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Water-based recreation disturbance on coastal bird populations. A canoeing/kayaking case study in Langstone Harbour, UK

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Statement of Originality

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Abstract

The two-fold purpose of facilitating recreational use and conserving wildlife resources is one of the biggest challenges for coastal managers. Exposure to water-based recreation activities often disrupts present birds' behaviour, which is known to cause heightened stress levels, energy costs, or even nestling predation as a result of decreased parental attendance to nests. The present study aims to explore evidence concerning the potential disturbance that canoeing and kayaking may have on bird populations, and to identify appropriate management measures, using Langstone Harbour (UK) as a case study.

Effective disturbance mitigation measures are informed, among other things, by the knowledge and attitudes of user groups, and accordingly, recreationists (N=59) were interviewed using a standardized questionnaire in Langstone Harbour in order to assess awareness of regulations applying in the site -as well as perception on bird disturbance, and mitigation measures they would support as user groups. In addition, relevant authorities and interest groups were interviewed and provided a deep understanding of the harbour management and insightful information concerning the issues related to the management of canoeing/kayaking. The results demonstrated that current information means are not effective and consequently awareness levels are very low, with a great potential to endanger bird populations' stability. Collected evidence allowed confirming the potential disturbance that paddling activities can have on Langstone birds and the need to introduce further mitigation techniques, being education and enforcement through access restriction the most favoured combination. A set of recommendations was elaborated, providing guidance on best methods of raising public awareness and engender support for responsible recreational use of the harbour and bird conservation.

Key words: bird, disturbance, canoe, kayak, recreation management

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List of Abbreviations

AID	Alert Initiation Distance
BAP	Biodiversity Action Plan
BCU	British Canoe Union
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
EA	Environment Agency
EMS	European Marine Site
FID	Flight Initiation Distance
HBC	Havant Borough Council
HCC	Hampshire County Council
HLS	Higher Level Stewardship
ICZM	Integrated Coastal Zone Management
LA	Local Authority
LHB	Langstone Harbour Board
LNR	Local Nature Reserve
MCAA	Marine Coastal Access Act
MCZ	Marine Conservation Zone
MMM	Mean Monthly Measure
MMO	Marine Management Organisation
MPA	Marine Protected Area
MSFD	Marine Strategy Framework Directive
NE	Natural England
NEG	Natural Environment Group
PCC	Portsmouth City Council
PDCC	Portsmouth District Canoe Club
RA	Regional Authority
RSPB	Royal Society for the Protection of Birds
SDMP	Solent Disturbance and Mitigation Project
SEMS	Solent European Marine Site
SAC	Special Areas for Conservation
SPA	Special Protection Area
SSSI	Sites of Special Scientific Interest
WT HIW	Wildlife Trust Hampshire and Isle of Wight

Chapter 1. Introduction

1.1 Introduction

The research project investigates evidence concerning kayaking/canoeing disturbance affecting bird populations and management measures utilised to mitigate their effects. A case study is developed in Langstone Harbour (UK) using a sociological approach to explore recreationists awareness, perception and opinion, as well as managers points of view that will allow establishing whether Langstone Harbour bird populations are subject to water-based recreational pressure and which mitigation measures should be encouraged in the site.

This chapter identifies the focus of the project and the rationale. Additionally, the aims and objectives of the project are outlined followed by a description of the dissertation structure.

1.2 Focus of the project and rationale

1.2.1 Conflicts between recreational activities and bird conservation

The impact of recreational activities on bird populations has become a favourite research and policy topic for analysis in recent years (Porter & Wescott, 2004; Drewitt, 2007; Stillman et al., 2009). Of particular interest and complexity are disturbance events caused by water-based recreation on coastal sites.

Marine and coastal recreational activities have been subject to a rapid growth that has been accompanied by both positive and negative impacts. On the one hand, water-based recreational activities benefit local economies and promote environmental conservation, gaining the community support through generating understanding and awareness of environmental issues (Liley, 2007). Nevertheless, access to natural areas through recreation also poses dangers to sensitive habitats and species (Mason & Mowforth, 1996; Porter & Wescott, 2004).

In south England, the Solent Mitigation and Disturbance Project (SDMP) was initiated in 2009 (Stillman et al., 2009) in order to determine visitor access patterns around the Solent coast and how recreational activities may influence bird population.

Nevertheless, the research undertaken to date has been devoted to overwintering birds and winter activities, rather than breeding populations that happen to meet with the popular water-based recreational activities that emerge during spring and summer months. The focus of this study on water-based activities in Langstone Harbour will assist to fill this inherent gap, considering throughout the year activities and their impact on birds.

In addition, the Solent European Marine Sites (SEMS) annual report (Solent Forum, 2012a) has identified canoeing and kayaking as 'high risk' activities to be having a detrimental impact upon bird populations, features of interest of this marine protected site. Disturbance potential is related to the ability of these crafts to access shallow areas and to approach the shoreline, which are habitats selected by birds for breeding and feeding (Titus & Van Druff, 1981; Smit & Visser, 1993; Burger, 1998; Kloubec, 2007; Sparks, 2009).

Whereas breeding birds must coexist with summer recreation, and are exposed to high nestling mortality rates caused by approaching recreationists that induce upflights (Ream, 1976; Burger, Gochfeld & Niles, 1995; Klein, Humphrey & Percival, 1995; Rodgers & Smith, 1995), overwintering birds are mainly affected through habitat displacement, which can comprise energy costs, increasing mortality rates or subsequent breeding failure. These are impacts which may vary depending on additional stress factors (Fitzpatrick & Bouchez, 1998; Schummer & Eddleman, 2003).

The study of effective disturbance mitigation techniques has become an important aspect for coastal managers (Liley & Tyldesley, 2013), and water-based recreation literature collates measures varying from implementation of buffer zones, management of visitors' access, restoration or creation of new bird habitats and the use of educational resources. The use of one or more techniques will vary from site to site, depending on both the bird species exposed and the visitors' characteristics (Schummer & Eddleman, 2003; Cline, Sexton & Stewart, 2007).

1.2.2 A sociological approach

Although there is a broad body of literature covering recreational activities disturbance effects on bird populations, few studies have been carried out on recreationists' awareness of their impacts, perceptions' on the issue and opinions. This information would inform the best practice for disturbance mitigation measures implementation (Taylor & Knight, 2003; Le Corre, Peuziat, Brigand, Gélinaud & Meur-Férec, 2013).

In addition, whereas water-based recreation literature focus on powerboating and large crafts, kayaking and canoeing have limited representation, and further understanding is needed in order to provide an insight into possible future management of these activities, potentially considered as 'green' or benign (McIntyre, 1998).

This topic provides an opportunity to investigate the related theory, add to the body of knowledge and assess if kayaking and canoeing are a real issue and need further management in the considered location: Langstone Harbour (UK), which belongs to the previously mentioned Solent European Marine Sites.

1.3 Aims and objectives of the research study

1.3.1 Aim of the study

The overarching aim of this study is to investigate the potential disturbance that kayaking and canoeing can have over bird populations and determine whether additional mitigation measures are required in Langstone Harbour (UK).

