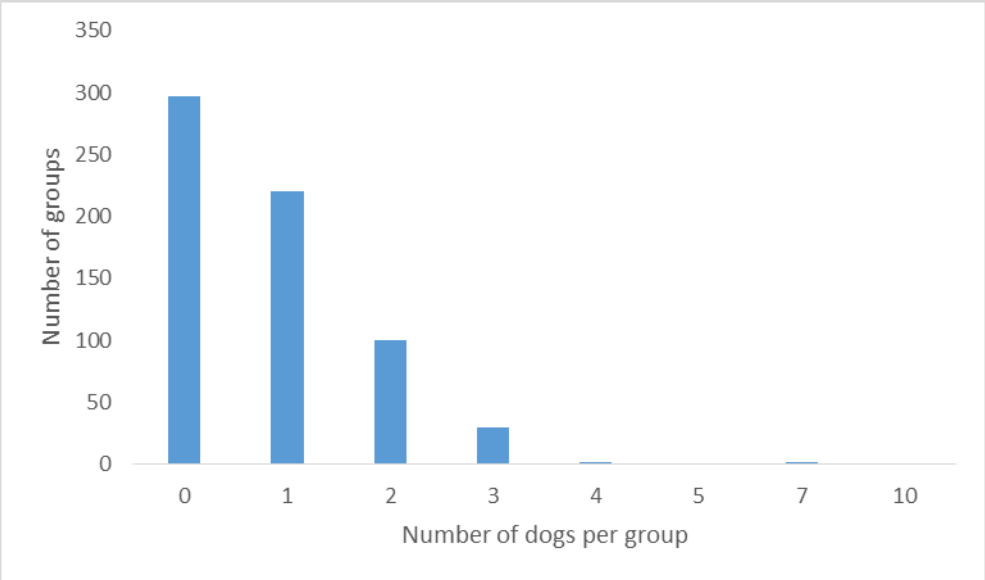


Figure 4.5: The percentage of respondents using each mode of transport to travel to the site (n = 640).

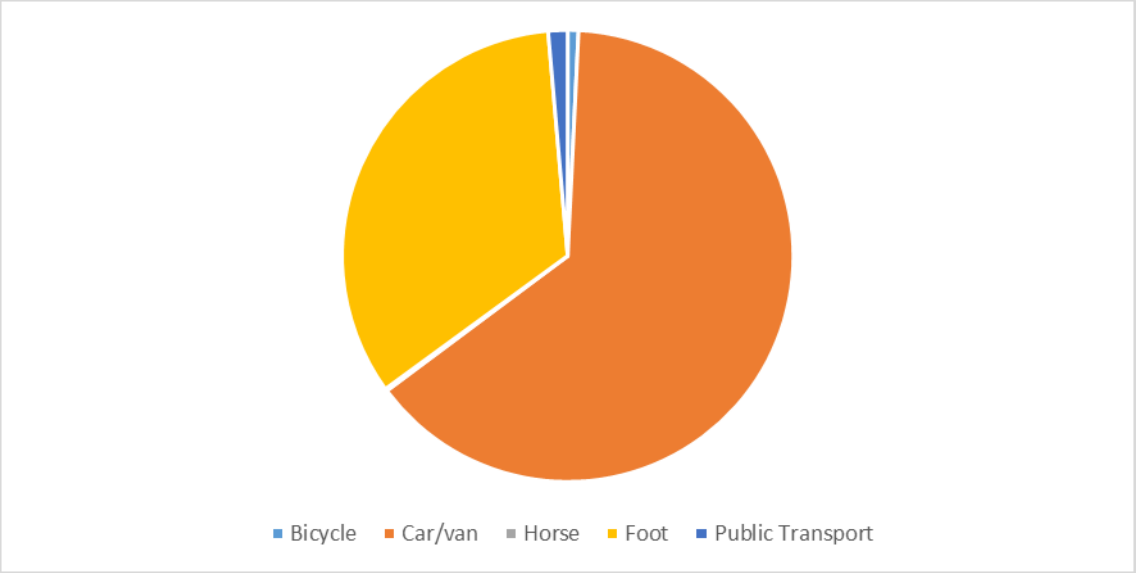


Figure 4.6: The number of respondents travelling to the site in each distance category (n-640).

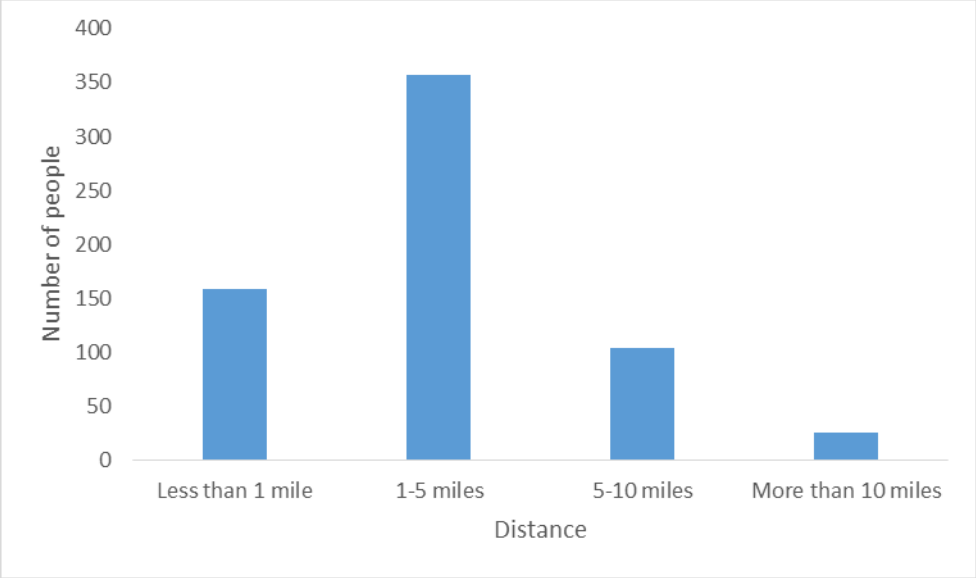


Figure 4.7: The percentage of respondents citing each attraction as the main reason for visiting (n = 640).

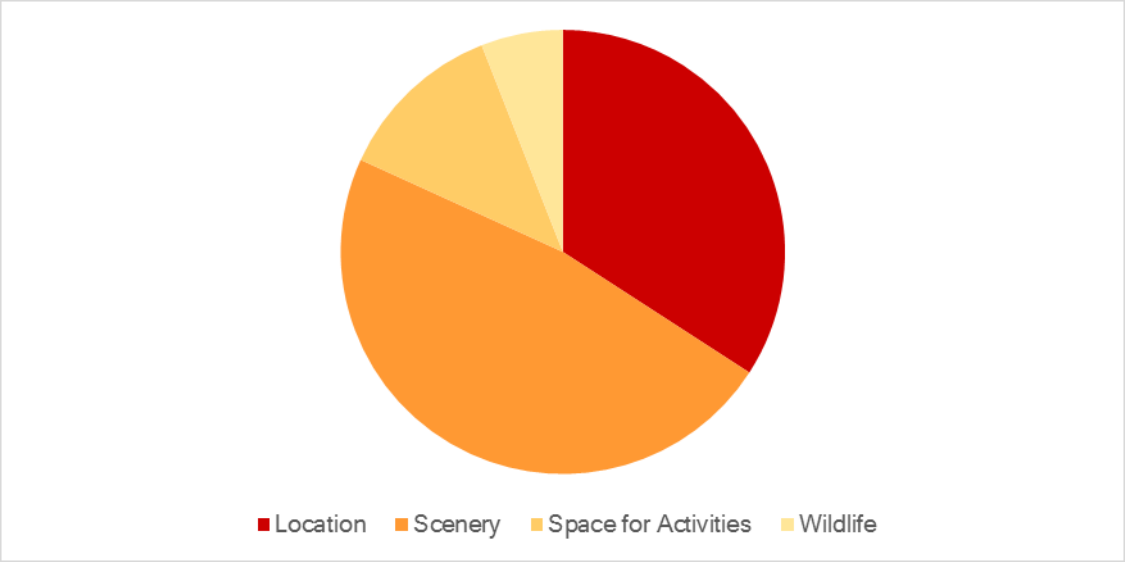


Figure 4.8: The percentage of respondents who are local or tourists (n=640).

Figure 4.9: The percentage of respondents in each time period of their activity at the site (n=640).

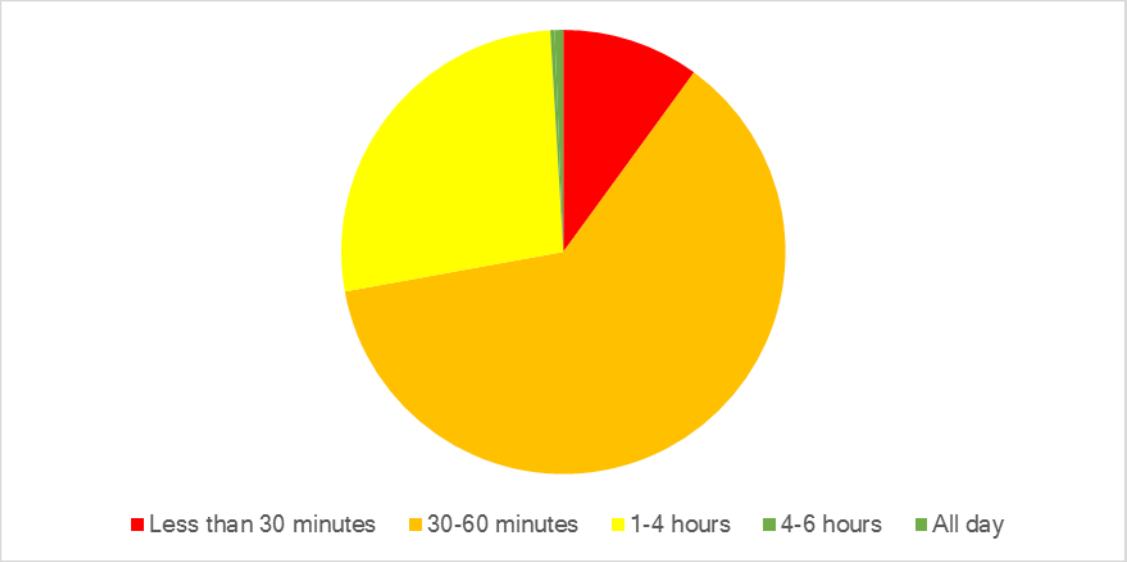


Figure 4.10: The percentage of respondents in each age group (n=640).

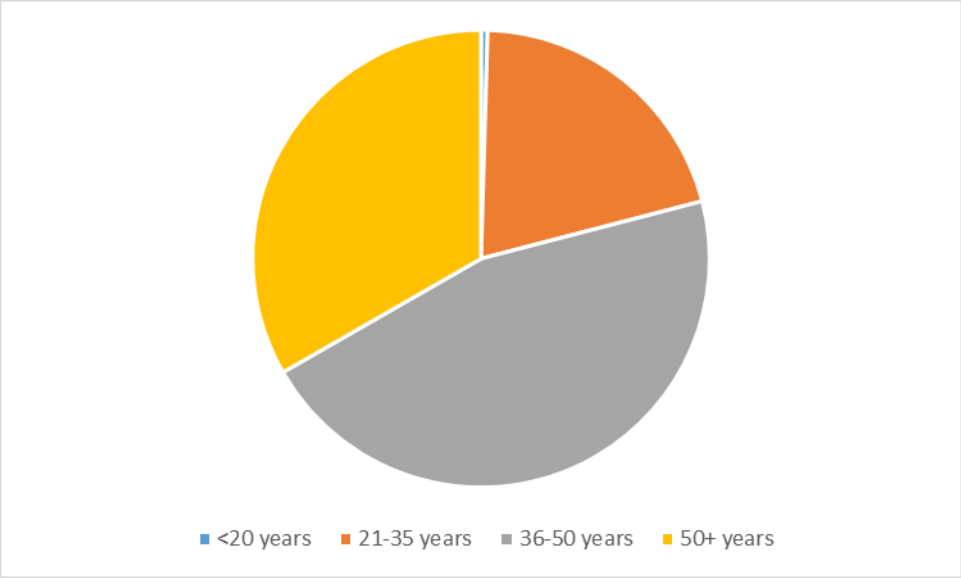


Figure 4.11: The percentage of respondents visiting at each time period (n=640).

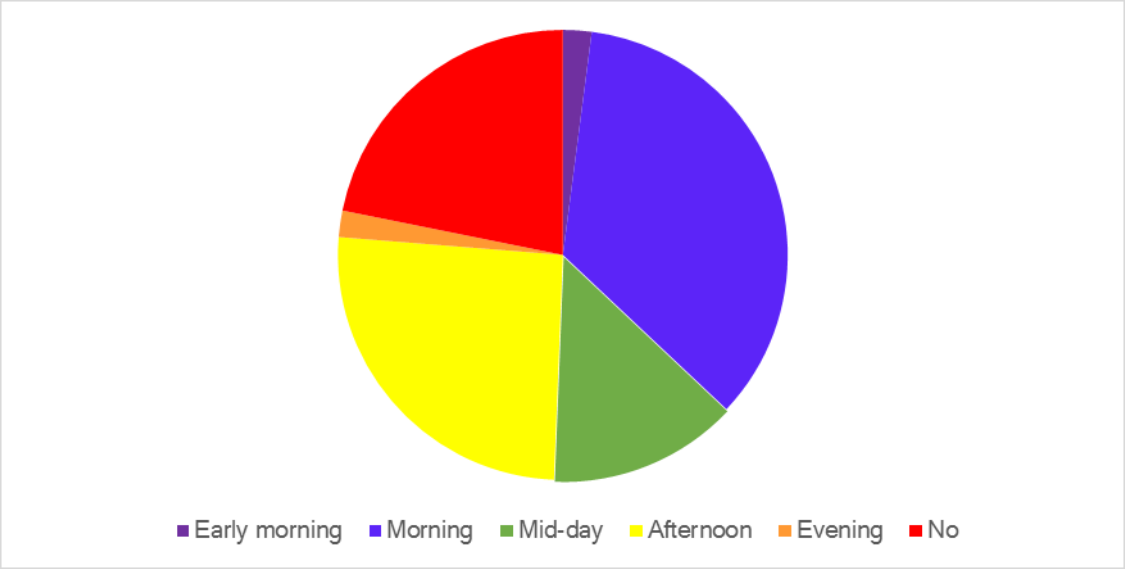


Figure 4.12: The frequency of visits respondents make to the site (n=640).

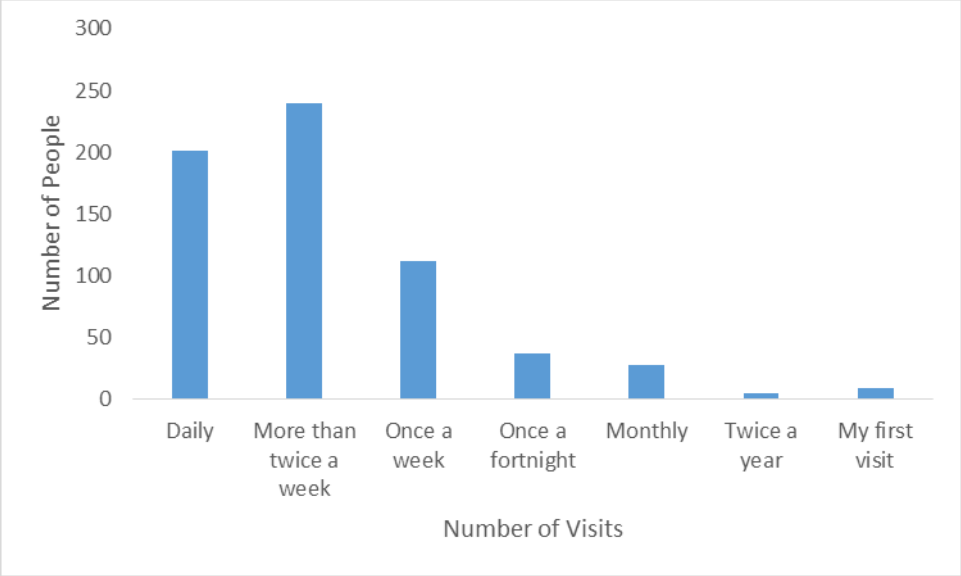


Figure 4.13: The percentage of respondents who are aware of the site's designation as a European Marine Site and SPA (n=640).

Figure 4.14: The number of respondents favoured future management options at the site (options outlined in questionnaire) (n=640).

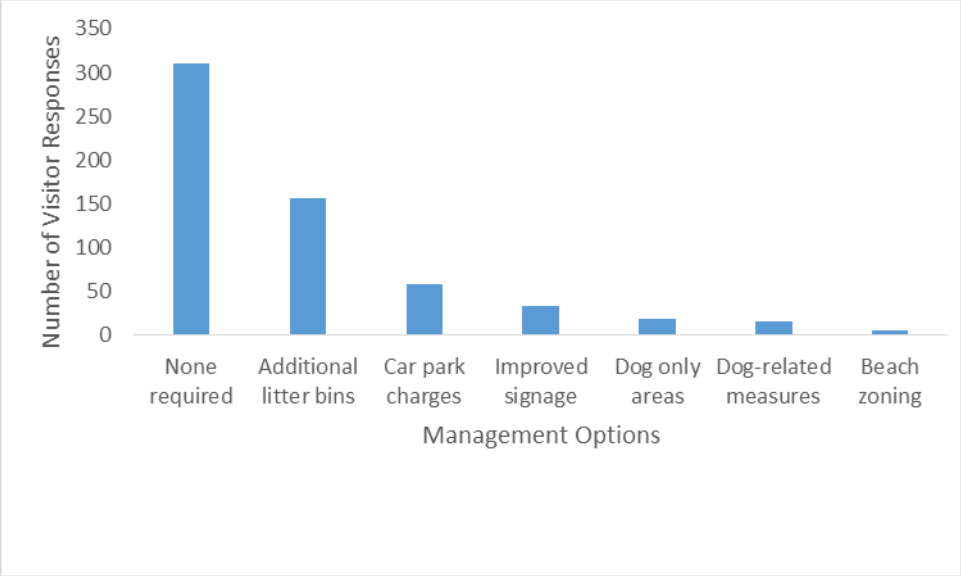
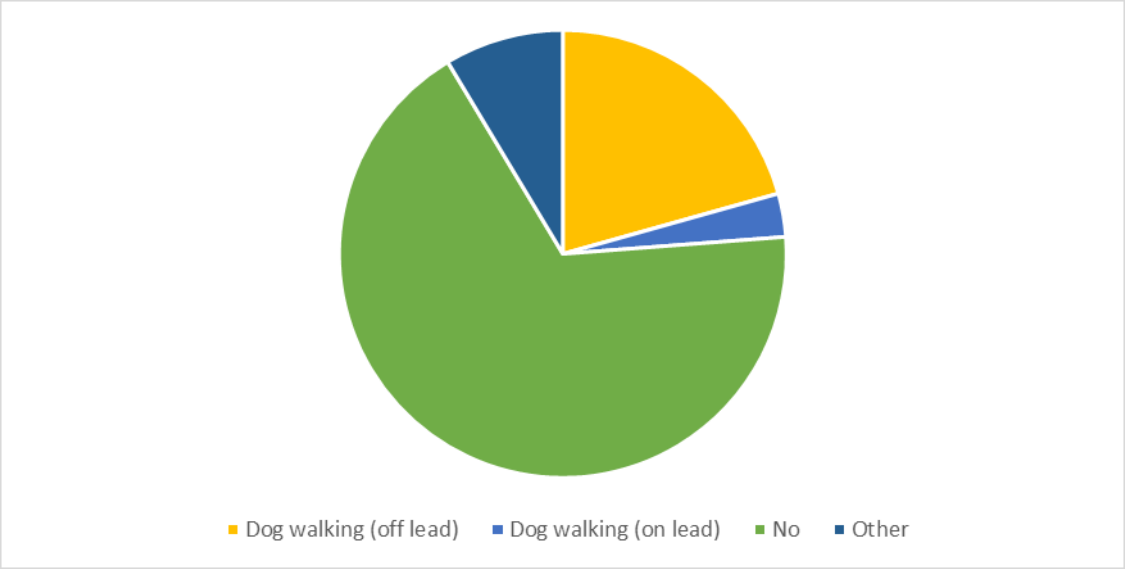


Figure 4.15: The causes of bird disturbance seen by the respondent at the site (%) (n=640).



4.6 Discussion

4.6.1 A total of 640 questionnaires were completed (an average of 33.6/day), and this effort exceeded that of other similar winter visitor surveys e.g. 18.3/day at the Exe Estuary (Liley & Cruickshanks, 2010); 12.5/day at the Humber Estuary (Fearnley *et al.*, 2012), and 19.6/day at the Solent (Liley *et al.*, 2011).

4.6.2 The most popular winter activity recorded was dog walking. At the Solent, dog walking was also popular (Liley *et al.,* 2010), but at the Humber it was less so (Fearnley *et al.*, 2012). On the Exe Estuary dog walking ranked at the same level as the Humber Estuary (Liley & Cruickshanks, 2010) and Teesside and the Cleveland Coast (Simpson, 2012). The nature of the coast at MN and NWF may make it especially attractive to dog walkers with numerous carparks (Figure 2.1) generating easy accessibility to the intertidal zone.

4.6.3 A comparison can be made with visitor surveys carried out in the summer of 2000 on Merseyside, when 6000 questionnaires were completed (Steward, 2000). Answers were less deterministic, with reasons to visit (Wirral area only) including relaxation (26%), scenery (16%), visit the beach (18%), nature/birdwatching (11%) and lunch (11%). These could be termed “ultimate” reasons (the “real” reasons to visit, rather than “proximate” reasons (Greenberg, 1998)). Scenery and wildlife were also ranked highly in this survey, scenery especially so.

4.6.4 Walking (34%) and dog walking (19%) still scored highly, but dog walking may not have been such a major leisure activity in 2000 than currently. A typical visitor to MN and NWF SSSIs may be identified as a local middle-aged dog walker who visits the site frequently by themselves or with another individual with their dog off the lead.

5. Bird Survey

5.1 Methodology

5.1.1 The bird counts and surveys of bird behavioural responses to recreational activities and disturbances were based on methodologies outlined in Liley *et al.* (2011).

5.2 Survey Sites

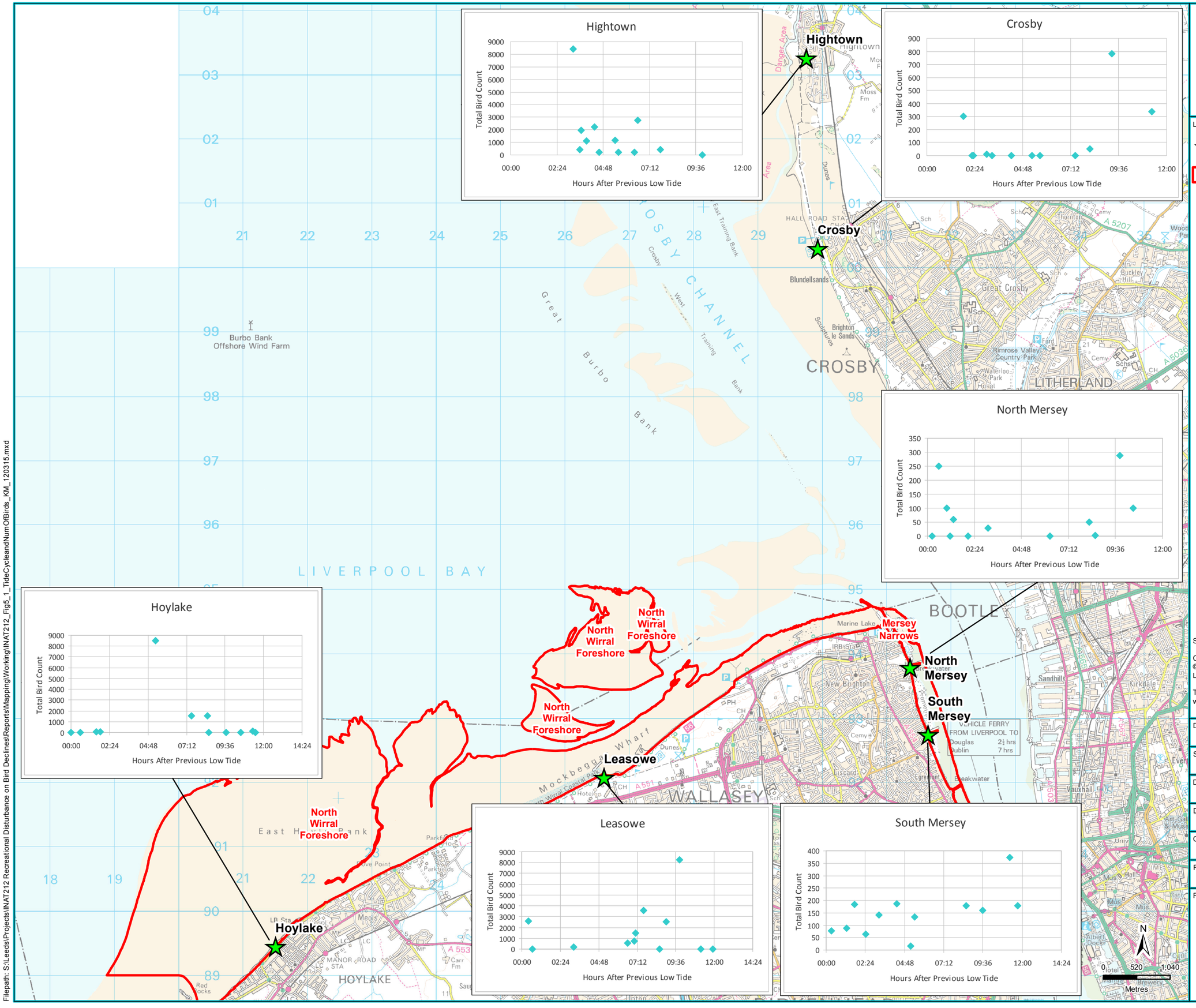
5.2.1 The study area was the MN and NWF SSSIs, and Crosby Beach and Hightown area (the latter two sites are part of the Ribble and Alt Estuaries SPA) (see Figure 2.1). Six access points were selected for combined bird and recreational monitoring (two at MN SSSI, two at NWF SSSI, and two along the Crosby to Hightown shoreline (see Figure 5.1)), based on information received from the RSPB. These are described below.

5.2.2 The bird survey vantage points were approximately equivalent to the visitor access points, except for three additional visitor access points along the NWF (Table 5.1).

Table 5.1 Visitor Access Points and their relationship to Bird Survey Points.

Visitor Access Point	Bird Survey Vantage Point
Kings Gap Road/North Parade	Hoylake
Bennets Lane/Meols Parade	n/a
Pasture Road Carpark	Leasowe
Seafront Carpark	n/a
Wallasey Beach	n/a
Victoria Road Slipway	North Mersey
Vale Park	South Mersey
Crosby Marine Park	Crosby
The Alt Centre, Hightown	Hightown

5.2.3 Observation (vantage) points were chosen on the basis of ensuring any focal area disturbance events in relation to the presence of birds within 200m could be accurately recorded. This was one of the main objectives of this study. This meant in practice that some areas where birds were numerous were not necessarily the optimum vantage point at a location, as the birds may not have been subject to disturbance because of, for example, lack of accessibility by people to the intertidal zone.



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Legend

- Vantage Points
- SSSI Boundaries

Site Grid Reference: 326,576 396,351

Drawing Ref	INAT212/18248/1
Scale at A3	1:55,000
Drawn: KM	Checked: NS
Date: 12/03/2015	Date: 12/03/2015
Client	Natural England
Figure Number	5.1

Figure Title

Tide Cycle in Relation to the Number of Birds Present

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Hoylake (North Wirral Foreshore)

5.2.4 Hoylake Lifeboat Station is a high tide roost for oystercatchers, knot, dunlin, bar-tailed godwit and redshank. The mudflats extend from the high water mark for over two km at low tide, here and along the entire NWF, providing feeding areas for these species and also shelduck *Tadorna tadorna*. The mudflats are entirely covered at high tide, with the sea coming up to the promenade. Access to the mudflats is provided by slipways from the promenade. The observation point (grid reference: SJ 21505 89447; Figure 5.1; Photographs 1 & 2 on Figure 5.2) was on North Parade, opposite Government Road. East of the Lifeboat Station is a wide tidal channel, opposite Meols Parade. This is a well-known birdwatching site (Smith, 2015)

Leasowe (North Wirral Foreshore)

5.2.5 Leasowe has a high tide roost on an artificial breakwater c.200m from the seawall and promenade (see Photographs 3 & 4 on Figure 5.2). This becomes accessible shortly after the tide begins to ebb. The mudflats extend out for over 2km at low tide. The site is used by many people both on the seawall promenade and the tidal mudflats. The observation point was opposite the high tide roost (grid reference: SJ 26609 92073; Figure 5.1; Photograph 3 on Figure 5.2).

North Mersey (Mersey Narrows)

5.2.6 Many pedestrians use the Tower Promenade overlooking the mudflats. The observation point was on the promenade, on the south side of a breakwater (grid reference: SJ 31368 93785; Figure 5.1; Photographs 1 & 2 on Figure 5.3), which was used as a high tide roost. This gave an overview of the high tide roost and the extensive mudflats to the south. At the breakwater on the shore is a driftwood ship installation (the “Black Pearl”) which is very popular with visitors (Photograph 1 on Figure 5.3).

South Mersey (Mersey Narrows)

5.2.7 The observation point was on the promenade, on the south side of a breakwater (grid reference: SJ 31647 92743; Figure 5.1; Photographs 3 & 4 on Figure 5.3), which was used as a high tide roost. This gave an overview of the high tide roost and the extensive mudflats to the south.

Crosby

5.2.8 Crosby Beach is the location of Another Place, an art installation by Anthony Gormley. A very popular site, with many people frequenting the mudflats in order to view the statues. The promenade extends south along the mudflats, with many access points to the mudflats. The tide rises quickly here, with no high tide roost. The observation point was at the southern end of the Hall Road West carpark (grid reference: SD 29933 00294; Figure 5.1; Photographs 1 & 2 on Figure 5.4).

Hightown

5.2.9 The Alt Estuary supports internationally important numbers of shore and wading birds including curlew, knot, sanderling, dunlin, redshank and bar-tailed godwit (Photographs 1 & 2 on Figure 5.5). This location is the northern part of the Crosby Marine Park and is known as Hightown

Photograph 1:
View north, Hoylake. Low tide.

Photograph 2:
View west, Hoylake. Dog walkers on mudflats.

Photograph 3:
View north, Leasowe. Offshore breakwater used as high-tide roost.

Photograph 4:
View north, Leasowe. Dog walkers on receding tide near breakwater.

Client: Natural England		Drawing Ref: INAT212/18249/1	thomson ecology
Figure Number: 5.2		Scale at A4: Not applicable	
Figure Title: Photographs of the Site - Hoylake and Leasowe		Drawn: KM	Checked: NS
		Date: 23/03/2015	Date: 23/03/2015

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Photograph 1:
View north, Mersey North. Promenade and walkers, the “Black Pearl”, and a breakwater used as a high-tide roost.

Photograph 2:
View south, Mersey North. The promenade and adjacent mudflats.

Photograph 3:
View south, Mersey South. Breakwater used as a high-tide roost.

Photograph 4:
View south, Mersey South. Birds on high-tide roost.

Client: Natural England		Drawing Ref: INAT212/18250/1	
Figure Number: 5.3		Scale at A4: Not applicable	
Figure Title: Photographs of the Site - Mersey North and Mersey South		Drawn: KM	Checked: NS
		Date: 23/03/2015	Date: 23/03/2015

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Photograph 1:
View west, Crosby. “Another Place” statues on falling tide.

Photograph 2:
View west, Crosby. Dog walkers on falling tide.

Photograph 3:
View west, Hightown. Low tide.

Photograph 4:
View south, Hightown. Walkers on shore.

Client: Natural England		Drawing Ref: INAT212/18251/1	thomson ecology
Figure Number: 5.4		Scale at A4: Not applicable	
Figure Title: Photographs of the Site - Crosby and Hightown	Drawn: KM	Checked: NS	www.thomsonecology.com enquiries@thomsonecology.com
	Date: 23/03/2015	Date: 23/03/2015	

Photograph 1:
Redshanks, Mersey North.

Photograph 2:
Knots, Hoylake.

Photograph 3:
Dog walker and dogs approaching redshanks at Leasowe.

Photograph 4:
Dogs close to birds, Leasowe.