1.3.2 Specific research objectives

1. To critically discuss the existing literature concerning evidence of potential disturbance to birds caused by kayak/canoe activities in worldwide case studies.
2. To identify management practices worldwide that have minimized bird disturbance caused by water-based recreation.
3. To asses and analyse Langstone Harbour recreationists' awareness, perception and opinions on bird disturbance and recreation using questionnaires.

4. To investigate recreational activities management in Langstone Harbour and assess views and opinions on the problem of relevant managers and interest groups through documentary analysis and the use of semi-structured interviews.
5. To examine the findings from both quantitative and qualitative methods, in order to discuss evidence and identify mitigation measures that can be applied in Langstone Harbour.
6. To put forward a set of recommendations for the future best practice of water-based recreation management in Langstone Harbour and possibly elsewhere.

1.4 Structure of the research study

The literature review is covered in Chapter Two. It primarily examines peer-reviewed studies that largely pertain to issues on water-based recreation, identifying effects on bird populations and mitigation measures put into place. It therefore focuses on objectives 1 and 2 as set out in sub-section 1.3.2. Three sections divide the chapter: A critical discussion on how bird disturbance effects are measured; followed by a description of kayaking/canoeing characteristics that makes them potentially disturbing, and a critical examination of associated studies; finally, mitigation techniques are identified and compared.

The research methodology is presented in Chapter Three. The first two sections indicate the underlying purpose of the methodology and the rationale for selecting a case study approach in Langstone Harbour, identifying the three main sources of information that are used: documentary evidence, questionnaires and semi-structured interviews. For these two last-named, sampling, design, procedure and treatment are detailed. Validity and reliability issues are also discussed in the last section.

Whereas Chapter Four presents and analyzes data obtained from questionnaires aimed at Harbour users (objective 3), Chapter Five investigates the functioning of Langstone Harbour in terms of recreation management and combines this information with views and interpretation of the harbour managers on the issue (objective 4).

Chapter Six includes an overall discussion of both quantitative and qualitative data that permit to identify the best approaches to manage paddling activities in Langstone

Harbour (objective 5). In addition, clear recommendations to increase the effectiveness of the approaches placed in Langstone Harbour are elaborated (objective 6). Finally, the concluding chapter summarizes the findings and details limitations of the project, encouraging further research on the topic.

Chapter 2. Literature Review

2.1 Introduction

This chapter considers the existing literature concerning bird disturbance caused by water-based recreation and management techniques applied to mitigate related impacts. In the first instance, a sensible starting point is to investigate what is meant by the term 'disturbance' and how it can be measured. Secondly, kayaking and canoeing characteristics will be described and a review of relevant disturbance studies will be undertaken. Studies will therefore be selected according to their focus on these activities and those water-based with similar effects, being additionally summarized and collected in Appendix A. Finally, mitigation techniques will be identified and compared using worldwide case studies.

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2.2 Human disturbance: Concept and measurement

2.2.1 Disturbance: Concept

Disturbance has been defined as the "deviation in an animal's behaviour from patterns occurring without human influences" (Frid & Dill, 2002, p.1). Disturbance refers, therefore, to a human activity to which a bird responds, although it can also be considered as a form of habitat loss, making suitable areas for birds temporarily unavailable for their exploitation (Nisbet, 2000).

The bird's response and ecological significance will differ depending on different factors, mainly the type of human activity and the bird ecologic species-specific features, as shown in Figure 2.1 (Steven, Pickering & Castley, 2011). For instance, frequent, high-intensity activities may be more disturbing than those continuous but low-intensity activities, as birds may develop an ability to habituate (Hill et al. 1997; Sterl, Wagner & Arnberger, 2002).

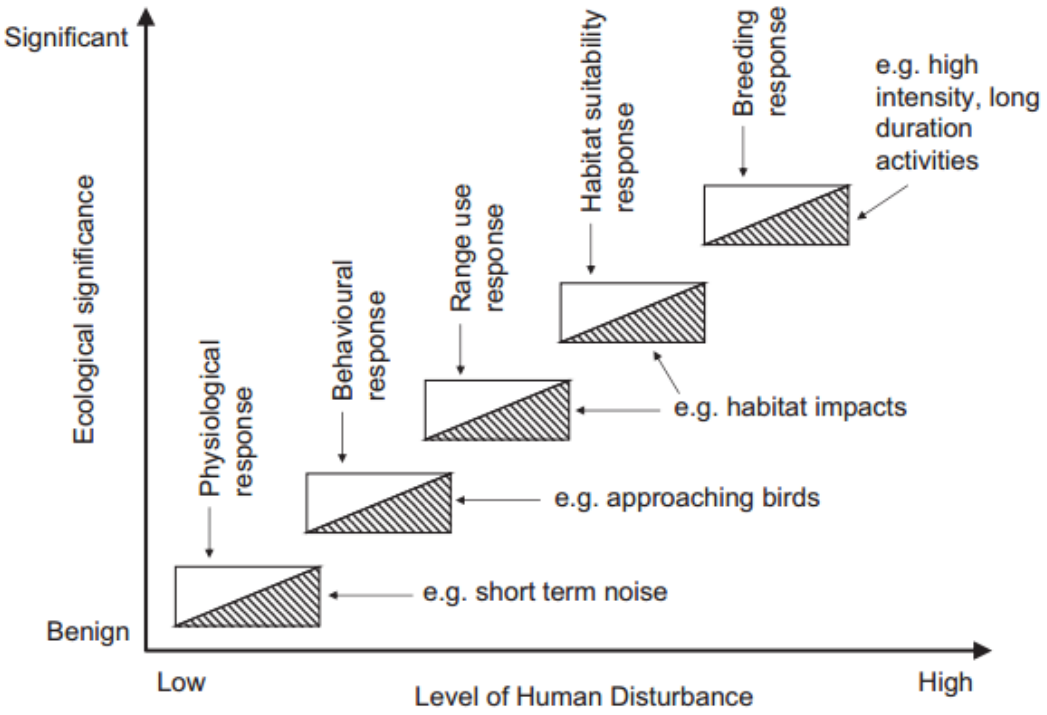


Figure 2.1. Conceptual relationship between the level of human disturbance and its ecological significance on bird populations. Significant ecological effects would depend on the type of human activity, its duration, intensity, extent and timing, additionally existing likely differences between individual and population level responses. Source: Steven et al. 2011.

Although disturbance effects on bird populations have been widely reported and identified as negative (see section 2.3.2), not all disturbing events are necessarily adverse, and only those affecting survival, fecundity or other population size alteration should be considered as so (Gill, Norris & Sutherland, 2001; Nisbet, 2000). Accordingly, some disturbance effects have been reported to be positive, such as grazing or fire, which can generate heterogeneous habitats that may enhance biodiversity and be used as a tool for conservation (Fuhlendorf et al. 2006).