Client: Natural England		Drawing Ref: INAT212/18252/1	
Figure Number: 5.5		Scale at A4: Not applicable	
Figure Title: Photographs of the Site		Drawn: KM	Checked: NS
		Date: 23/03/2015	Date: 23/03/2015

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Dunes and Meadows, which has been proposed as a Local Nature Reserve (Southport Council, 2015). There is a high tide roost on the northern side of the river Alt, abutting the Altcar Rifle Range. This roost is not accessible from the south side of the river. This site is the only one of the six survey sites lacking a promenade, with sand dunes and a sandy beach adjacent to the mudflats. The river channel runs south parallel to the shore, 50m at its closest point, which prevents access to the mudflats. The observation point was by a large pipe outflow (grid reference: SD 29756 03255; (Figure 5.1; Photographs 3 & 4 on Figure 5.4), which gave an overview of the high tide roost and the mudflats,

5.3 Focal Area

5.3.1 A focal area for the bird and disturbance fieldwork was defined at each survey location observation point. This area comprised an arc of 500m radius (area of 39.25ha) from the surveyor facing seawards, and included all visible areas of intertidal habitat, below mean high water mark (MHWM), within this 500m radius. The focal area did not include land above the MHWM, as no disturbance to birds occurred in this area (as no birds were present). The 500m radius was based on Liley *et al*.'s (2011) methodology, as the maximum distance "*at which surveyors felt confident counting birds at the same time as recording levels of human activity, and within which it was possible to reliably estimate distances between disturbance events and the birds*". It is emphasised that any birds or events occurring outside the focal area were not formally recorded as part of the survey.

5.3.2 The focal area was then split into three standard distance bands (0-50m, 50-200m, 200-500m), representing distance from MHWM and parallel to the shore rather than concentric rings around the surveyor, within which the distribution of bird counts and recreational events could be recorded.

5.4 Data Collection

5.4.1 Each site was visited four times during December 2014, January 2015 and February 2015, totalling 12 surveys at each site in all. The survey periods were:

- 27th – 30th December 2014 (27th & 28th weekend dates)
- 22nd – 25th January 2015 (24th & 25th weekend dates)
- 14th – 18th February 2015 (14th & 15th weekend dates)

5.4.2 Each survey lasted one hour (excluding the time required to count the birds present at the beginning and end of the survey period, which varied from site to site). An attempt was made to visit each site as at many different stages of the tide cycle as possible, in order to build a complete picture of bird numbers and recreational activity at each site. For the purposes of this survey, a tide cycle was defined as beginning at low tide, and lasting 12 hours 20 minutes, until the next low tide.

5.4.3 On each survey, the tidal area visible (i.e. the distance of the tideline from the shore) and the state of the tide (high or low) was recorded. A high tide state was determined as being when the tideline was less than 100m from the shore at the commencement of the survey period. Low tide states were determined to be when the tideline was more than 100m from the shore at the commencement of the survey period.

5.4.4 Data on weather conditions (cloud cover, temperature, wind direction and speed, precipitation) was also collected for each survey period.

5.5 Bird Survey Methodology

5.5.1 The birds to be surveyed reflected those outlined in the MN and NWF SSSIs citations and MN and NWF SPA citation (see sections 2.1. 2; 2.1. 3 and 2.1. 6). These are turnstone, redshank and cormorant (all MN SSSI) and knot, bar-tailed godwit and dunlin (all NWF SSSI). The SPA citation includes knot and bar-tailed godwit, with grey plover, oystercatcher and sanderling also named in the waterbird assemblage (NE, 2013).

5.5.2 As well as the species named above, all other WeBS (BTO, 2015) species present in the survey area surveyed. The species named in section 5.5.1 are also WeBS species.

5.5.3 WeBS species includes all waterbirds, which includes ducks, geese, swans, cormorants, herons, grebes, rails, waders and kingfishers *Alcedo atthis*. Gulls are an optional group in the WeBS scheme, and were not counted in this survey, although the species present were noted. Other bird disturbance studies (e.g. Liley *et al.*, 2011; Linaker, 2013) have followed a similar procedure. All WeBS species were counted at the beginning and at the end of the survey period. The maximum number of a species present (i.e. either the first count total or the second count total, whichever was the highest) was regarded as the number present during the survey period. The bird counts could then be related to tide state, compared between sites, and compared between standard distance bands

5.6 Spot Count Methodology

5.6.1 Spot counts recorded the overall activity of people visible to the surveyor from the observation point. Spot counts give an index of overall activity at a site, not an actual count of the numbers present, but still enable comparisons to be made between all sites so surveyed. Counts were in the form of a single continuous sweep of the survey area. Counts were made of all of the people present on the promenade, the shore and the intertidal area, and the activity they were engaged in (see Appendix 3, Table 1 for Activity Codes). The definition of the various areas where spot counts and recreational activities were surveyed does not appear to have been rigorously defined in previous studies (e.g. Liley *et al.*, 2011; Linaker, 2013; Simpson, 2012), so the definitions used in this study are given here:

- Promenade: a paved public walk, typically one along the seafront at a resort;
- Shore – usually refers to “land along the edge of the sea or ocean”; however, in this study it refers to the beach (the zone above the water line at a shore of a body of water, marked by an accumulation of sand, stone, or gravel that has been deposited by the tide or waves). In law, it refers to “the space between the ordinary high-water and low-water mark”, but in this report it is our definition of the following term “intertidal zone”.
- Intertidal zone: the area that is above water at low tide and under water at high tide (Liley *et al.*, 2013).

5.6.2 Promenades (including the sea-wall) were included in the spot counts as this was where people accessed the shore and mudflats from, and gave a more accurate representation of visitor

numbers to each site, rather than only shore and intertidal visitor numbers. Any craft moving on the water, intertidal zone, shore, promenade or overhead in the survey area were also recorded. Four spot counts were carried out on each survey visit, one every twenty minutes, over the period of one hour. This data enabled comparisons to be made between sites regarding usage by people and activities. The DW code refers to a dog walker with at least one dog off the lead, although other dogs in the group may have been on leads.

5.7 Potential Disturbance Event (PDE) Methodology

5.7.1 Recreational events that occurred within 200m of any WeBS species within the focal area on the intertidal or the (sandy) shore were categorised as 'potential disturbance events' (PDE) (based on Ravenscroft *et al.*, 2007).

5.7.2 It was clear from the commencement of the surveys that although many (hundreds) of people frequented the promenades, and were often within 200m of birds on the intertidal or high tide roosts, that these should not be categorised as PDE. No behavioural responses were recorded from any WeBS species within 200m of a promenade, although looked for on each survey, when time permitted. It may be that the height of the promenades was sufficient to render the presence of people and/or dogs unthreatening (see further comments in the Discussion).

5.7.3 The length of the study area at each site (one km from start to finish along the shoreline/promenade) also precluded any meaningful assessment of pedestrian traffic as PDE. Recording the pedestrian traffic on the promenades as PDE would also have rendered observing intertidal PDE and bird responses extremely difficult (Liley *et al.*, 2011; Ross & Liley, 2014).

5.7.4 PDE had to be scrutinised closely to ensure that all behavioural responses were correctly recorded (see section 5.7.2). This required all intertidal PDE to be observed from commencement to exit from the intertidal zone. This very occasionally meant that other PDE occurring simultaneously were not recorded.

5.7.5 A record of the behavioural response of each species present to the PDE was recorded. For each event, this included the distance at which birds responded (or not), the activity the bird was engaged in (either feeding or resting (including roosting), the behavioural response observed (Table 5.2), the distance displaced (if any, by land, sea or air), the time taken to resume its previous activity (prior to being disturbed), the habitat (shore, intertidal or water), human activity, group size (number of people, and number of dogs, if present), any notes and occasionally photographs of the event. A single PDE could therefore affect several species, each with its own individual response to the event. A constraint on data collection was that lesser responses were not recorded in some instances, i.e. a bird could go through several intermediate response stages until a flight reaction, as the PDE approached more closely, for instance.

Table 5.2 Behavioural Response Categories to Potential Disturbance Events.

Response Category	Code	Indices
No visible response	N	0
Alert - Bird raises head and resumes activity	A	1
Alert – Bird moves on foot from disturbance and then resumes activity	B	2
High Alertness – Birds stop feeding/roosting and show agitation	C	3
Short-flight (<50 m)	D	5
Long-flight (>50 m) (birds do not leave the survey area)	E	5
Birds leave the survey area	F	6

5.8 Data Analysis

5.8.1 The results were entered into Excel and then analysed using the statistical programme Genstat (17th edition, 2014). Non-parametric statistical analyses were used to test:

- The relationship between the distances and categories of response for homogenous groups of bird species; and,
- The total proportion of events that resulted in disturbance in relation to distance.

5.8.2 Statistical analysis followed the methods outlined in Cox & Ravenscroft (2009) and Linaker (2013), therefore:

- Mann Whitney U tests were used for a comparison of two samples;
- Kruskal-Wallis analysis were used for the comparison of multiple samples; and,
- Spearman's rank correlation coefficient were used to test the significance of a relationship between two variables.

5.9 Bird Survey Results

5.9.1 The sites were visited at various stages of the tide cycle, Figure 5.1 illustrates the times after low tide when each site was visited, and the maximum count of WeBS birds present at that time. The spread of visits to each site encompassed most stages of the tide cycle (low, flow, ebb and high) (Fig 5.1).

5.9.2 Hightown, Hoylake and Leasowe recorded maximums of over 8000 birds on at least one visit (Fig. 5.1). Crosby recorded a maximum of 781 birds, and North Mersey and South Mersey recorded a maximum of 289 birds and 374 birds respectively (Fig. 5.1). Hightown had the highest diversity of WeBS species (18). Leasowe had 14 species, followed by the other four sites (8-10).

5.9.3 Overall only three sites recorded birds on all visits (Hightown, Hoylake and South Mersey). Crosby had the most number of visits without birds recorded (5/12 visits), as at high tide no birds were present. The median number of birds counted ranged between one (Crosby) to 664 (Leasowe) and 787 (Hightown).

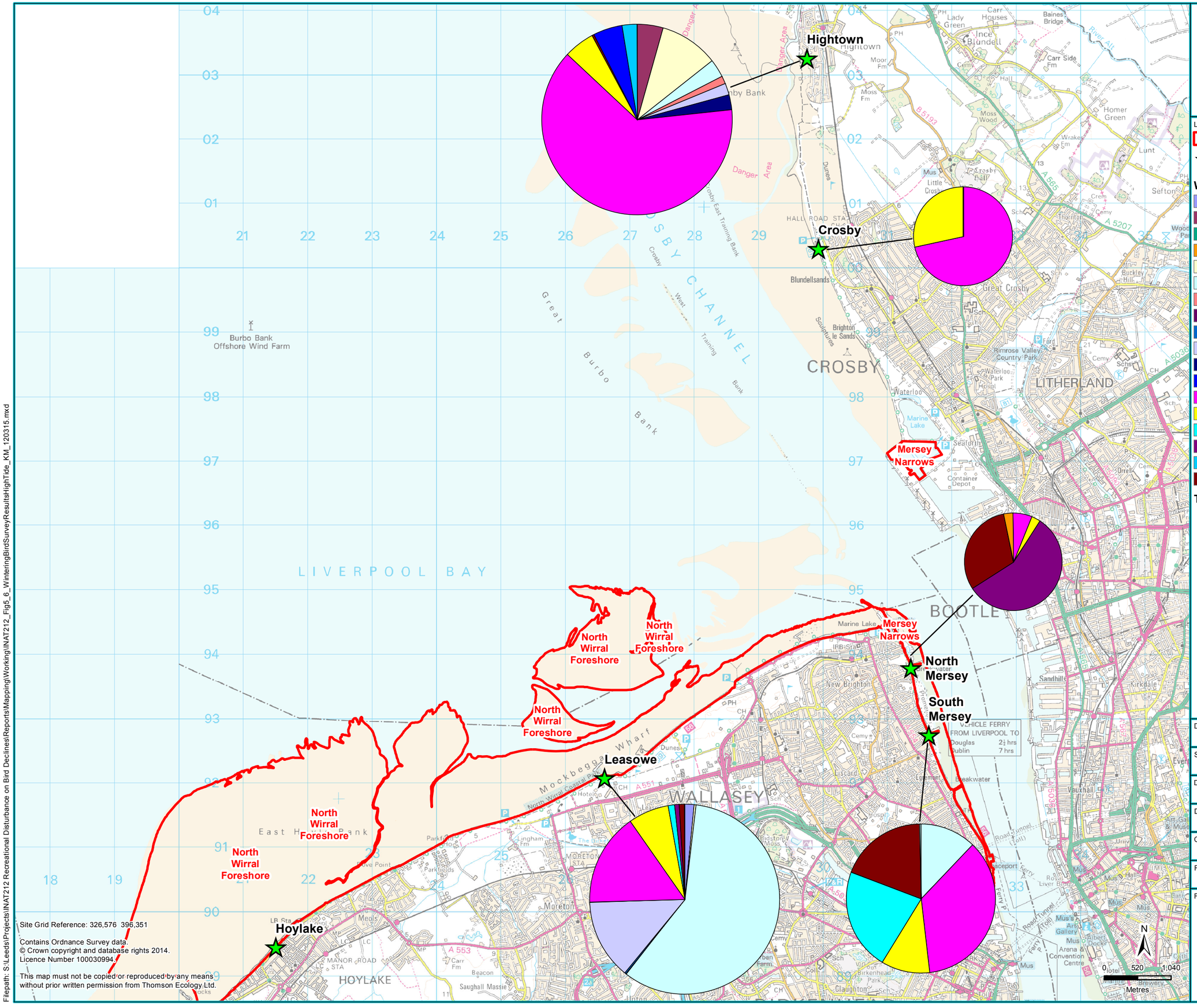
5.9.4 There were 22 WeBS species recorded in total and the proportions of these found at each site are shown in Figures 5.6 and 5.7. The maximum numbers of MN and NWF qualifying SSSI/SPA species are shown for high and low tides at each site in Table 5.3. Other WeBS species maxima at high and low tide are shown in Appendix 3, Table 2.

5.9.5 Of the MN SSSI qualifying species, redshank were found in high numbers at Leasowe and Hightown. Turnstone were found in low numbers (<50) at four sites, and went unrecorded at Hoylake and Crosby. Cormorants were found in ones or twos at most sites, with a large low tide roost at Hoylake (660 in January).

5.9.6 Of the NWF SSSI qualifying species, bar-tailed godwit were only recorded at Crosby, Hightown and Leasowe (Table 5.3). The highest count was 600 at Crosby in February during low tide (Table 5.3). Dunlin were found at all sites, with the highest numbers at Hoylake (4000 at low tide) and Leasowe (2600 at the high tide roost). Knot were not recorded at North or South Mersey. Thousands of knot were however recorded at low tide at Hoylake (2000), Leasowe (7000) and Hightown (6000). Large numbers of some species of qualifying waders were seen at some sites on occasion, but were not included in the counts as they were without the 500m survey area (e.g. at Hoylake, Leasowe and Hightown (pers. obs.).

5.9.7 The total area of the three standard bands over the six sites was 1ha for 0-50m, 5ha for 51-200m, and 33ha for 201-500m. The total number of birds in each band was 2000 (0-50m), 4000 (51-200m) and 48000 (201-500m). The density of birds therefore in each band was 7700 birds/ha (0-50m), 900 birds/ha (51-200m) and 1500 birds/ha (201-500m).

5.9.8 Of the SSSI qualifying species, redshank and turnstone had their highest densities in the 0-50m band. Dunlin, cormorant, knot and bar-tailed godwit had their highest densities in the 201-500m band.