Regardless of the presumable effects a disturbing event has, quantification and evidence assessment is required in order to relate human disturbance with negative effects on bird population size or productivity (Nisbet, 2000). Shorebirds, in particular, have grown within dynamic environments and accordingly may compensate for short-term effects such as temporary loss of habitat or foraging time (Peters & Otis, 2007), being prone to habituation, which is defined by Hinde (1970), as cited in Nisbet (2000, p. 315), as "the relatively persistent waning of a response as a result of repeated stimulation which is not followed by any kind of reinforcement".

2.2.2 Measurement of disturbance

Human disturbance effects on bird populations have been object of research in a great number of studies (see Appendix A). They have an overall aim of assessing human impact on bird populations' and establish best practice towards mitigation and reconciliation of both human access and nature conservation objectives (e.g. Natural England commissioned reports: Penny Anderson Associates (2001), and Lowen, Liley, Underhill-Day & Whitehouse, 2008).

However, there is a great controversy on how these studies can actually assist management for this aim (Hill et al. 1997; Nisbet, 2000; Penny Anderson Associates, 2001). It responds to the variety of methods in dispute that can be used to assess disturbance impacts.

Disturbance methods are selected depending on whether the issue relates to a site, a group of individuals or whole populations, and research can have various levels of specificity in order to provide different information (Fig. 2.2). Approaches can include experimental measures, which manipulate natural populations controlling most of the relevant factors (Hairston, 1989), or comparative measurement, which allows considering a wide range of locations or circumstances (spatial or temporal variation) but often lack baseline data (Peters & Otis, 2007). In addition, different responses produced can be addressed: behaviour, distribution, demographic changes or population responses (Gill, 2007; Liley, 2007).

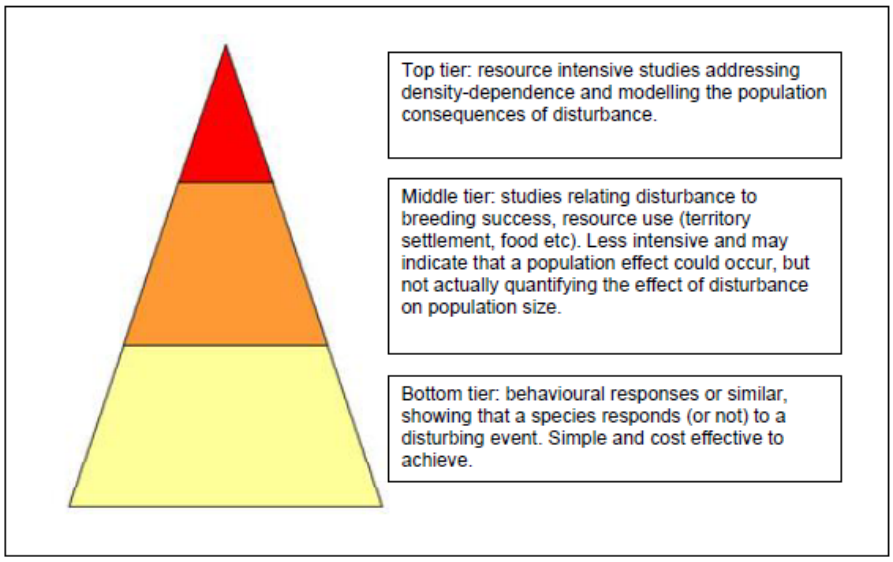


Figure 2.2. Three tiers of disturbance research. Each method provides different information. For instance, individual birds information may assess ability of individual species for habituation; demographic studies can result particularly useful at a local scale in order to define disturbance impacts on exploitation of resources and population studies will define population-scale impacts. Source: Liley, 2007, p.5

Whereas most of the studies focus on bird behaviour responses, they lack evidence of direct implications of human activity on reproduction failure or population level effects -critical in order to accurately identify when human presence becomes a threat to conservation (Nisbet, 2000; Gill et al. 2001; Frid & Dill, 2002; Gill, 2007; Sutherland, 2007; Borgmann, 2010).

Behaviour studies can be very diverse, measuring different factors, such as flight responses, reductions in nest incubation or changes in foraging behaviour (Gill, 2007). However, behaviour responses depend on individual circumstances and numerous factors (e.g. quality of the area, availability and relative quality of alternative areas, relative predation risk on current and alternative sites, etc) (Ingold, 2005; Gill, 2007; Mallord et al. 2007). Consequently, behaviour studies must be combined with other methods in order to determine human effects at a population level, including modelling (Bennett et al. 2009), and understand the strength of density-dependence (Gill et al. 2001; Gill, 2007; Liley & Sutherland, 2007; Mallord, Dolman, Brown & Sutherland, 2007; Murison et al. 2007), which additionally allows predicting population size that the site would be able to support when different and hypothetical levels of disturbance are present (Liley & Sutherland, 2007).

Each methodology presents its own advantages and disadvantages, its adequacy will depend on the final research objective. Understanding different methodologies is a key requirement when reviewing bird disturbance case studies.

2.3 Impact of water-based recreational activities on bird populations

A significant number of papers have examined and reviewed studies addressing disturbance on bird populations caused by mere human access to nature and wildlife (Penny Anderson Associates, 2001; Lowen et al. 2008), many focused on recreational activities (Boyle & Samson, 1985; Hill et al. 1997; Carney & Sydeman, 1999; Leung & Marion, 2000; Davenport & Davenport, 2006; Cline, Sexton & Stewart, 2007; Drewit et al. 2007; Stillman, West, Caldow, & Durel, 2007; Borgmann, 2010; Steven et al. 2011), and some specifically reviewed water-based activities studies (York, 1994; DeLong, 2002).

Water-based recreational activities are considered as one of the main sources of disturbance for seabirds, and a potential threat to biodiversity (Hill et al. 1997, Gill, 2007). However, the number of studies focusing on effects of kayak and canoeing activities is limited (Sparks, 2009). Accordingly, this section will consider kayaking and canoeing characteristics that are likely to make them disturbing activities for birds, and review studies that have investigated their impact on bird populations. By better understanding these impacts, responsible authorities will be able to introduce visitor programmes (see section 2.4) that minimize wildlife disturbance while providing recreational opportunities for the community.

2.3.1 Paddling: Kayaking and canoeing activities' characteristics

Canoeing and Kayaking (Figure 2.3) -generally known as paddling- are both recreational and sport activities that were first popularized in the United States and the United Kingdom in the late 1980's (British Canoe Union [BCU], n.d.a).

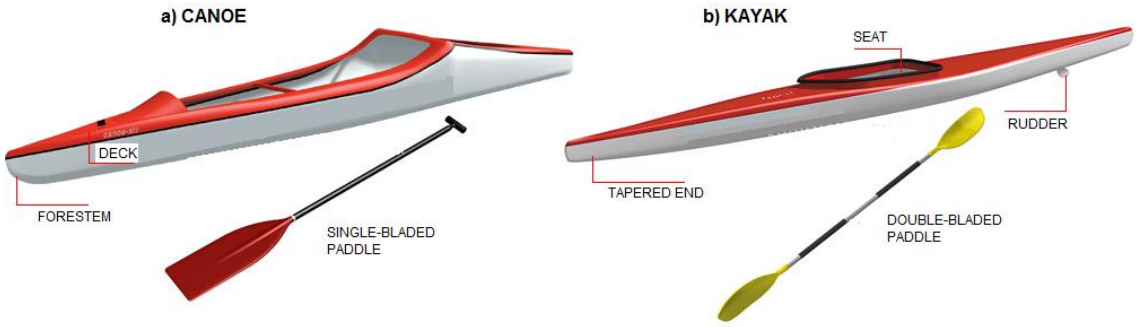


Figure 2.3. Differences between Canoes and Kayaks. Canoeists use a paddle with a single blade and traditionally kneel on the boat, Kayak users sit on the boat, propelling it by a single paddle with a blade at either end (BCU, n.d. a).

Paddling activities are, in general, reported to produce 'high-intensity infrequent' disturbance together with other water-based recreational activities, related to the unpredictability associated with their access to natural habitats and ability to produce agitated status among birds (Korschgen & Dahlgren, 1992; Hill et al. 1997). Kayaking/canoeing have been identified as particular activities warranting individual studies, as a focused study of a particular user group could provide useful results for site managers and ecologists (Liley, 2007; Solent Forum, 2012b).

Compared to other boats, whereas motorboats are claimed to have the greatest disturbance potential because they involve both movement and noise, sailing and

canoeing are said to be less disruptive, only involving movement (Knight & Cole, 1995). However, it has been stated that the ability of these paddling activities to approach birds without making noise and avoiding the development of early warnings, make them more threatening than other motor-based watercrafts (Jenkins, 2002), perceived by the birds as 'stalking predators' (Frid & Dill, 2002; Beale & Monaghan, 2004). In other cases, distant sounds or glimpses of passing paddlers may be the cause of disturbance and has been considered to impede habituation to human presence (Titus & Van Druff, 1981; Kloubec, 2007; Karp & Roote, 2009).

Nevertheless, kayaking and canoeing threats are generally related to their ability to increase the access of humans to habitats that were previously inaccessible. Because of their shallow draughts, these crafts are able to penetrate further into shallows, go into the far reaches of coves or tidal creeks, access small islands and ride close to the shore, areas that are used by birds for breeding, nesting, roosting and foraging (Titus & Van Druff, 1981; Smit & Visser, 1993; Burger, 1998; Kloubec, 2007; Sparks, 2009). Their accessibility can be potentially damaging, and accordingly, Koepff & Dietrich (1986), as cited in Smit & Visser (1993), found that due to the ability to approach high-tide roosts, kayaks and small sailing boats recorded a higher disturbance frequency than motorboats or windsurfers in roosting waders and shelducks within the German Wadden Sea.

Assuming low disturbance rates in kayaks and canoes due to the lack of high speed or high noise potential is therefore misleading.

2.3.2 Review of disturbance effects of water-based recreational activities on bird populations

Disturbance effects of water-based recreational activities have been widely reported (see Appendix A) and classified (Pomerantz, Decker, Goff & Purdy, 1988), being the main ones indentified in the following figure (Fig. 2.4).

Main disturbance effects on Bird populations

1. Physiological effects without overt changes in behaviour (e.g., increases in heart rate, 'stress');
2. Walking or flying off the nest, returning after ceasing of disturbance (e.g. displacement of loafing, non-breeding, or prospecting birds from the colony-site);

3. Desertion of the nest by one or both members of a pair;
4. Abandonment of the colony-site by some or all;
5. Reduction in hatching success or deaths of individual chicks;
6. Reduction in breeding success;
7. Deaths of individual adults;
8. Reduction in local, regional, or total populations.

Figure 2.4. Disturbance effects on bird populations. Different effects are listed here in an approximate order of increasing severity. Adapted from Nisbet, 2000.

Noise, speed and vicinity of watercraft induce varied levels of disturbance. However, it is species-specific which of these factors will cause a stronger response, determined by the birds' colonial behaviour, breeding patterns, distribution, or habitat requirements among others (Boyle & Samson, 1985; Borgmann, 2010). For instance, some species may respond indifferently to motor or non-motor boats (e.g. Great Egret) (Rodgers & Smith, 1995), while others may be more sensitive to higher speeds approaching boats (e.g. Common Terns) (Burger, 1998). For other species, flushing probability has been proved to be significantly more influenced by increasing approaches than increasing speeds (e.g. Black Guillemots) (Ronconi & Cassady St. Clair, 2003).

Moreover, if recreational activities occur during roosting or foraging periods, it is also species specific how negatively these will be affected or have no-problem to habituate to watercraft penetrating into their habitats, the so-called 'national-park effect'' (Sterl, Brandenburg & Arnberger, 2008).

An example of disturbance affecting habitat selection can be found in the study undertaken by Bratton (1990) in a Georgia estuary. The researcher found that ciconiiformes were more strongly disturbed if small boats passed though tidal creeks instead of near the shore, as they depend on tidal regimes to make use of feeding areas (Fitzpatrick & Bouchez, 1998; Colwell et al. 2003). Roosting fidelity has also been tested in the Moray Basin (Scotland), where populations of Red Knots, Bar-tailed Godwits, Common Redshanks, Dunlins, Oystercatchers, Ruddy Tunstones and Ringed Plovers happen to meet. Roost selection variability appeared as species-specific, and the authors identified Ruddy Turnstones, Ringed Plovers and adult Eurasian Curlews as the least movable species. Accordingly, it has been asserted that birds with a strong roost-site fidelity and minimal capacity to change selected roost-sites are subject to greater disturbance effects than those mobile species (Rehfisch, Insley & Swann, 2003).

Trampling effects can also be related to paddle sports, as users can easily access islands or other remote habitats and go ashore, preventing the usage of these habitats by birds or causing their direct destruction (Riffell, Gutzwiller & Anderson, 1996; Kloubec, 2007). For studies on trampling impacts on coastal birds, the reader is referred to the report commissioned by Natural England: Lowen et al. (2008).

The time of the year when disturbing events occur also relates to species-specific vulnerability. For instance, Navedo & Herrera (2009) recognized canoeing as one of the main disturbing activities affecting Eurasian spoonbills (Platalea leucorodia) in Santoña saltmarshes (Cantabria, Spain) during migration. Canoeing, together with summer celebrations, were claimed to potentially alter the success of migration of a 10% of the Eurasian spoonbills Atlantic population.

The following section outlines disturbance evidence when flight response has been measured, and distinguishes between specific characteristics that make breeding and overwintering birds susceptible to disturbance.

2.3.2.1 Flight response to canoeing/kayaking

Waterfowl rely on stored nutrients gained while wintering, migrating or staging to meet the energy requirements for latter reproduction. Disturbing recreation activities can have energy costs within the birds' annual cycle.