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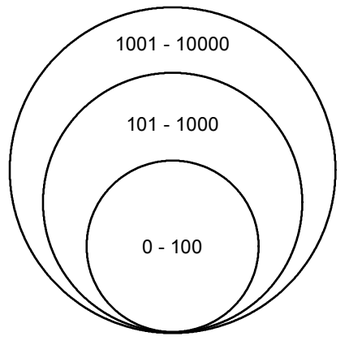
Legend

- SSSI Boundaries
- Vantage Point

WeBS species

- Bar-tailed Godwit
- Black-tailed Godwit
- Common scoter
- Cormorant
- Curlew
- Dunlin
- Golden plover
- Greenshank
- Grey plover
- Knot
- Lapwing
- Mallard
- Oystercatcher
- Redshank
- Ringed plover
- Sanderling
- Shelduck
- Turnstone

Total Number of Birds Seen



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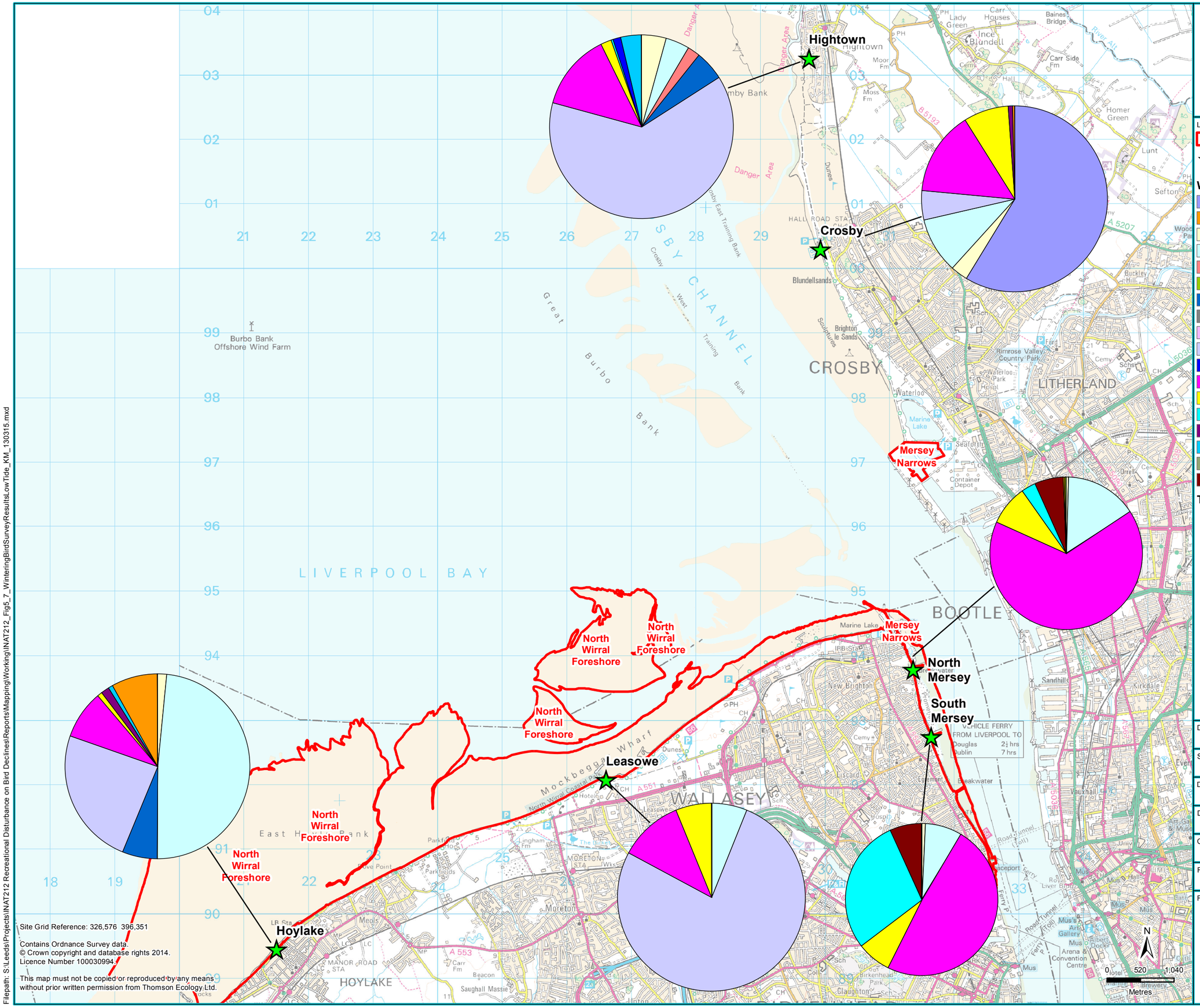
Date: 12/03/2015	Date: 12/03/2015
Client	Natural England
Figure Number	5.6

Figure Title

Maximum Count of WeBS Species at all Sites at High Tide

N

0 520 1,040 Metres



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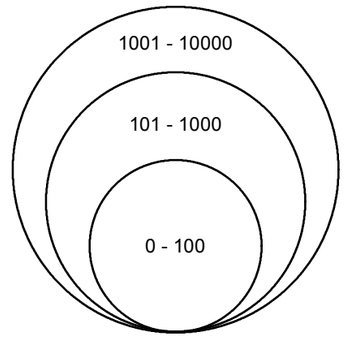
Legend

- SSSI Boundaries
- Vantage Point

WeBS species

- Bar-tailed Godwit
- Cormorant
- Curlew
- Dunlin
- Golden plover
- Great crested grebe
- Grey plover
- Greylag
- Heron
- Knot
- Mallard
- Oystercatcher
- Redshank
- Ringed plover
- Sanderling
- Shelduck
- Snipe
- Turnstone

Total Number of Birds Seen



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Scale at A3	1:55,000
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Date: 13/03/2015	Date: 13/03/2015
Client	Natural England
Figure Number	5.7

Figure Title

Maximum Count of WeBS Species at all Sites at Low Tide

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Table 5.3: Maximum high and low tide counts for MN and NWF SPA/SSSI qualifying species.

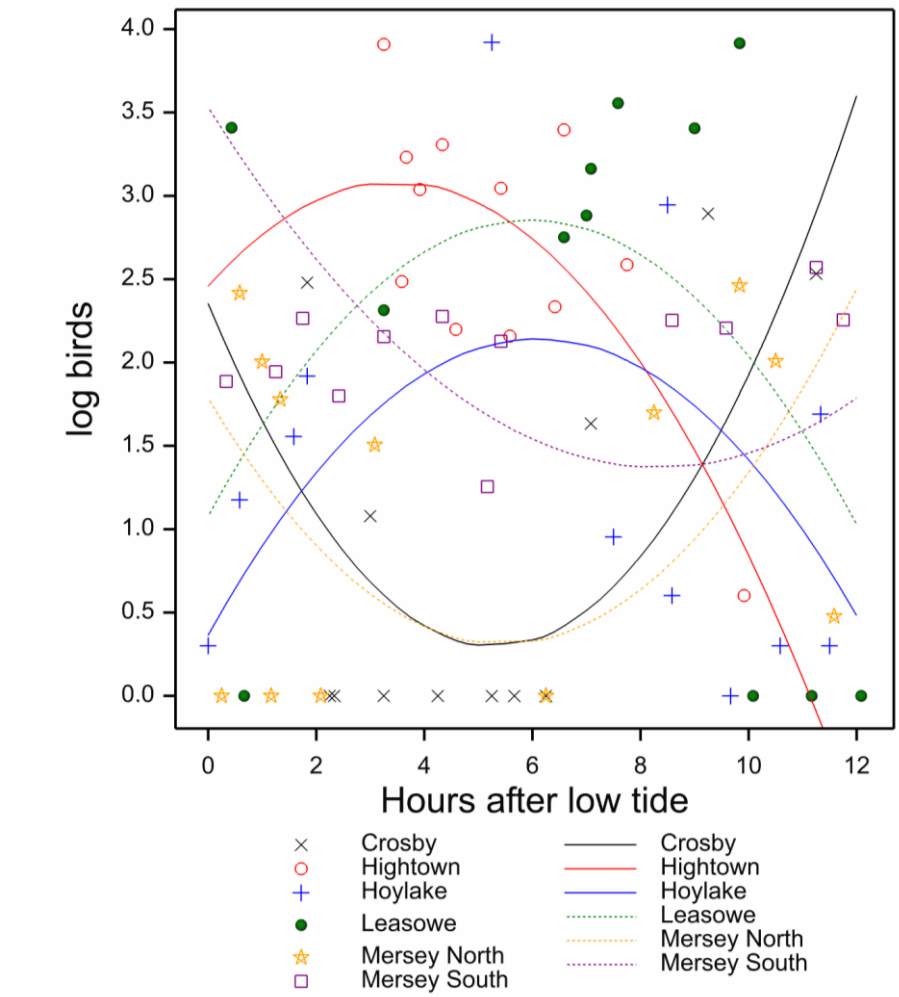
Species	SSSI	Tide	CR	HI	HO	LE	NM	SM	Total maxima
Redshank	MN	High	12	180	0	301	1	26	520
		Low	80	200	80	550	28	30	968
Turnstone	MN	High	0	12	0	33	10	46	101
		Low	0	0	0	1	20	27	48
Cormorant	MN	High	0	2	0	2	1	1	6
		Low	1	3	660	1	1	0	666
Bar-tailed godwit	NWF	High	0	1	0	70	0	0	71
		Low	600	12	0	0	0	0	612
Dunlin	NWF	High	0	100	0	2600	0	30	2730
		Low	100	400	4000	550	50	32	5132
Knot	NWF	High	0	70	600	600	0	0	1270
		Low	50	6000	2000	7000	0	0	15050

Key: MN = Mersey Narrows; NWF = North Wirral Foreshore; CR = Crosby; HI = Hightown, HO = Hoylake; LE = Leasowe; NM = North Mersey; SM = South Mersey;

5.9.9 To investigate relationships between wader numbers and other factors, a model was fitted to the log-transformed total number of waders. As waders tended to have higher numbers than the other groups, the model was very similar if it is fitted to all birds. This parametric model was considered to be more informative than a non-parametric analysis.

5.9.10 There was a highly significant interaction between time after low tide (quadratic model) and site ($F=4.83$ with 10 and 43 d.f., $P<0.001$) (Figure 5.8). Crosby and North Mersey appeared to have their highest numbers at low tide, whereas Hightown and Leasowe had their highest numbers at high tide, which accords with the latter two sites' significant high tide roosts. The model also indicated that wader numbers differed significantly between sites ($F=7.25$ with 5 and 61 d.f., $P<0.001$) and month ($F=20.22$ with 2 and 61 d.f., $P<0.001$). January had the highest number of WeBs birds, with 32212 birds counted during the surveys, February had 19917 birds, and December the lowest count with only 1539 birds.

Figure 5.8: The relationship between wader numbers (log scale) and time after low tide at each site.



5.10 Spot Count Results

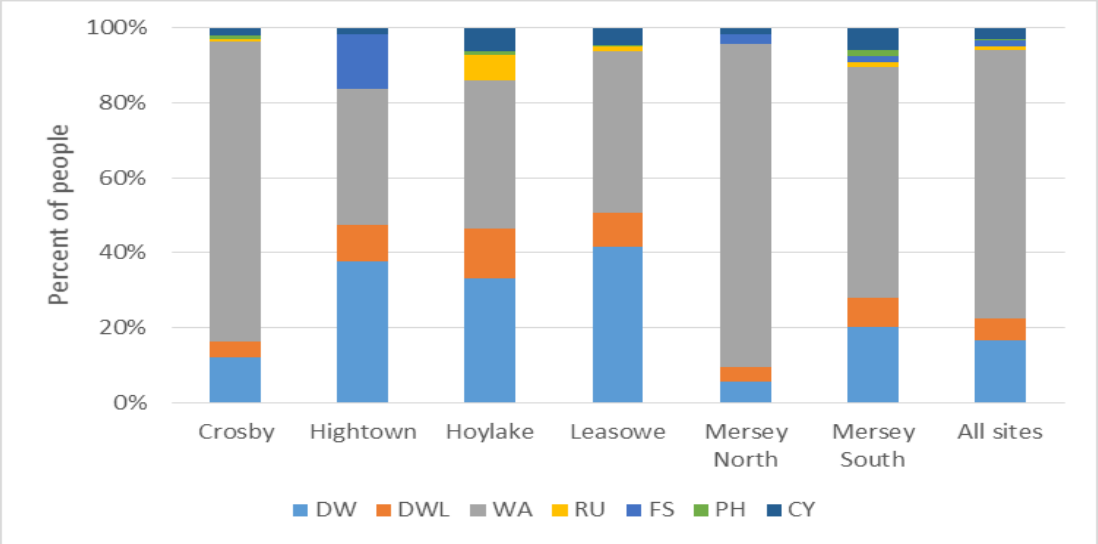
5.10.1 A total of 72 hours of fieldwork was undertaken recording visitor numbers. The spot counts recorded a total of 3036 people and 522 dogs using the six sites (Table 5.4). Table 5.4 below shows the total number of people using each site. North Mersey stands out in terms of the numbers of people recorded. Hightown recorded the fewest visitors (Table 5.4). The mean hourly rate of people visiting the sites overall was 43 people/hour, with North Mersey the highest at 103 people/hour, and Hightown the lowest at five people/hour (Table 5.4). Leasowe had the highest number of dogs (189; Table 5.4), and also the highest number of dogs per person ration (0.40 dogs/person).

Table 5.4: Number of people, mean number of visitors per hour and total number of dogs at each site.

Site	Total number of people	Mean number of visitors per hour	Total dogs
Crosby	803	67	89
Hightown	63	5	22
Hoylake	215	18	78
Leasowe	467	39	189
North Mersey	1237	103	87
South Mersey	281	23	57
All sites	3066	43	522

5.10.2 Figure 5.9 shows the number of people recorded participating in each recreational activity at each site. Walkers outnumbered dog walkers by over three to one. The main activities noted were walking (71% of all people), dog walking (off lead) (16% of all people), and dog walking (off lead) (6% of all people) (Figure 5.9). Walking was the main activity at Crosby, North Mersey and South Mersey, whereas dog walking (on and off lead) predominated at Hightown, Hoylake and Leasowe (Figure 5.9).

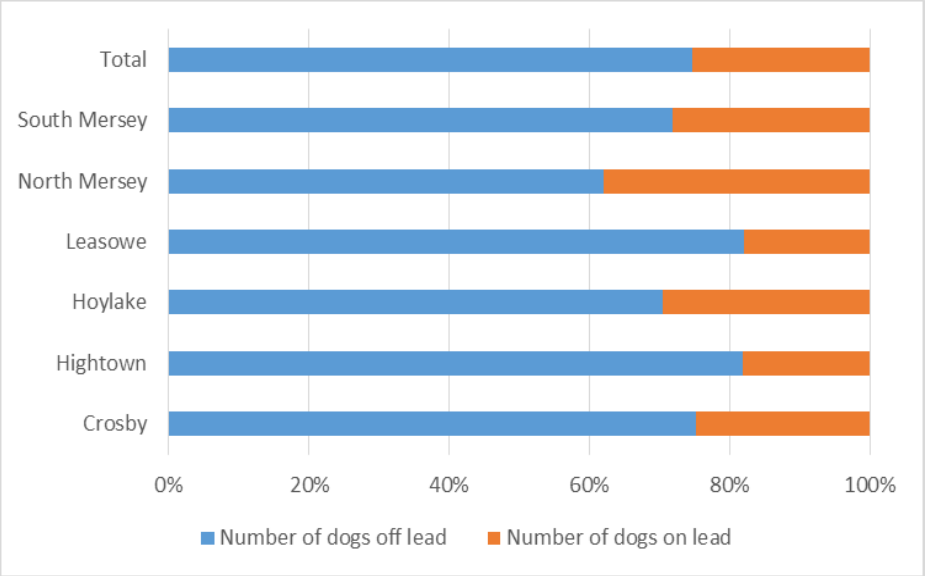
Figure 5.9: Percentage of Recreational Activities at each site.



Key: DW Dog walker (off lead); DWL Dog walker (on lead); WA Walker; RU Runner; FS Fisherman; PH Photographer; Cy Cyclist.

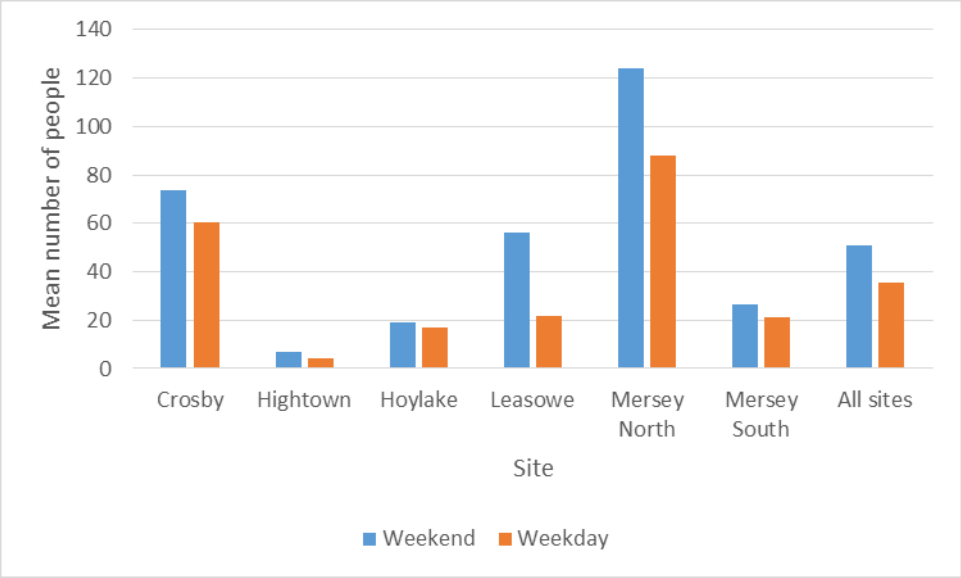
5.10.3 Figure 5.10 shows the percentage of dogs off the lead, which is significantly different between sites (χ^2 = 14.05 with 5 d.f., P=0.015). Leasowe and Hightown had the highest percentage of dogs off lead (82%), and North Mersey the lowest percentage (62%).