Although flush rates may not reflect species sensitivity to disturbance (Peters & Otis, 2006), they have been chosen as the most studied behaviour to guide management, as it implies the highest energy cost (Pease, Rose & Butler, 2005). Accordingly, Avocet Research Associates (2004) conducted disturbance trials during the winter months in California to estimate flush distances of waterbirds in response to kayaking. Results, as presented in Table 2.1, illustrate behaviour differences between four different classes of waterfowl.

Table 2.1. Birds flush distances by class. Data obtained through six disturbance trails conducted between November 15, 2004 and February 15, 2005.

Group	Number of events	Mean flush distance (m)	Standard	Range (m)
Waders	34	36.0	3.5	4-56
Divers	208	34.74	1.2	17-51
Dabblers	20	31.00	4.7	10-52
Gulls	24	12.5	1.2	7-18

Source: Avocet Research Associates, 2004, p.25.

According to the obtained data, whereas waders, divers, and dabblers appeared as the most prone to disturbance, gulls had significantly different flush distances.

Waders' flush distance was related to the different species body size and time of the year. In winter, small flocking sizes (e.g. sandpipers) allowed kayaks to pass as close as 10 meters or less without inducing birds to take flight. However, as the migration period approached, they increased the flush distance.

In the case of divers, flush distances depended mainly on flock size, being the small flocks or individual birds more tolerant to disturbance (Avocet Research Associates, 2004). However, the stage of the life cycle must be considered to make this assumption. For instance, Kaplan & Tischler's canoeing study (2001), as cited in Ruddock & Whitfield (2007, p.67), identified the highest vulnerability in pairs of divers during the hatching phase in Lake superior, finding the strongest effect of canoeing at a mean distance of 55 m from the nest.

Finally, whereas dabblers recorded the lowest number of disturbing events because of their preference to land habitats, gulls showed the highest level of habituation to human presence (Avocet Research Associates, 2004).

2.3.2.2 Breeding bird species

Breeding bird populations tend to assemble together in fixed small areas, resulting in high nest density sites. They are highly visible and appear attractive to human visitors (Burger, Gochfeld & Niles, 1995; Klein, Humpfrey & Percival, 1995). In addition, the breeding season often coincides with the peak use of natural areas by recreationists (e.g.

during summer), making birds subject to a significant human pressure (Burger et al. 1995; Klein et al. 1995).

In general, disturbance of bird colonies has demonstrated to cause nest losses through predation, trampling and nest abandonment (Rodgers & Smith, 1995). Disturbance caused by non-motorized boats provokes flushing responses aimed at distancing from danger or intimidating potential predators, consisting of group rather than individual responses (Burger & Gochfeld, 1991; Rodgers and Smith 1995). Upflights can leave nests exposed to predation and/or abandonment resulting in a high egg and nestling mortality rate, also affecting nestling development (e.g. effect on body mass, heat regulation, growth rate, premature fledging, etc.), and/or adult behaviour (Ream, 1976; Rodgers & Smith, 1995), being particularly damaging to inexperienced juveniles (Velando & Munilla, 2011). The time taken to return to the nest will depend on the individual condition and ability to balance the risk of starvation against the risk of predation (Borgmann, 2010)

In order to reduce their exposure to humans and other predators, colonially-nesting birds tend to choose remote islands as nesting places (Goutner, 1990; Burger & Gochfeld, 1991; Fasola & Canova, 1991). However, they are still exposed to paddling activities that permit approaching, passing close to the islands or even landing on islands.

Burger (1998) examined the vulnerability of Common Terns (Sterna hirundo), nesting on an island in Bamegat Bay (New Jersey), to motor boats and personal watercraft. The author found that personal watercrafts elicited the strongest responses regarding flight behaviour due to their facility to reach places close inshore, provoking upflights above the colony. However, it was not proved whether the impact was encouraged by high noise levels or high speeds, and behaviour responses could not indicate further effects at a population level.

Considering paddling activities, authors do not agree with the significant disturbance that these activities may have. For instance, Common Loons' breeding behaviour against recreation activities has been widely examined in Michigan and Minnesota. On the one hand, Ream (1976) claims that close approach and access to nesting habitats by canoes are a significant cause of reproductive failure, especially if disturbed early in nesting season. McIntyre (1977) also highlights the increased chicks' vulnerability to

predators caused by canoeists approach causing upflights, considering it to have significant population effects.

On the other hand, Titus & Van Druff (1981) and Jung (1991) agree that canoeing activity does not have a significant negative impact on reproductive success and that loons have demonstrated to be able to habituate to these disturbing activities, recording, within a 25 year time period, increasing number of individuals regardless of the increasing popularity of canoeing (Titus & VanDruff, 1981).

From these four studies, it appears clear that canoeing/kayaking disturbance potential will depend on the level of intensity to which birds are exposed, as it is true that upflights presented in a frequent basis will lastly result in reproductive losses or colony desertions.

2.3.2.3 Overwintering bird species

Bird species overwintering in temperate climates are exposed to high metabolic requirements, being significantly susceptible to disturbance that comprises energy costs, such as upflights and habitat loss (Korschgen, George & Green, 1985; Rehfischet al. 2003). For instance, a resultant 10km flight caused by disturbance could increase a Red Knot's daily energy expenditure by a 5.9% (40 min of extra-feeding time equivalent) (Rehfischet al. 2003).

There are a great number of studies tackling canoeing and kayaking activities' effects on wintering birds, in which habitat loss appears as the main mean through which recreational activities may cause disturbances (Smit & Visser, 1993).

Herrera et al. (2007) undertook an experimental study in the Ason estuary (Cantabria, North Spain). The researcher used a non-motorized boat and observed reactions of different overwinter species, finding that only those associated with zoostera islands (Eurasian Spoonbill) showed a strong response to disturbance that could have further population effects. Conversely, winter muddy bird species[1] did not register any disturbances.

[1] Eurasian Wigeon (Anas Penelope), Eurasian Spoonbill (Platalea leucorodia), Eurasian Curlew (Numenius arquata), Black-tailed Godwit (Limosa limosa) and Bar-tailed Godwit (Limosa lapponica).

There has been a lot of discussion about whether these disturbing events are significant as far as population level is concerned.

On the one hand, it has been stated that during winter, disturbance is only a population level issue if summed to lack of alternative habitats or resources. Accordingly, Gill et al (2001) found that Black-tailed godwits' survival rate or reproductive success in England were not jeopardized by recreational activities (including non-powered water craft) due to the abundance of prey. In other species of overwintering diving ducks, motorboat disturbance only proved to be harmful if repeated frequently, as it determined whether the individual chose to return to its original location or not (Korschgen et al. 1985; Borgmann, 2010).

A 4-season study in Wisconsin showed that autumn and winter months recorded infrequent recreational boating disturbance on canvasback, and birds were observed to compensate feeding opportunity losses at night (Kahl, 1991). Canoeing was also found as having little impact on the daily activity or distribution of wintering ruddy shelducks in Nepal, as average daily duration of disturbance appeared generally short (Hulbert, 1990). Conversely, during spring months, lack of alternative feeding areas or lower food quality, summed with a strong presence of recreationists was related with cumulative effects and consequences on the energy balance (Kahl, 1991).