Figure 5.10: The percentage of dogs on and off lead at each site.



5.10.4 The mean number of people per survey visit (i.e. total of the four spot counts) is shown in Figure 5.11. The mean number of people is greater on weekends (F=12.61 with 1 and 278 d.f., P<0.001), but this effect does not significantly differ between sites (F=1.59 with 5 and 273 d.f., P=0.163).

Figure 5.11: The mean number of people per hour of survey at weekends and weekdays.



5.10.5 Figure 5.12 shows the relative usage of the intertidal and promenade/shore areas. This is based on all data, including those observations at high tide where there may be little intertidal zone exposed. 813 people used the intertidal zone (27%), compared to 2253 people on the promenade and shore (73%, Figure 5.12). The site with proportionately most visitors to the intertidal zone was Hoylake (55%). No visitors to the intertidal zone were recorded at Hightown, as there was no intertidal access at this site. Hightown was also the only site with a true shore, the other sites being covered by the sea up to the promenade at high tide. Dog walking (off lead) was a predominantly intertidal activity, whereas dog walking (on lead) was promenade or shore based (Figure 5.13).

Figure 5.12: The relative usage of intertidal and promenade/shore areas at each site.

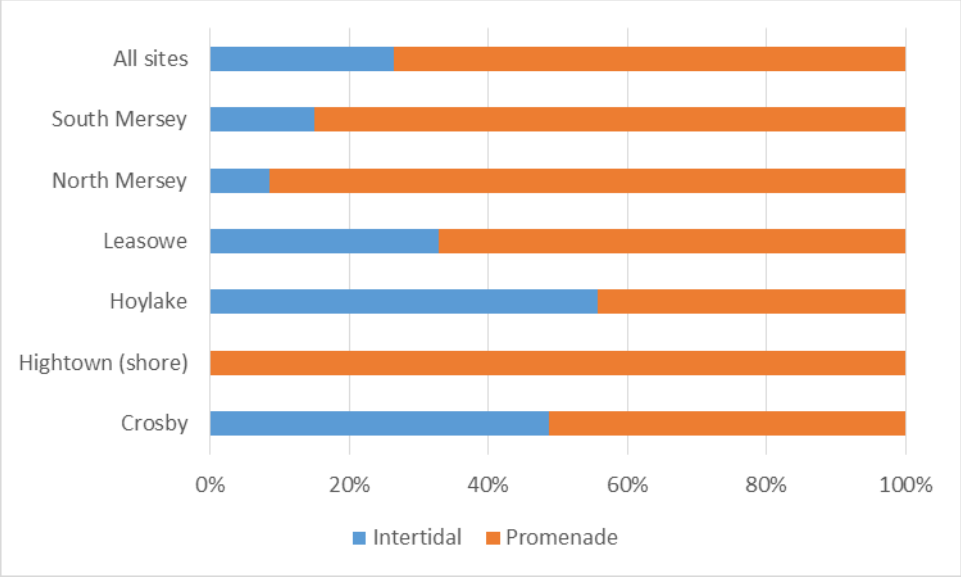
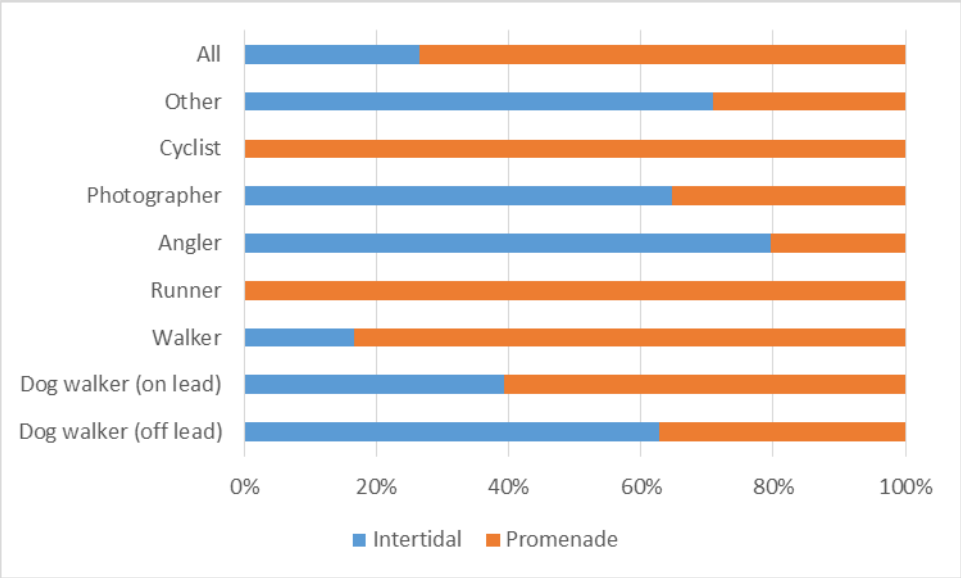
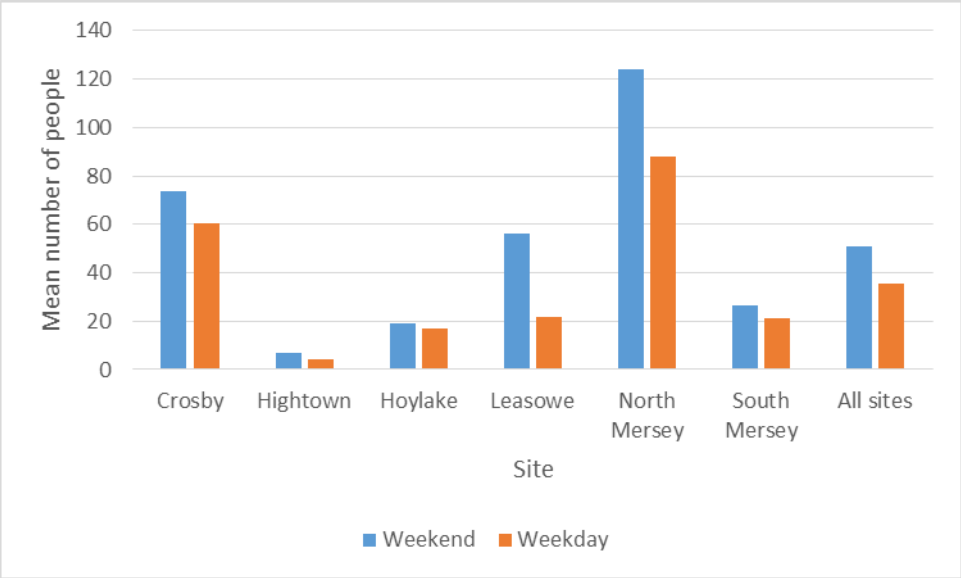


Figure 5.13: The percentage of recreational activities in the intertidal and promenade/shore areas at each site.



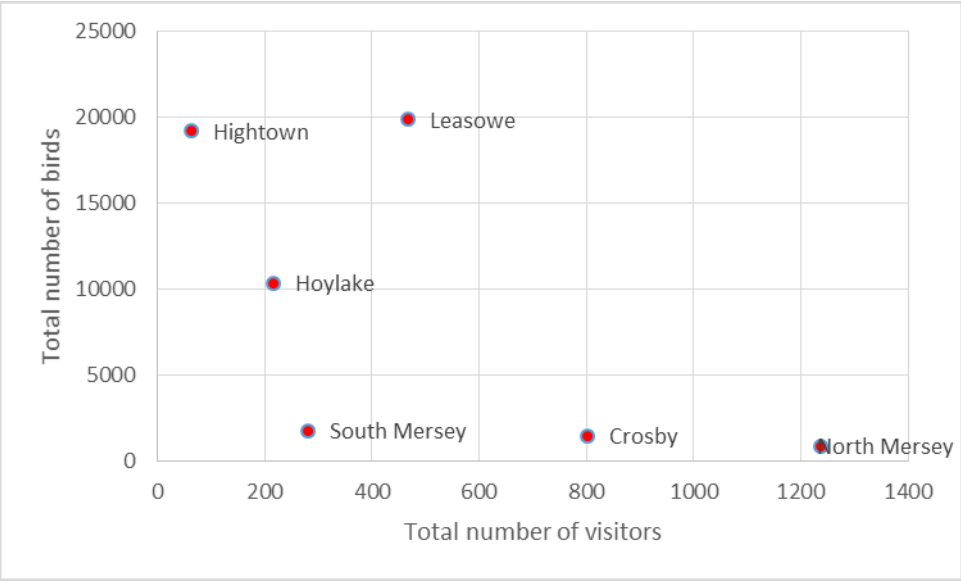
5.10.6 Figure 5.14 shows the monthly visitor spot count totals for each site. Numbers were highest in February for all sites apart from Hightown.

Figure 5.14: The total number of people recorded on spot counts by site and month.



5.10.7 The correlation between the total number of people recorded at each site and the total number of birds recorded is significant (Spearman's rank correlation coefficient -0.657, P=0.034; n=6; Figure 5.15). However, the sample size is very small (a sample size of at least 15 is recommended (RGS, 2015)), and further data and/or analysis is needed.

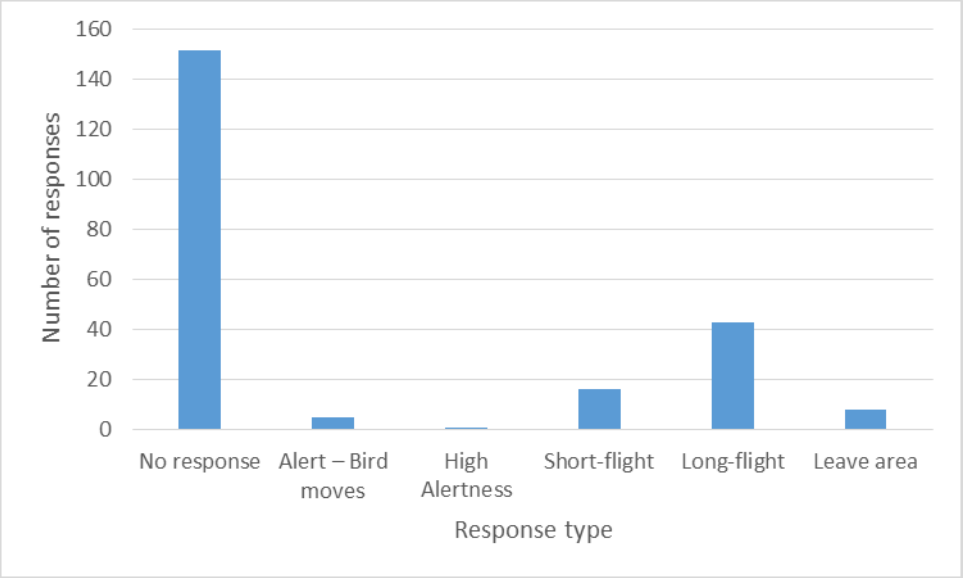
Figure 5.15: The total number of birds related to the total number of people at each site.



5.11 Potential Disturbance Events Results

5.11.1 As previously noted, PDE were recorded only from the intertidal zone at five of the sites, or the shore (at Hightown). There were 225 PDE recorded, of which 73 evoked a response (33%) (Figure 5.16). The hourly rate of PDE during the survey periods was 3.12/hour. There was only a single observation for 'high alertness' and none at all for "raises head", so the three alertness categories were combined into one in subsequent tables. Similarly, there were only three disturbance activities (DW, DWL and WA) with sufficient numbers of observations to be analysed, and only three bird species (turnstone, redshank (both MN SSSI qualifying species) and oystercatcher) which could be separately analysed.

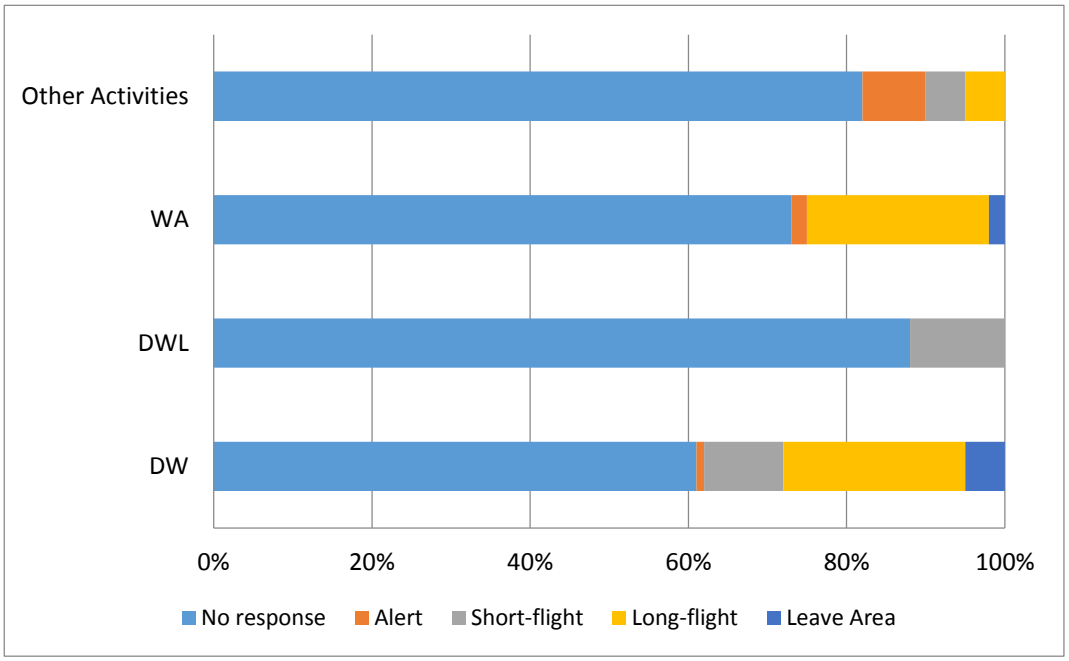
Figure 5.16: The number of PDE by response type. The code 'Alert-raises head' (A) was not recorded.



5.11.2 Figure 5.17 splits these response types by the activity causing the disturbance; dog walkers without leads have the highest percentage of active responses (see Photographs 3 & 4 on Figure 5.5). Dogs being walked on leads appear to cause less disturbance, although the sample size is small. A chi-squared test suggests that these differences are significant (χ^2= 29.29 with 12 d.f., P=0.004), however this test should be treated with caution, since it does not allow for the lack of independence between events created by the different sites and different visits, plus there are some cells with small number of observations. A modelling approach would allow some of these variables to be quantified.

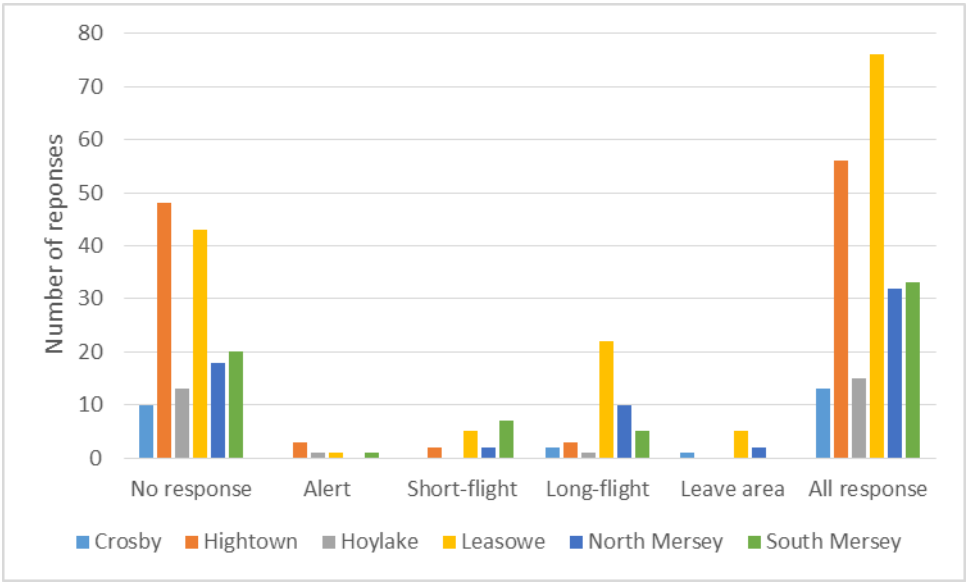
5.11.3 Other activities classed as PDE which occurred during the survey periods were angling (1 PDE), cycling (6), jet-skiing (1) running (2), and vehicles (1) which elicited no visible responses. Bait-digging (4 PDE, 1 long flight response), bird-watching (1 PDE, 1 alert response), metal-detecting (3 PDE, 1 alert, 1 short-flight response), photography (3 PDE, 1 high-alert response). This totalled 22 "other activities" PDE, with just four responses (18%). The response rates of all the "other activities" was less than that of the other PDE (dog walking and walking).

Figure 5.17: Bird responses per activity (grouped across all sites and all species).



Key: DW = dog walker (off lead), DWL = dog walker (on lead), WA = walker; Other Activities = angling, cycling, jet-skiing, running, vehicles, bait-digging, bird-watching, metal-detecting and photography.

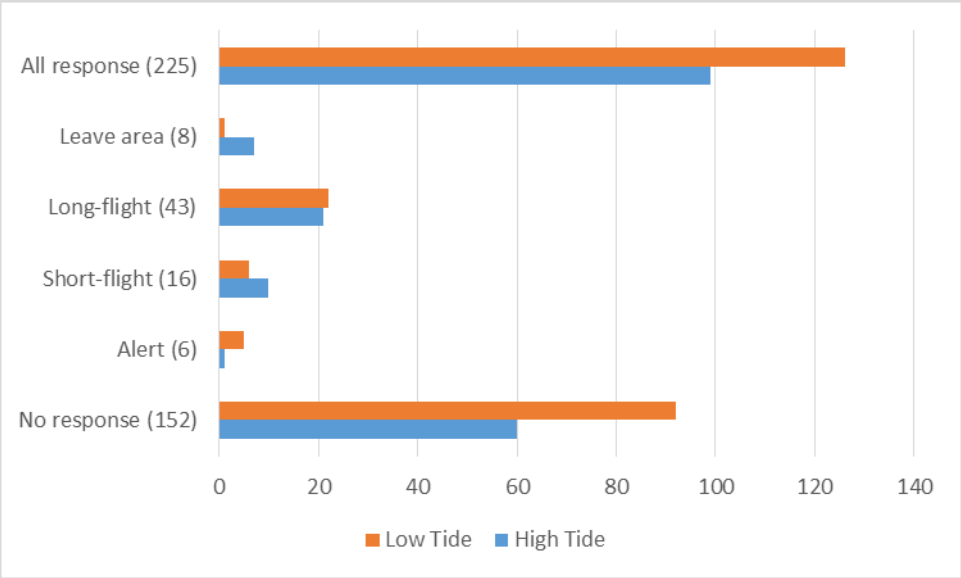
Figure 5.18: The number of PDE by response type and site.



5.11.4 Figure 5.18 shows site differences in responses, which are significant, subject to the caveats mentioned earlier (χ^2= 42.70 with 20 d.f., P = 0.002). The site with the most PDE was Leasowe (Figure 5.18) and the site with the most responses was also Leasowe (Figure 5.18). The sites with the least PDE and least responses were Crosby and Hoylake (which was related to the lack of birds within 200m of any PDE). The only site where PDE occurred on the shore was

Hightown, all other PDE being in the intertidal zone. Hightown appeared to have a high number of "no visible response" compared to "responses" (Figure 5.18), but this was a result of the very few birds (one or two redshanks and several mallards by and on a tidal channel) within the 200m zone being apparently habituated to walkers and dog walkers. Leasowe and North Mersey had proportionately more long-flight responses than might be expected. At North Mersey many waders fed close to the promenade on a muddy substrata, where PDE were frequent as dog walkers used this area at low tide.

Figure 5.19: Comparison of low tide and high tide PDE responses.



5.11.5 High tide and low tide PDE were nearly evenly divided (Figure 5.19), but very few of the high tide PDE resulted in disturbance to high tide roosts. Rather, high tide related to the amount of mudflat left uncovered at the start of the survey period (less than 100m of mudflat), so that PDE could still occur on the intertidal zone. At Leasowe, North and South Mersey, high tide roosts were found on breakwaters, but these were inaccessible at high tide. On a falling tide these became progressively more accessible. At Crosby there was no high tide roost, and at Hightown the roost was on the far side of the River Alt, and inaccessible to the general public. At Hoylake, the high tide roost was outwith the vantage point survey area.

5.11.6 The correlation between the total number of people recorded within 200m and the number of disturbance events is significant (Spearman's rank correlation coefficient = 0.886, P=0.004). However, if the number of people from the spot counts is used instead the correlation is negative and almost significant (Spearman's rank correlation coefficient =-0.543, P=0.060) because Crosby and North Mersey have high numbers of visitors. The number of people from the spot counts also shows a negative correlation with the percentage of PDE showing no visible response (Spearman's rank correlation coefficient =-0.771, P=0.015).

5.11.7 Species (those with more than 10 PDE recorded) differences are shown in Figure 5.20. Whilst there are some differences in the percentages showing different responses, a chi-squared test suggests that these are not significant (χ^2= 17.86 with 12 d.f., P = 0.120), Other species with less than ten PDE included bar-tailed godwit, curlew, dunlin, knot and ringed plover (Figure

5.21). As the sample size for each of these species was very small, these data could not be individually analysed.

Figure 5.20: Number of events by response type and species.

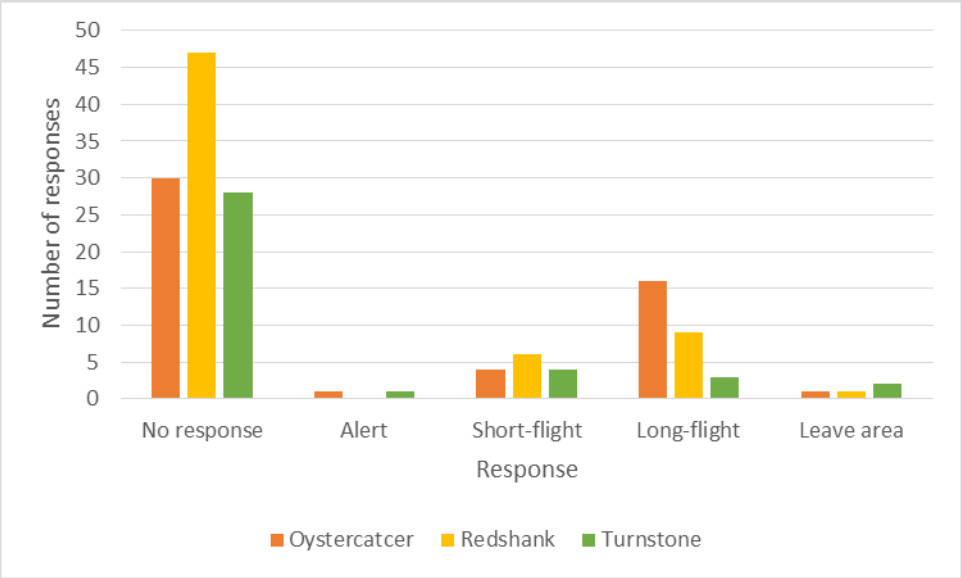


Figure 5.21: Species with less than ten PDE recorded and their responses.

5.11.8 Table 5.5 shows average distances for each response type. After simplifying this into just 'no visible response' and active responses there is no significant difference in distances (Mann-Whitney U=5102.5, P=0.229, n.s.).

Table 5.5: The mean, median and range of distances for each response type.

Response	N	Mean (m)	Standard error	Median (m)	Range (m)
No visible response	152	58.8	1.9	50	20-200
Alert	6	73.3	18.7	60	20-150
Short-flight	16	50.6	4.1	50	10-150
Long-flight	43	67.3	4.9	50	20-150
Leave area	8	65.0	13.0	50	30-150

5.11.9 However, a problem with the Mann-Whitney analysis is that c.70% of distances were recorded as exactly 50m, which means that either a parametric or non-parametric analysis will be unsatisfactory. Instead Table 5.6 subdivides events into whether the distance is 50m or less, or greater than 50m. A Fisher's exact test suggests that differences are significant (P=0.016), since active responses seem more common for distances over 50m, i.e. the PDE is further away from the birds.

Table 5.6: Presence of a response in relation to whether the distance between the activity and the birds is over 50m.

Response	<=50m		>50m	
	N	%	n	%
no visible response	123	71.9	29	53.7
active response	48	28.1	25	46.3
All responses	171	100.0	54	100.0

5.12 Overview of Results

5.12.1 High numbers of birds were recorded at Hightown, Hoylake and Leasowe. SSSI/SPA qualifying species were found at all sites, but were least numerous at North and South Mersey. As the mudflats extended out for over 2km at low tide within the NWF SSSI, many birds went unrecorded.

5.12.2 High tide roosts were found at Hightown (inaccessible to the public), North and South Mersey, and Leasowe. The latter was subject to some disturbance when the tide began to fall and dog walkers could gain access. However, low tide, when dog walkers accessed the mudflats, appeared to be the period when most disturbance occurred.

5.12.3 Leasowe was particularly prone to disturbance, due to a high number of dog walkers accessing the intertidal zone, and the proximity and accessibility of the high tide roost on a falling tide to dog walkers.

5.12.4 Most PDE did not result in a visible response (67% of all PDE). PDE were only recorded from the intertidal zone at five sites, or the shore (at Hightown). The most frequent response was long-flight. Dogs (off leads) elicited the most responses. There were no significant differences in responses between redshank, oystercatcher or turnstone, the three species with sufficient data to be analysed.

5.12.5 Redshank and turnstone were predominantly found in the 0-50m distance band i.e. close to the shore, so would be more likely to be subject to PDE. The other qualifying species (dunlin, cormorant, knot and bar-tailed godwit) were found beyond 200m, and so were probably less likely to be disturbed.

5.13 Discussion

5.14 Factors Influencing Bird Diversity and Distribution

5.14.1 Bird numbers and densities varied widely across each site, depending on the state of the tide. At Crosby, very few waders were seen at high tide due to the lack of a roost, yet this was the site where the most bar-tailed godwit were recorded at low tide. The extent of the mudflats at low tide at the MN and NWF (see Figure 2.1) meant that many birds were beyond the 500m focal area, as they followed the tide's ebb and flow (black-tailed godwit, dunlin and avocet are tide followers, for instance (Nehls & Tiedemann, 1993). Other species (bar-tailed godwit, grey plover and redshank) are dispersed foragers' or 'preferred area foragers' (Nehls & Tiedemann, 1993; Tiedemann & Nehls, 1997; Granadeiro *et al.*, 2006). So even if waders were present in good numbers at a site, the restrictions inherent in the methodology meant that many waterbirds were not counted or considered in the study, as they were outwith the 500m focal area. At Hoylake, for instance, thousands of waders could be seen distantly, but were not recorded as part of the survey (pers. obs.). There are also problems with counting birds accurately at low tide, which may bias any survey results (Burton *et al.*, 2004; Dias *et al.*, 2006).

5.14.2 The distribution of birds at low tide in an estuary is governed by many factors: tide cycles (Burger *et al.*, 1977); prey density (Goss-Custard, 1970; Zwarts, 1981; Roukema, 1984; Meire *et al.*, 1991; Kalejta & Hockey,1994; Yates *et al.*,1993 and Zwarts & Wanink,1993; seasonal changes in prey choice (Niels & Tiedemann, 1993), foraging mode (Kaletja & Hockey (1994); food intake rates (as reviewed by Goss-Custard,1985); digestive constraints (van Gils & Piersma, 2004); inter-specific and intra-specific competition (Piersma *et al.*, 1993); the presence of drainage channels (Leopold *et al.*, 1993; Lourenco *et al.*, 2005); predation risk (Cresswell, 1994; Hilton *et al.*, 1999; Lank & Ydenberg, 2003; Whitfield, 2003; Dekker & Ydenberg, 2004), sediment drainage (Rosa *et al.*, 2007) and shoal morphology (Vanermen *et al.*, 2006) (which determines the area of intertidal habitat that is available to waders). As these change over time and space, the numbers and distribution of the waders present will also change, and thus it may be difficult to attribute any changes over time to a specific factor.

5.15 Factors Influencing Bird Density

5.15.1 Ross-Smith *et al.* (2013) suggested that key WeBS species were declining in the MN and NWF SPA (= MN and NWF SSSIs). However, further examination of their data reveals that only bar-tailed godwit and turnstone have shown declines of more than 50% in the MN and NWF SPA, most other wader species showing lesser declines or even increases (Table 3.1.ii in Ross-Smith *et al.*, 2013). Bar-tailed godwit declined at Hoylake, whilst turnstone declined at Leasowe. Bar-tailed godwit declined from c350 birds in the 1990s to c50 birds in the early 2000s, so it has not been numerous in recent years on the western side of the Mersey (there are good numbers at Seaforth, part of the MN SSSI (which was not surveyed in this study) on the eastern side of the Mersey Estuary (Fig. 2.1)). Ross-Smith *et al.* (2013) additionally stated that for the species which had increased, some increases could be attributed to redistribution from other sites.

5.15.2 It may be that few PDE were recorded at Crosby and Hoylake in the intertidal zone because disturbance levels are currently so high that birds do not habitually use the area. Zoning these sites, so that people cannot access certain areas, or comparing nocturnal and diurnal usage may be one method of ascertaining this.

5.15.3 Kirby *et al.* (1993) studied PDE at wader roosts on the Dee Estuary, because of concern at the levels of disturbance. They found that that wader species which had previously declined were increasing, even though the level of beach disturbance had increased significantly. Indeed, the numbers of most waders were greater when PDE rates were high (p. 58 in Kirby *et al.*, 1993).

5.15.4 Waders also differ in their fidelity to roost sites. While most species show strong fidelity to high water roosts, knots, bar-tailed godwits and dunlins wintering in Scotland were found to be highly mobile, showing poor fidelity to roost sites (Rehfisch *et al.*, 2003). Declines in bar-tailed godwits in the MN and NWF SSSI may therefore have been simply because they relocated to another roost site. Turnstone similarly have been found to remain in the MN area, rather than flying to roost at Leasowe (Clee & Cross, 2000), so again changes in high tide roost preference may account for declines reported in the Leasowe area. Rehfisch *et al.* (2003) attributed changes to a combination of food distribution, predation risk and disturbance. For MN and NWF SSSIs, the reported declines cannot be attributed to any specific cause at present.

5.15.5 At Hightown, golden plover, lapwing, knot and turnstone showed recorded declines by 50% or more, but other species including oystercatcher, grey plover, sanderling, dunlin and bar-tailed godwit did not (Table 3.1.ii in Ross-Smith *et al.*, 2013). Again, if disturbance is a cause, then one might expect all wader species to be affected, not just some. Body mass has been related to response distance (Liley *et al.,* 2010), but in this case, one would expect the species with a mid-range body mass (golden plover, lapwing, knot and turnstone: 120-230g (BTO, 2015) to be less affected than the larger species (oystercatcher, grey plover, and bar-tailed godwit: 240-540g (BTO, 2015)). Wader species also have different responses to high tide roost disturbance and roost use is often highly variable (Peters & Otis, 2006).

5.15.6 Frequent disturbance may sometimes force waders to abandon traditional high-tide roosts. This was demonstrated in the Dee estuary (Mitchell *et al.*, 1988) where bar-tailed godwits declined by 99%, knots by 79% and dunlins by 81% after disturbance. In this case the birds continued to use traditional feeding areas. This behavioural change involved higher energy costs, because the

birds had to fly an extra 40km during each tidal cycle. Heavy disturbance can also lead to a total departure from feeding sites.

5.16 Spot Counts

5.16.1 The spot counts documented the relative visitor and recreation activities present (albeit some rare events may not have been noted), and enabled the surveyor to concentrate on recording PDE, rather than being distracted by the need to constantly monitor visitors (for example at the Solent (Liley *et al.*, 2010) where one site (Emsworth Promenade) had very high visitor numbers of visitors and so it was not possible to accurately count people and birds simultaneously. The popularity of the MN and NWF coast (and Hightown/Crosby) was shown by the high visitor rate of 43 people/hour compared to e.g. 15.2 people/hour on Teesmouth (Linaker, 2013); 20.4 people/hour at the Solent (Liley *et al.*, 2011) and 5.8 people/hour at the North Kent Marshes (Liley & Fearnley, 2011); the latter numbers all derived from actual counts. The spot count results were in marked opposition to the visitor questionnaires, where dog walking was the main recreational activity recorded (63% dog walkers recorded in the questionnaires compared to 22% dog walkers recorded in the spot counts). The spot count results were heavily influenced by the preponderance of walkers at Crosby and North Mersey.