On the other hand, it has been claimed that winter flexibility is not without cost, and that the use of non favoured areas or avoidance behaviour can comprise energy costs, which are more likely if coinciding with stress factors (e.g. lack of prey or weather conditions) (Fitzpatrick & Bouchez, 1998; Schummer & Eddleman, 2003). In addition, if compared to resident individuals, migrants have shown a lower tolerance to human disturbance, probably related to the lack of habituation and inexperience (Klein et al. 1995; Navedo & Herrera, 2009; Borgmann 2010).

Overall, there is a clear link between bird migration and subsequent breeding success, and the quality of wintering sites (Gill et al. 2001)

2.4 Critical evaluation of management techniques aimed at disturbance mitigation

Although experimental/observational studies have failed in some cases to confirm detrimental impacts of canoeing/kayaking, the precautionary principle must always be taken into account when considering if further mitigation measures are needed (see Figure 2.5)

Precautionary Principle

All forms of environmental risk should be tested against the precautionary principle which means that where there are real risks to the site, lack of full scientific certainty should not be used as a reason for postponing measures that are likely to be cost effective in preventing such damage. It does not however imply that the suggested cause of such damage must be eradicated unless proved to be harmless and it cannot be used as licence to invent hypothetical consequences. (...) It is important to take account of the associated balance of likely costs, including environmental costs and benefits.

Figure 2.5 The precautionary principle. Source: DETR, 1998 as cited in Bayliss, 2002.

Existent techniques are mostly related to planning and design of human facilities or determination of special usage areas. For instance the Great Barrier Reef Marine Park Authority (1997) locates moorings sufficiently far from any seabird colony in order to ensure that boat disturbance does not occur. Another option involves the provision of alternative areas for visitors, the so-called "suitable alternative greenspace sites" (Kidd, 2011). Measures can also include visitor access limitation to certain sites, manipulation of visitors or habitats management (Cline et al. 2007; Sutherland, 2007). In any case, there is a need to combine different techniques to fit sites specific needs, and should consider individual species requirements (e.g. foraging behaviour, habitat requirements, and migration chronologies) (Schummer & Eddleman, 2003) and visitors' characteristics.

Nevertheless, only a small body of literature has been dedicated to explore the human aspect of bird disturbance (Le Colle et al., 2013); understanding visitors' preferences, perceptions and opinions has been identified as key to establish sensible interventions that influence visitor behaviour and promote wildlife conservation (Taylor & Knight, 2003; Bathe, 2007; Underhill-Day & Liley 2007).

This section will differ between the four most popular techniques that have been applied worldwide in the case of water-based recreation management (Table 2.2).

Table 2.2. Management techniques classification. The table shows the most frequently used techniques aimed at mitigation disturbance caused by water-based recreational activities, determining advantages and disadvantages.

	Buffer zones	Manage visitor access	Habitat creation	Education
Description	Use of buoys to guide paddlers and set safety distances to avoid disturbance	Spatial and/or temporal restriction: limit boat speed or density; exclusion in certain areas	Artificial habitats with similar characteristics of natural ones are introduced	Introduction of education campaigns for paddlers aimed at obtaining support and compliance with conservation rules
Advantages	Considers crafts' characteristics and species-specific requirements	Highly effective, it can decrease disturbance to minimum levels	Allow paddlers to access wildlife without restrictions whereas birds are protected	Creates awareness of local issues and respect for wildlife
Disadvantages	Possible conflicts with paddlers' access rights or other users	Compliance may be difficult to control	Design must be carefully undertaken to avoid alternative sources of disturbance; Available area can be limited	Behaviour cannot always be controlled or predicted, and further measures should always be taken in combination

Source: Author's own

2.4.1 Buffer Zones

Buffer zones are one of the most frequently used strategies to minimize effects of human disturbance to wildlife, restricting human activity up to a safe distance (Great Barrier Reef Marine Park Authority, 1997; Rodgers & Smith, 1997; Peter & Otis, 2007; Evans, 2009). Whereas in terrestrial environments access is usually restricted through the establishment of well-defined paths (Pearce-higgins, Finney, Yalden & Langston, 2007), within aquatic habitats, buffer zones can be marked using offshore buoys, leading visitors away from sensitive areas (Burger, Gochfeld, Jenkins & Lesser, 2010). Buffer zones size can be very varied. For instance, those aimed at protecting breeding terns range from 50 to 200 m, and those for wading birds can vary from 100-250 m (Rodgers & Smith, 1997). In order to determine buffer zones, disturbance distance measures are used. The 'alert distance' (distance between source of disturbance and

point where the animal responds) and the 'flight initiation distance' (point at which the animal flushes) are the most commonly applied (Ruddock & Whitfield, 2007). Other factors such as those related with the craft (e.g. size, speed and approach distance of boats) (Ronconi & Cassady St. Clair, 2003), and those related with the species (e.g. vulnerable time for the birds, behavioural measure of most concern, reproductive stage, level of response) (Fernandez-Juricic et al. 2007; Burger et al. 2010) should also be considered when applying buffer zones.

In order to establish buffer zones, Avocet Researchers Associates (2004) calculated flush distances in overwinter waterbirds caused by kayaks in California. The study demonstrates the complex decision-making process for managers, and illustrates a comparison of three different estimations (Table 2.3) and their implications.

Table 2.3. Flush distances and extrapolated buffer zones based on observed responses of waterbird groups to kayaking. (A) use of mean flush distance, (B) the upper 95% quantile of "standard normal flush distance", which is the closest distance at which birds will flush 5 percent of the time, used, among others, by Burger et al. (2010) and (C), a measure utilized by Rodgers & Smith (1997), who add a 40-meter buffer zone to the previous extrapolated values and avoids underestimation of unobserved responses prior to flushing.

Option	A	B	C
Group	Mean flush distance (m)	$\pm t_{0.05,df}$ x sd (m)	+ 40-m (m)
Waders	36.9	70.3	110.3
Divers	34.7	63.4	103.4
Dabblers	31.0	67.6	107.6
Gulls	12.5	24.5	64.5

Source: Avocet Researchers Associates, 2004, p.26

The application of the resulting range of distances minimized disturbance in a 60% (A) and 95% (B) or completely avoided (C) disturbance. In the two latter cases, the buffer zone would not let lanes to be established, and the lagoon would have to be closed to watercraft. The first option was therefore selected accompanied by other supporting mitigation measures (Avocet Researchers Associates, 2004).

Assessment of buffer zones' effectiveness, as in most of mitigation measures, is very limited. An example can be found in the river Seine (France), where overwinter birds were subject to port traffic disturbance and buffer zones were proposed. A behaviour-based model permitted to determine that a 150 meters buffer zone could restore shorebird mortality and body condition to pre-disturbance levels (Durell et al. 2005).