5.16.2 Depending on the coastal area's characteristics, the relative occurrence of recreational activities is very similar at most coastal sites (Ravenscroft, 2012). Walking (with or without dogs) is the dominant activity. Dog walking usually predominates at coastal sites (e.g. 41% of activity at the Solent (Liley *et al.*, 2011); 52% of activity at Teesmouth (Linaker, 2013); 47% of activity at Poole Harbour (Liley & Fearnley, 2011). Especially where there are promenades walking makes up a higher proportion of recreational activities (e.g. 65% of activity at Teesside (Simpson, 2012)). In some areas, activities which were rarely recorded in the MN and NWF SSSIs, such as bait-digging (23% of activity at Teesmouth (Linaker, 2013)) or birdwatching may be popular.

5.16.3 Overall weekend visitor rates were higher at weekends, but this effect did not manifest itself at individual sites, perhaps suggesting that at any particular site surveys at weekend or on weekdays would give the same results.

5.16.4 The intertidal zone was popular, especially at Crosby and Hoylake. Ease of access at these sites, and the attraction of the art installation at Crosby, meant that the intertidal zone received many visitors, and this can be viewed as directly displacing any waders that would otherwise use the site. Dog walking was also very popular on the intertidal zone, where most dogs were off lead and allowed to run free (81% of all dogs). Overall intertidal use in this study comprised 27% of the total visits, compared to, for instance, 10% at the Solent (Liley *et al.*, 2011) and 23% at the North Kent Marshes (Liley & Fearnley, 2011).

5.17 Potential Disturbance Events

5.17.1 The MN and NWF SSSI, and Hightown to Crosby, were surveyed during winter 2014-2015. The locations chosen to be surveyed were based on the expectation that Potential Disturbance Events (PDE) and bird species of interest (SSSI qualifying species) would show some degree of interaction. In the event, 225 PDE were recorded, spread over the six survey sites, with 33% of these causing a behavioural response, and of these latter nearly all causing a flight reaction. The "alert" (A & B) and "high-alert" categories (C) were rarely recorded, perhaps because of the

distances involved, and the difficulty in assessing whether any behavioural action was indeed caused by a PDE, or was just part of natural foraging behaviour, but more often because behavioural responses escalated to flight responses as the PDE approached more closely. Activities on the sea were rare in the vicinity of birds, and the only sea-borne PDE noted were two jet-skis that approached within 100m of oystercatchers. No reaction was noted in this instance however. "Minor" activities, such as bait-digging and bird-watching were rarely noted, and these caused less responses than the "major" activities of dog walking and walking.

5.17.2 The methodology used in determining PDE may influence the results, for instance Linaker (2013) on Teesmouth indicated that all events within presence of birds at a site constituted disturbance, but gave no limit to the PDE zone. Her results may not therefore be directly comparable with other studies that give a defined limit to the PDE zone. Simpson (2012) also mentioned that PDE occurred on the promenades adjacent to the Teesside EMS, but gave no further details as to what extent and as to how these were measured.

5.17.3 The rates of PDE causing disturbance (any behavioural response) varies from study to study, with rates encompassing 7% (Simpson, 2012); 13% (Cox & Ravenscroft, 2009); 17% (Liley *et al.,* 2011); 19% (Ravenscroft *et al.,* 2007); 26% (Liley & Fearnley, 2011); 28% (Linaker, 2013) and 33% (this study). An aspect worth further study is how few PDE appear to evoke a response, and this may be a result of habituation (see Photographs 3 & 4, Figure 5.5) (Fitzpatrick & Bouchez, 1998).

5.17.4 In general the proportion of disturbance responses caused by any activity is a reflection of relative occurrence of that activity (Ravenscroft, 2012). So where dog walkers are more frequent than walkers, then they will cause most incidents, but the converse is also true. In this study dog walkers and walkers caused the most disturbance, as would be expected from their frequency. Dogs off leads caused the most disturbance in this study, but this result should be treated with caution due to statistical constraints inherent in the data. Dog walkers (off lead) and walkers would appear to cause the most extreme responses (long-flight and leave area), but this may be a function of these being the predominant PDE, and so this would be expected. Ravenscroft (2012) found that there were no significant differences between walkers and dog walkers, and dog walkers with dogs on leads and dogs off leads, perhaps contrary to expectations. The presence of humans was the over-riding factor, so lessening the activity rate of the prevalent activity would in theory lead to a reduction of disturbance. Liley *et al.* (2011) and Liley & Fearnley (2011) found that high numbers of visitors did not necessarily result in high disturbance levels.

5.17.5 The area where PDE occur is also important, the intertidal area usually being the zone where most PDE result in a response (Liley *et al* ., 2011; Liley & Fearnley, 2011). The intertidal was the zone where most disturbance occurred in this study, events on the promenades not being classified as PDE. Liley *et al* . (2011) found that 17% of 4604 PDE resulted in disturbance, but that 41% of activities on the intertidal resulted in disturbance, compared to only 12% of shore-based activities. Liley & Fearnley (2011) found that 59% of intertidal PDE caused disturbance compared to 23% of shore-based activities. However, Liley & Fearnley (2011) also found that the effect of zone is reduced with distance, and there is no significant difference between activities taking place on the water and on the intertidal, once distance is included.

5.17.6 Liley & Fearnley (2011) found in their modelling that after controlling for distance, the presence of dogs, the number of dogs, the species of bird and tide were significant predictors of major flight occurring. In this study, only dog walkers (off leads) appeared to cause more disturbance than dog walkers (on leads) and walkers. The number of people within 200m of the birds was significantly correlated with the number of PDE, as would be expected. However the total number of visitors to a site showed a negative correlation with PDE, indicating that where visitors went (on the intertidal zone) and what activity they participated in (dog walkers (off leads) were more important. No species differences were found in this study, perhaps due to the small sample size.

5.17.7 Disturbance has been clearly shown to have an adverse impact on species of wintering waterfowl at other sites (Durell *et al.*, 2005; Goss-Custard *et al.*, 2006). West *et al.* (2002) modelled disturbance to oystercatchers on the Exe estuary and found that numerous small disturbances would be more damaging than fewer, larger disturbances. When the time and energy costs arising from disturbance were included, disturbance could be more damaging than permanent habitat loss. However, they also found that the current levels of disturbance at their site would not cause increased mortality. Beale & Monaghan (2004) stated that a distinction must be made between effects and impacts of disturbance. In this study disturbance occurred, but whether it had any population-level effect could not be quantified without further modelling.

6. Review of Current Management Practices

6.1 Introduction

6.1.1 This review aims to assess the effectiveness and efficiency of current management measures which address recreational pressures on the MN and NWF SSSIs, and the Crosby to Hightown coast. Suggested improvements to the mitigation measures that are currently being implemented are included. Future monitoring that would inform either recreational disturbance impacts or the effectiveness of management techniques is suggested.

6.1.2 As previously mentioned in Section 3, mitigation measures to reduce bird disturbance can include (Batey, 2013):

- Habitat management, including man-made bird roosts;
- Human access management, including buffer zones, zoning, path design and management; screening and dog control orders; and,
- Education including codes of conduct, signage, leaflets, visitor boards and enforcement.

The mitigation measures which are currently in place in the study area, and their efficacy, are discussed below.

6.2 Methodology

6.2.1 The literature review (Section 3) and recreational activities assessment (stakeholder questionnaires and public questionnaires) (Section 4) were analysed to determine stakeholder and public perception of current management measures.

6.3 Results

Literature Review

6.3.1 On the MN and NWF coast measures to manage vehicle and boat access and movement, and sporting activities are in place. None of these measures appear to be specifically aimed at reducing bird disturbance or modifying visitor behaviour. AA's and HRA's have been carried out of the Local Plans and Strategies, and recommendations made to address disturbance. Despite this visitors are actively encouraged to access the coastline, and there are numerous carparks, footpaths and access points available at most locations (WBC 2015). The only educative measure appears to be a few visitor boards and disturbance warnings placed at occasional access points.

6.3.2 On the Sefton Coast (Hightown and Crosby) the SCP (2008) aims to monitor and control disturbance. However, the mechanisms through which this could be done are unclear, and it is not known whether any measures which may be in place are enforced.

Stakeholder Questionnaires

6.3.3 The Hoylake Sailing Club respondent was unaware of any measure in place to minimise disturbance, and also did not see a need for any mitigation measures to be introduced to limit

any activities. Counter to this, the four respondents who were involved with birds (all WeBS counters) saw disturbance by dog walkers at the Hoylake high tide roost as a major issue, and wanted more done to alleviate this. Within the NWF SSSI, aerial disturbance and high tide roost disturbance were viewed as important issues. At Crosby and Hightown, no mitigation measures were known of, and no new measures were recommended (at Crosby it was "*highly unlikely anything can be done*" because of the Another Place installation, designed to specifically attract visitors to the site). In summary, most of the respondents were not aware of any mitigation measures, beyond volunteer dog wardens and signage, and official wardening and more signage were recommended as future initiatives.

On-site Public Questionnaires

6.3.4 A typical visitor to the MN and NWF SSSIs, and Hightown to Crosby, can be identified as a local middle-aged dog walker who frequently visits the site by themselves or with someone else, with their dog off the lead. These visitors are also the people most likely to cause PDE, and any resultant disturbance. These visitors could be considered the ones which require targeting in terms of education and awareness of disturbance issues.

6.3.5 The question was asked of interviewees "*How do you think management of the area can be improved?*". The majority of the respondents thought that no management was required and that visitor numbers were acceptable. Options regarding bird disturbance were the zoning of beaches (wildlife only areas) and dogs on leads, dog only areas and dog wardens but these latter three options may have been in relation to dog fouling/nuisance rather than disturbance to birds. These responses were in the minority. A further related question was "*Have you seen any activities which caused bird disturbance?*". The majority of respondents replied that none were observed, but a quarter of respondents also thought that dog walking caused bird disturbance. A high percentage of the respondents were also aware that the area was internationally important, and an EMS and SPA. It would appear that the majority of the public are not aware of disturbance issues, but almost one quarter do realise that dogs are causing disturbance. Many people are aware of the site's wildlife importance which may provide a means to facilitating further education.

Bird Survey

6.3.6 The bird surveys revealed that high numbers of birds frequented some sites especially Hightown, Hoylake and Leasowe. Due to the methodology utilised, many birds went uncounted. The large area of the SSSI at low tide meant that most birds could escape disturbance. Some species, however, especially turnstone and redshank, preferred being close to the MHWM and thus may have been more prone to disturbance. Other qualifying species did not appear to be as subject to PDE, as a result of their distribution and/or avoidance of areas where they might be subject to PDE (for instance, Hoylake at low tide). Most PDE also did not result in visible responses, perhaps indicating a high degree of habituation and tolerance. The proportion of birds in the MN and NWF SSSIs that are affected and /or impacted also needs to be ascertained.

6.3.7 Birds at high tide roosts would appear to be most vulnerable, as they are unlikely to have alternative roosts, and may have to utilise valuable resources in flight. Some sites, especially Leasowe, had large numbers of dog walkers on the intertidal zone at low tide, and this would

need to be addressed in future mitigation. Dog walkers (dogs off leads) were responsible for most disturbance, and this information, tied in with the data gleaned from the visitor surveys, would enable effective educative and preventative measures to be enacted.

Discussion

6.3.8 There appear to be very few formal mitigation measures in place in the MN and NWF SSSIs aimed specifically at reducing or eliminating bird disturbance caused by human activity. There appears to be awareness of the issue on the Sefton coast, but again there do not appear to be any dedicated measures implemented. The stakeholders and public are not aware of any mitigation measures, although many people are (a) aware of the importance of the area as an EMS/SPA and (b) perceive dog walking as a bird disturbance activity.

Future Monitoring of Recreational Disturbance

6.3.9 Recreational disturbance effects still need further clarification. On present evidence some disturbance does take place, especially at low tide, and at some high tide roosts (Hoylake and Leasowe) but whether this has had fitness consequences for individuals or local populations is unclear. Still *et al.* (2014) stated that "*whether recreational disturbance has a direct effect on populations of water-birds in and around the Liverpool City Region SPAs remains unclear, as avoidance of recreational disturbance does not always reflect population level consequences.*"

6.3.10 There are clearly two aspects of disturbance, disturbance at high tide roosts, and disturbance of birds on the tidal mudflats, when birds are foraging. Further monitoring of visitor activity and recreational disturbance is required. A whole coast survey should be undertaken to pinpoint the hotspots where disturbance is deemed to be occurring. This should aim to survey all types of disturbance including the scarcer activities such as sand yachting and helicopters which were not surveyed during the present study but were mentioned in the stakeholder questionnaires. Full day surveys at targeted sites could yield valuable data on the frequency of disturbance and its effects on birds.

6.3.11 The greatest difficulty, as suggested previously by other studies (Smit & Visser, 1993; Fitzpatrick & Bouchez, 1998; Liley *et al.*, 2011; Borgmann, 2012; Batey, 2013) is proving that disturbance is having or has the potential to have population-level effects on birds. It is obvious that at an individual or flock level birds are responding to disturbance, but mitigation may take place in the form of habituation (Fitzpatrick & Bouchez, 1998), the usage of other areas, or nocturnal foraging (Robert & McNeil, 1989; McNeil *et al.,* 1992; Lourenco *et al.*, 2008). The latter behaviour also opens up another avenue of exploration regarding the disturbance of nocturnal foraging birds. The use of control zones, where disturbance previously occurred, may indicate if displacement is occurring as a result of displacement. The comparison of nocturnal and diurnal foraging areas may also yield useful data.

6.3.12 In order to understand the consequences of disturbance at a population scale, data which are suitable for modelling the rates of disturbance and their effects on the various species present need to be acquired. Parameters such as bird locations, bird density (however these may be reflections of current disturbance rather than what may be "normal"), the proportion of the population so affected, behaviour, disturbance rates and types, consequences, flight distances, energy costs, prey distribution and density, seasonal effects, and between-site effects need to

be gathered (Stillman *et al.*, 2001; West *et al.*, 2002; Stillman *et al.*, 2009; Stillman & Goss-Custard, 2002; Ravenscroft, 2012; Liley *et al.*, 2011).

Recommendations for Mitigation Measures Improvements Regarding Disturbance

6.3.13 Very few studies have measured the effectiveness of management techniques to reduce human disturbance (Batey, 2013). There must be a clear difference shown between before and after effects, and the difference should be able to be statistically analysed e.g. differences in counts, area usage or in bird behaviour.

6.3.14 Habitat management does not appear to be an option as high tide roosts do not appear to be prone to disturbance in the study area, and there do not appear any plans to create new groynes or breakwaters that may be used at high tide (AECOM, 2012).

6.3.15 Human access management including buffer zones, zoning, path design and management; screening and dog control orders, could be enacted and enforced relatively easily and their effectiveness monitored through site usage, visitor and bird counts and behaviour. However these measures presuppose a need for their enactment, so evidence must be acquired showing that a) disturbance is having population-level effects on a species and b) the measure will have the desired effect of reducing disturbance. A very simple and cost-effective technique could be the placing of signs at certain strategic locations, where disturbance is considered an issue, asking dog walkers to keep their dogs on leashes or to avoid certain areas, and to monitor the results.

6.3.16 At West Kirby on the adjacent Dee Estuary a wardening scheme that has been in place for almost 30 years. It involves 'closing off' the tide line on tides 8.9m and over from October to March for 2-3 hours over the high tide. There are wardens present during this time with relevant equipment (radios) and fixed and moveable signs. There are also buoys in place to keep wind/kite surfers away from the tideline – these are put in place with GPS and harbour master directions. This has been very successful in reducing wader disturbance. This scheme could be introduced at Leasowe and Hoylake where an informal scheme with fixed signs and volunteer wardens occasionally giving out advice and leaflets has been operating for some years.

6.3.17 A tool that is readily available to control activities on the coast is the advice contained within Defra (2004) "*Managing coastal activities: a guide for local authorities*", which discusses voluntary approaches, the use of byelaws, designing management schemes and enforcement. However, this approach is dependent on the willingness of the local authority to utilise it, and their awareness of the need to utilise it in some circumstances.

6.3.18 Educational measures are a very cheap and efficient option, and their effectiveness can be measured through visitor surveys and public awareness, e.g. asking dog walkers whether their behaviour has been modified as a result of signage or other education.

6.3.19 In the intertidal zone two types of legal system overlap: one governing terrestrial environments, the other governing marine environments (DETR, 1998). Most intertidal European Marine Sites will also be designated SSSI. As such, the relevant authorities, landowners and occupiers and others will be notified by the appropriate conservation agency of the special interest of the SSSI. They will also be provided with the conservation agency's views about management and a list of

operations requiring the agency's consent. This information is considered to be equivalent to Regulation 33 advice. To reiterate, the agencies' conservation objectives and advice on operations for entirely intertidal European marine sites can be delivered though the SSSI mechanism thereby fulfilling obligations under Regulation 33 of the Habitats Regulations.

6.3.20 Under the Habitats Regulations (2010), Regulation 36, an EMS Management Scheme should be established. The Regulations place a general duty on all statutory authorities exercising legislative powers to perform these in accordance with the Habitats Directive. An EMS management scheme can be the best means to achieve this by providing a framework for management.

6.3.21 Each scheme will be prepared by a group of authorities having statutory powers over the marine area - the relevant authorities. The Regulations set out which authorities have responsibilities for managing these sites and how they are to be managed.

6.3.22 Relevant authorities are those who are already involved in some form of relevant marine regulatory function, and would therefore be directly involved in the management of a marine site, and may include the following:

- country conservation agencies;
- local authorities; and
- the environment agencies

6.3.23 A scheme may be established by one or more of the relevant authorities. It is expected that one will normally take the lead. Once established, all the relevant authorities have an equal responsibility to exercise their functions in accordance with the scheme. WBC would be the expected lead in this case.

6.3.24 Whilst only relevant authorities have the responsibility for establishing a management scheme, government policy (DETR, 1998) strongly recommends that other groups including owner and occupiers, users, industry and interest groups be involved in developing the scheme. To achieve this it suggests the formation of advisory groups and a process for regular consultation during the development and operation of the scheme.

6.3.25 Within the Regulations, the nature conservation bodies have a special duty to advise the other relevant authorities as to the conservation objectives for a site and the operations that may cause deterioration or disturbance to the habitats or species for which it has been designated. This advice forms the basis for developing the management scheme. NE has recently published conservation advice for the MN and NWF SPA (NE, 2014). Only those activities that would cause deterioration or disturbance to the features for which a site has been designated need to be subject to restrictions under a management scheme.

6.4 Summary

6.4.1 Mitigation measures aimed at reducing human disturbance at MN and NWF SSSIs, and Crosby-Hightown, appear to be limited, and perhaps restricted to minimising disturbance by the use of certain byelaws.

6.4.2 There is a need to determine if disturbance is having a population-level effect and the only feasible method at present is by the acquiring of data that can be used to inform models that reflect current disturbance rates and their outcomes. Surveying control zones (before and after) and comparing diurnal and nocturnal foraging areas could yield useful insights. WeBS data could also be used to determine if any high tide roosts within the MN and NWF SSSIs are being affected, and if this can be related to ongoing disturbance.

6.4.3 If it is shown through population modelling that disturbance is having a deleterious effect, then legislative requirements will enable mitigation measure to be installed. These measures will need to be monitored to ensure that they are having the desired effect. A mixture of hard and soft approaches (Mason, 2005) could be utilised to educate the public and formalise regulations.

6.4.4 A Management Scheme should be established as soon as possible, in line with the Habitats Regulations (2010), Regulation 36, to meet the requirements of the Habitats Directive.

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Appendix 1: Stakeholder Questionnaire

Bird Disturbance Mersey and North Wirral Foreshore SSSI's. Stakeholder Questionnaire

Sector:

Name:

Position:

Organisation:

1. Where, in your opinion, are the key areas for recreational users in this sector?

2. Using the key below, in your opinion, give the approximate frequency of each activity over the course of the year.												
Activity / Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Dog walking - on lead												
Dog walking - off lead												
Cockling												
Walking												
Running												
Angler												
Kite surfer												
Sailing												
Windsurfing												
Boat moored												
Birdwatcher												
Photography												
Horse riding												
Sea kayak												
Metal detecting												
Cycling												
Football / ball games / outing with family												
Model plane flying / kite flying?												
Bait digging												
Walk to Hilbre Island												
Sand yachts												
Kite land-boarding												
Other (please state)												

Key for Question 2.	
0	**Not in this month**
1	**2 days or less**
2	**3 - 10 days, typically weekends**
3	**3 - 10 days, typically weekdays**
4	**11 - 20 days**
5	**20 days plus, less than 5 events per day**
6	**20 days plus, greater than 5 events per day**

3. Using the key, give your opinion on number of recreational users over a day.	
Activity	
Dog walking - on lead	
Dog walking - off lead	
Cockling	
Walking	
Running	
Angler	
Kite surfer	
Sailing	
Windsurfing	
Boat moored	
Birdwatcher	
Photography	
Horse riding	
Sea kayak	
Metal detecting	
Cycling	
Football / ball games / outing with family	
Model plane flying / kite flying?	
Bait digging	
Walk to Hilbre Island (if applicable)	
Sand yachts	
Kite land-boarding	
Other (please state)	

Key for Question 3.	
0	**< 10 People**
1	**10-19 People**
2	**20-49 People**
3	**50+ People**

4. Using the key, give your opinion on approximate extent of each activity in the sector.						
Activity	Coastal Path	Backshore	Foreshore - beach	Foreshore - mudflat	Inshore - Surf zone	Inshore - beyond surf
Dog walking - on lead						
Dog walking - off lead						
Cockling						
Walking						
Running						
Angler						
Kite surfer						
Sailing						
Windsurfing						
Boat moored						
Birdwatcher						
Photography						
Horse riding						
Sea kayak						
Metal detecting						
Cycling						
Football / ball games / outing with family						
Model plane flying / kite flying?						
Bait digging						
Walk to Hilbre Island						
Sand yachts						
Kite land-boarding						
Other (please state)						

Key for Question 4.	
0	**Does not occur in this zone**
1	**Rarely in this zone**
2	**Occasionally in this zone**
3	**Frequently in the is zone**
4	**Predominantly in this zone - localised, <10% of area used**
5	**Predominantly in this zone - widely, 11 - 50% of area used**
6	**Predominantly in this zone - throughout, > 50% of area used**

5. Using the key, give the number of years that each activity has occurred in the sector.	
Dog walking - on lead	
Dog walking - off lead	
Cockling	
Walking	
Running	
Angler	
Kite surfer	
Sailing	
Windsurfing	
Boat moored	
Birdwatcher	
Photography	
Horse riding	
Sea kayak	
Metal detecting	
Cycling	
Football / ball games / outing with family	
Model plane flying / kite flying?	
Bait digging	
Walk to Hilbre Island (if applicable)	
Sand yachts	
Kite land-boarding	
Other (please state)	

Key for Question 5.	
0	**No Occurrence**
1	**1 Year**
2	**2 Years**
3	**3 Years**
4	**4 Years**
5	**5 Years**
6	**6 + Years**

6. Using the key, give your opinion on the level of disturbance to the wetland birds from each activity.	
Activity	**Level of Disturbance**
Dog walking - on lead	
Dog walking - off lead	
Cockling	
Walking	
Running	
Angling	
Kite surfing	
Sailing	
Windsurfing	
Boat moored	
Birdwatching	
Photography	
Horse riding	
Sea kayaking	
Metal detecting	
Cycling	
Football / ball games / outing with family	
Model plane flying / kite flying	
Bait digging	
Walking to Hilbre Island	
Sand yachting	
Kite land-boarding	
Land sailing	
Other (Please state)	

Key for Question 6.	
0	**NONE**
1	**LOW e.g. birds show awareness but no response.**
2	**Slight - e.g. short disruption to feeding.**
3	**MEDIUM e.g. short avoidance flights.**
4	**HIGH e.g. prolonged disruption to feeding/roosting.**
5	**Very Strong - e.g. most birds move >200m.**
6	**Severe - e.g. most birds leave the sector completely.**

7a. For those activities you have scored as 4 or above in question 6, are you aware of any current mitigation measures in place?

7b. If yes, what are these measures and do you feel they are adequate?

7c. If not, how could they be improved?

7d. Do you think mitigation measures should be introduced for any other activities?

7e. Briefly outline which activities and what mitigation measures could be introduced

If you are familiar with certain wetland bird species, then please answer the following questions (8-9)

8. Please tick which species are most susceptible to disturbance from recreational activity.						
	Activity on backshore (above MHW)		Activity on foreshore (MHW - water)		On the water	
Key Species	**High Tide**	**Low Tide**	**High Tide**	**Low Tide**	**High Tide**	**Low Tide**
Bar-tailed Godwit						
Knot						
Turnstone						
Dunlin						
Optional Species	**High Tide**	**Low Tide**	**High Tide**	**Low Tide**	**High Tide**	**Low Tide**
Bewick's Swan						
Whooper Swan						
Shelduck						
Wigeon						
Teal						
Pintail						
Common Scoter						
Great Crested Grebe						
Cormorant						
Oystercatcher						
Ringed Plover						
Golden Plover						
Grey Plover						
Lapwing						
Sanderling						
Black-tailed Godwit						
Curlew						
Redshank						
Little Gull						
Black-headed Gull						

Key for Question 8.	
0	**No Disturbance**
1	**Bird Raises Head then Resumes Activity**
2	**Bird Moves on Foot then Resumes Activity**
3	**Bird is Agitated**
4	**Bird Flies <50m**
5	**Bird Flies >50m**
6	**Bird Leaves Area**

9. Do you have any other comments?

Table 1: Stakeholders contacted and responses received (in bold)

Organisation	Representative	Response
Wirral Council	Parks Development Officer	
Wirral Council	**Senior Ranger - Wirral's Coast**	**Acknowledgement**
Dee Estuary Voluntary Wardens	**Voluntary Warden**	**SQ**
Dee Estuary Voluntary Wardens	**Chair**	**SQ**
MEAS	Ecology Team Leader	
Royal Society Protection for Birds/Dee WeBS	**Site Manager/Dee WeBS Co-ordinator**	**SQ**
Sandyachting Club	Secretary of Wirral Sand Yacht Club	
Sandyachting Club	Membership Wirral Sand Yacht Club	
Airforce UK Kite Surfing School	Co-owner	
Hoylake Sailing Club	**Hon Secretary**	**Acknowledgement**
West Cheshire Sailing Club	Hon Secretary	
Wallasey Yacht Club	Hon Secretary	
Royal Mersey Yacht Club	Hon Secretary	
Crosby Sailing Club	Hon Secretary	
Blundellsands Sailing Club (Hightown)	**Hon Secretary**	**SQ**
Friends of Hilbre	Chairman	
Sefton Council	Sefton Council	
Sefton Council	Principal Coast and Countryside Officer	

Organisation	Representative	Response
Holyhead Coastguard (covers Dee Estuary to Cardigan Bay)	Maritime Controller	Acknowledgement
Merseyside WeBS	Mersey Estuary	SQ
Merseyside WeBS	North Shore	SQ
Dee WeBS	Hoylake	SQ
Merseyside WeBS	Alt Estuary Representative	SQ
Merseyside Regional Representative (WeBS)	Regional Representative	Acknowledgement
Wirral Regional Representative (WeBS)	Regional Representative	

Table 2: Averaged Monthly Frequency of Recreational Activities at Each Site Where Questionnaires were returned from (Parentheses indicates activity only occurs during some months; - indicates not noted).

Recreational Activity	Crosby	Blundellsands, Hightown	Hoylake (1)	Hoylake (2)	Hoylake (3)	Hoylake (4)
Dog walking (off lead)	5	6	6	5	6	6
Dog walking (on lead)	5	-	6	6	6	
Walking	5	3	6	5	6	6
Running	-	3	4	2		5
Angling	-	2	2		2	3
Horse riding	2	0	2	3	2	3
Metal detecting	1	1	0			2
Model plane flying/kite flying	(3)	(1)	(1)			3
Birdwatching	-	5	4	2	4	2
Photography	-	2	4	2	4	2
Cycling	-	3	0		6	
Football games/family outing	-	(5)	2 (5)	2	6	5
Bait digging	-	(1)	0			
Sailing	-	(2)	0		2	
Sea kayak	-	0	0			
Boat moored	-	2	0		6	
Kite surfing			1		2	
Sand yachting			2		1	2
Kite land-boarding			(2)		0	3

Key: None: 0; 2 days or less: 1; 3-10 days (typically weekends): 2; 3-10 days (typically weekdays): 3; 11-20 days: 4; 20 days plus, less than 5 events a day: 5; 20 days plus, more than 5 events a day: 6

Appendix 2: On-site Public Questionnaire

Visitor Questionnaire

1. In which age group are you?	
Up to 20	
21 to 35	
36-50	
50+	

2. How (mode of transport) did you travel here today?	
Car/Van	
On foot	
Bicycle	
Horse	
Motorcycle	
Public transport	

3. How far did you travel into site today?	
Less than 1 mile	
1-5 miles	
5-10 miles	
More than 10 miles	

4. Are you a local resident or visiting tourist?	
Local	
Tourist	

5. What activities did/will you undertake while you were here?	
Dog walking - on lead	
Dog walking - off lead	
Walking	
Running	
Angler	
Kite surfer	
Sailing	
Windsurfing	
Boat moored	
Birdwatcher	
Photography	
Horse riding	
Sea kayak	
Metal detecting	
Cycling	
Football / ball games / outing with family	
Model plane flying / kite flying?	
Bait digging	
Walk to Hilbre Island	
Sand yachts	
Kite land-boarding	
Other	

6. Have you seen any activities which caused birds disturbance?	
Dog walking - on lead	
Dog walking - off lead	
Walking	
Running	
Angler	
Kite surfer	
Sailing	
Windsurfing	
Boat moored	
Birdwatcher	
Photography	
Horse riding	
Sea kayak	
Metal detecting	
Cycling	
Football / ball games / outing with family	
Model plane flying / kite flying?	
Bait digging	
Walk to Hilbre Island	
Sand yachts	
Kite land-boarding	
Other	
No	

7. For how long did you undertake the activity?	
Less than 30mins	
Between 30mins and an hour	
1-4 hours	
4-6 hours	
All day	

8. Is this typical of your usual visit?	
Yes	
No	

9. How frequently do you visit this site to undertake this activity?	
Daily	
More than twice a week	
Once a week	
Once a fortnight	
Monthly	
Twice a year	
This is my first visit	

10. Typically, do you undertake these activities at a certain time of day?	
NO	
Early morning	
Morning	
Mid-day	
Afternoon	
Evening	

11. What are the main characteristics that make you want to visit here?	
Wildlife	
Scenery	
Location	
Space for activities	

12. Are you aware that this site is internationally important and designated as a European Marine Site and SPA?	
Yes	
No	

13. Do you visit any other coastal sites in the region? If so, which 2 do you use most often?	
Holyoake	
Leostowe	
North Wirral Coastal Park (Lighthouse)	
Wallasey	

New Brighton	
The Promenade	
Perch Rock	
Red Rocks	
Parkgate	
Thrustaston Visitor Centre	
West Kirby	
Neston	
Crosby marine lake	
Blundel sands	
Southport	
Ainsdale Sands	
The beach at Lytham St Annes	
The beach at Blackpool	
No	

14. How busy do you find the site?	
On a scale of 1-5 (1 being very quiet and 5 being very busy)	

15. Should visitor numbers be carefully managed and how do you think management of the area can be improved?	
YES	
NO	
Dogs only permitted if on leads	
Dog only areas	

Specific walking routes	
Improved signage / visitor boards	
Additional litter bins	
Carparking charges	
Close carparks between 10pm -8am	
Other	
No management required, visitor numbers are acceptable	

Appendix 3: Bird Survey Results

Table 1: Recreational Activity Codes used during field recording of spot counts and recreational events

Recreational Activity	Code
Dog walker (with dog(s) off lead)	DW
Dog walker (with dog(s) on lead)	DWL
Bait digger	BD
Cyclist	CY
Walker	WA
Runner	RU
Angler	FS
Birdwatcher	BW
Photographer	PH
Horse rider	HR
Jet Skier	JS
Metal Detectorist	MD
Vehicle	VH

Table 2: Maximum high and low tide counts for other WeBS species recorded at each site.

Species	Tide	HO	LE	NM	SM	CR	HI	Total maxima
Oystercatcher	High	700	700	2	88	30	2200	3720
	Low	220	1020	215	200	150	1300	3105
Curlew	High	140	10				350	500
	Low	12	11	2	4	31	400	460
Shelduck	High	15					90	105
	Low	82			3		330	415
Ringed plover	High		50				2	52
	Low			10	120		2	132
Black-tailed godwit	High						150	150
Greenshank	High		1					1
Golden plover	High						50	50
	Low						213	213
Grey plover	High		10				1	11
	Low	500						500
Lapwing	High		1				80	81
Sanderling	High		40	18				58
	Low		100			10		110
Common scoter	High		1					1
Common snipe	Low						1	1
Greylag	Low						4	4
Great crested grebe	Low			1		1		2
Grey heron	Low						1	1

Key: Ho = Hoylake; LE = Leasowe; NM = North Mersey; SM = South Mersey; CR = Crosby; HI = Hightown