Nevertheless, buffer zones can appear unsuitable in some places. Beale & Monaghan (2004) claim that buffer zones are likely to be inappropriate in those wildlife sites with fluctuating numbers of visitors (a general situation), as safe distances are subject to the number of visitors. The adoption of a precautionary approach that considers a worst-case scenario is therefore recommended (Blumstein, Anthony, Harcourt & Ross, 2003; Beale & Monaghan, 2004; Bellefleur, Lee & Ronconi, 2009).

2.4.2 Manage visitor access

Restrict visitor access must count on an effective management in order to be successful (Beale & Monaghan, 2005). It is not the preferred option by neither managers nor visitors (Taylor & Knight 2003; Beale & Monaghan, 2005), and it should only be considered when recreational activities have been demonstrated to be severe, as it can jeopardize the public support towards ecosystems' conservation (Sutherland, 2007).

Restriction can be established temporally or spatially. Considering a temporal scale, it may be permanent or coincide with peak birds' presence, assigned during key time periods (Schummer & Eddleman, 2003; Navedo & Herrera, 2009). For instance, in the estuary of Drakes Estero (California), kayaking is restricted from March to June, and, although initially it was aimed at harbour seals conservation, spring migrating shorebirds have also benefited (Hickey, Shuford, Page & Warnock, 2003).

Limiting the number of crafts or assign time periods can also reduce disturbance produced by paddlers (Avocet Research Associates, 2004). For instance, Velando & Munilla (2011) identified a model that could predict conditions that would minimize disturbance to foraging shags associated with the number of boats. Accordingly, in the case of Cíes islands (Galicia, Spain) the number of boats has been limited to 250 boats per day.

Considering a spatial scale, restriction can focus on special habitats, such as small islands where birds choose to breed. Accordingly, Titus & VanDruff (1981) propose to discourage small islands by visitors in order to preserve breeding sites intact, "keeping boats 150 m from shores or islands would help to ensure that adult loons are not outsed from their nests and that chicks are not separated from their adults" (Jung, 1991, p.216).

Finally, visitors can also become influenced through effective information means, such as education (see section 2.4.4) or signposting. Although it has been claimed that signposting can draw attention and promote human approach to bird habitats, the measure proved successful for Little terns in Portugal, where nesting success increase was registered after implementing the measure (Medeiros et al. 2007).

2.4.3 Habitat management

There are some cases in which habitat loss cannot be avoided, and for which alternative habitat restoration or creation is preferred. Extension of available habitat, creation of new ones or introduction of refugees are measures that have also been widely accepted by managers and researchers (Klein et al. 1995; Fasola & Canova, 1996). However, design must be careful in order to avoid off-refuge areas to become highly recreational, which could diminish the value of the refugee for birds (Klein et al. 1995)

Artificial islands have also been introduced in order to increase breeding success (Jung, 1991) or provide new roosting sites. For instance, in Cleveland (England), human development affecting roosting-sites for wintering birds was offset by the introduction of artificial islands (Burton, 1996). Although, they provided a new undisturbed habitat, non all birds felt attracted to roost in the island. Therefore, the authors highlight the importance of design and space of artificial islands, which must meet species specific requirements.

The effectiveness of creating new habitat to offset boat disturbance was assessed by Durell et al. (2005). In response to roost disturbance affecting shorebirds, a 100 ha area of mudflat was proposed in the Pont de Normandie (France). Whereas dunlins and curlews benefited from the measure, oystercatchers did not experience amelioration in their body condition. It was found that the new area influenced the presence of prey, and invertebrate densities were being reduced. This experience showed the importance of design new habitats effectively, considering proper locations, size and quality.

2.4.4 Education

Recreationists are not likely to be aware of the negative impacts that their presence may have on wildlife. Moreover, their unpredictable behaviour can hinder the effectiveness of certain measures (Carney & Sydeman, 1999). Encouraging education of countryside responsible access and environmental awareness promotes interest of current and future

generations (Sutherland, 2007). The most suitable form of education varies with location and depends on characteristics of the visiting population, for which social visitor studies are encouraged (Porter & Wescott, 2004).

Wildlife managers, wardens and local clubs (e.g. those providing recreational equipment) appear as a useful resource in this context, as they have direct contact with both nature and visitors and can stimulate visitor appreciation and support (Titus & VanDruff, 1981; Whitfield & Roche, 2007; Kim, Airey & Szivas, 2011; Liley et al. 2012).

The effectiveness of using an education campaign aimed at personal watercraft users proved to be a successful disturbance mitigation tool in New Jersey, where mandatory 3 hour courses about wildlife disturbance and damage, in combination with public meetings aimed at indicating most vulnerable sites, resulted in an increase in subsequent reproductive success of Common terns (Burger, 2003). However, these depend on the audience and their receptiveness, and are not likely to solve problems in the short term (Liley & Tyldesley, 2013).

Codes of conduct can be used to outline the responsibilities of or proper practices for individuals or groups. These can be subsequently enforced by bylaws, although paddling activities are not usually considered by these. An exemption can be found in Walpole (Massachusetts) where a zoning bylaw applies in order to preserve wildlife habitats and species among other aims (Town of Walpole, 2010). Other sites have adopted canoeing voluntary access agreements[2] such as the Beaulieu river (Larter, 2007), which can be combined with codes of conduct, as in Pembrokeshire, Wales (Activities Liaison Officer, 2012) (Figure 2.6).

In general, information is usually made available through leaflets, internet or clubs. In addition, in the UK, whereas England only counts on canoeing environmental guidelines (Canoe England, 2010), Wales and Scotland, owning codes of conduct at a regional level, have produced educational videos aimed at kayakers which attempts to raise awareness by showing coastal features of interest, legislation that protects them

[2] More information about voluntary access agreements can be found in Environment Agency (2006)

and the content of the codes from the kayaker's perspective (Animality productions, 2013).

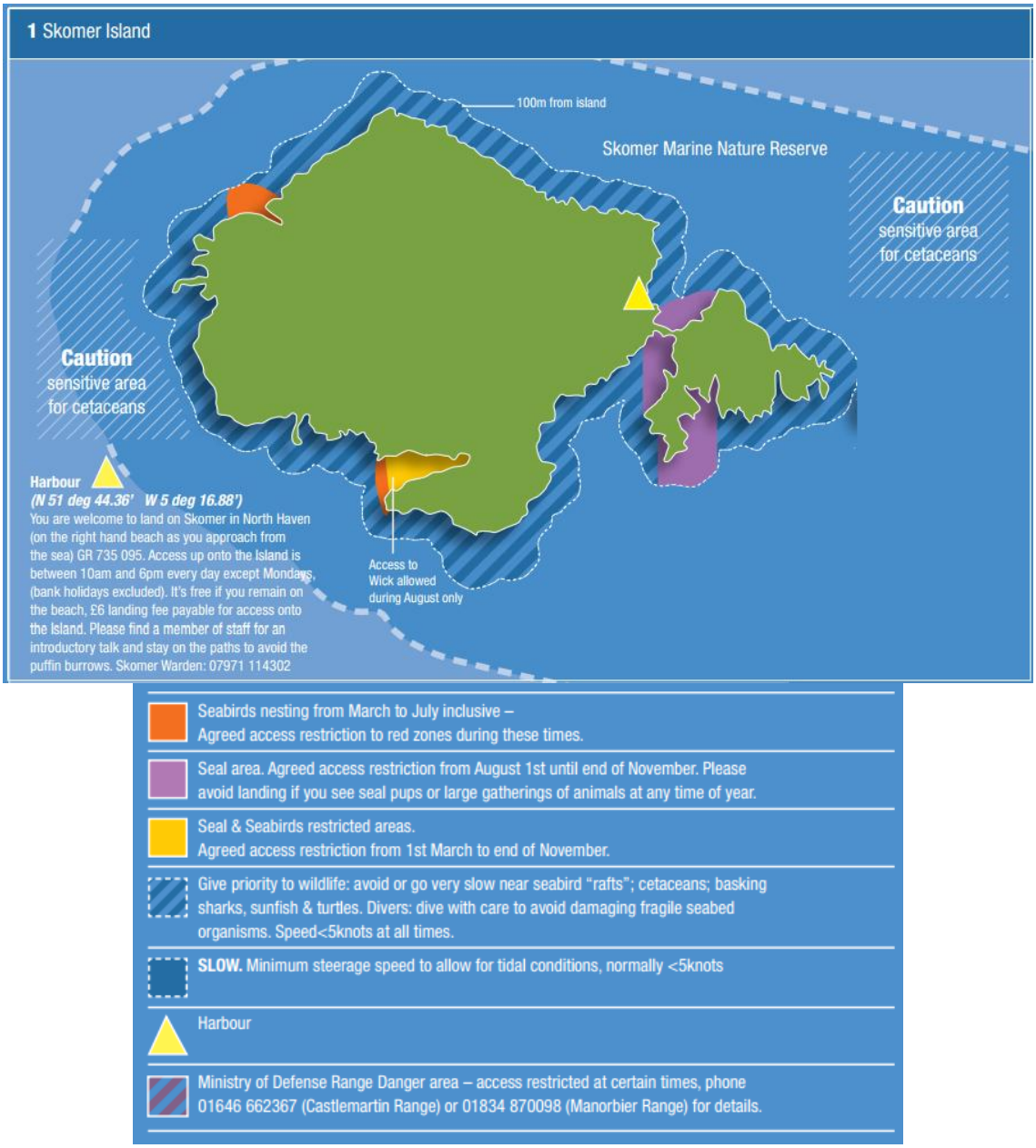


Figure 2.6. Example of Pembrokeshire agreed access restrictions: Skomer Island. Skomer Island is protected by different national and international designations and its declared a marine nature reserve. Image Retrieved from: http://www.pembrokeshiremarinecode.org.uk/wpcontent/uploads/2011/02/marine_code_maps.pdf

2.5 Summary

Critical discussion of the above areas of literature has permitted an understanding of disturbance impacts on bird populations caused by canoeing and kayaking, a key

requirement before introducing appropriate mitigation measures, and the first objective of this research study.

Whereas some authors claim the harmlessness of paddling activities, other studies have found that breeding birds and their colonial behaviour seem to be vulnerable to close approach of kayaks/canoes, with consequent reproductive failure and potential to expose chicks and eggs to predators; being overwintering birds more affected by energy losses caused by disturbance and habitat displacement.

In terms of mitigation measures, worldwide case studies have identified the most popular techniques (objective 2), for which monitoring must always be applied in conjunction. The adoption of one technique or another will depend on the present species and their requirements, as well as each site characteristics, including environmental but also social factors, which justifies the empirical research in the field of community awareness, a sociological approach towards recreation management that this study uses.

Chapter 3: Methodology

3.1 Introduction

This chapter outlines the methodology applied in this research project and its theoretical concepts. The selected methods used to acquire data (data collection) are outlined, clearly stating the advantages and disadvantages considered for their selection, and a specific section is dedicated to describe the location of the study and its characteristics. The research design is therefore discussed, with specific emphasis placed on the sampling selection criteria, followed logically by the data analysis techniques.

3.2 Methodology- underlying purpose

The thorough literature review has addressed the extent to which kayaking and canoeing can be considered a threat to the stability of bird populations, and which measures can be taken to mitigate their impact. Research gaps have identified the study of the sociological perspective to inform recreation management as a complement to experimental studies.

Accordingly, research objectives to be gained through primary research assisted in the selection of the methodology: a case study in Langstone Harbour (UK) based on documentary evidence, quantitative and qualitative data collection, which will provide evidence of whether canoeing/kayaking can be considered a disturbing activity for Langstone Harbour bird populations, and whether further mitigation measures should be encouraged.

3.3 Research methods employed

3.3.1 Overview of the methodology

The case study research strategy was chosen in this study in order to develop a detailed and intensive knowledge about a single case, which is preferred if ‘how’ or ‘why’

questions are the focus of the study, contemporary events are being considered and relevant behaviours or events cannot be controlled (Yin, 2009).

Various studies have used survey tools to identify coastal management issues of most significance to stakeholders and coastal managers (Vistad, 2003; Fletcher & Pike, 2007; Whitfied & Roche, 2007), or to assess visitors perceptions and awareness of recreation disturbance on wildlife (Priskin, 2003; Taylor & Knight, 2003; Vistad, 2003; Porter & Wescott, 2004; Orsini & Newsome, 2005**;** Sterl et al., 2008; Le Corre et al, 2013), sources of information that can assist to develop effective recreation management tools.

Using the case study's main strength: "ability to deal with full variety of evidence" (Yin, 2009, p.11), this study relies on both qualitative and quantitative methods, which allows overcoming weaknesses or biases resulting from the use of a single method (Bell, 2010). Accordingly, short questionnaires were delivered to water-based recreationists, and interviews aimed at different authorities and interest groups were conducted. The information collected was analyzed in conjunction with documentary evidence.

Therefore, the present case study relies on three different sources of evidence (Table 3.1), used to fulfil different research objectives, and conforming the case study database (Gillham, 2010). Literature review results and collected evidence were subsequently linked together in what Yin (2009) names as 'a chain of evidence', and 'converging lines of inquiry' were developed, a triangulation method that corroborates evidence repeatedly, strengthening the validity of the study.

Table 3.1. Three sources of evidence selected for the case study: Strengths, weaknesses and driving purpose.

Source of evidence	Strengths	Weaknesses	Driving Purpose
Documentation	▪ Provide a formal framework; ▪ Stable; ▪ Unobtrusive: not created as a result of the case study; ▪ Precise; ▪ Broad coverage.	▪ Retrievability: not always easy to find; ▪ Biased selectivity if collection is incomplete; ▪ Reporting bias; ▪ Access/Availability;	▪ [Objective 4] To investigate and understand recreational activities management in Langstone Harbour (applicable Policies).
Questionnaires	▪ Insightful into interpersonal behaviour and motives; ▪ Standardised questions provide straightforward analysis.	▪ Bias due to ambiguous or unclear questions; ▪ Response bias, accuracy and honesty of some answers may be questionable; ▪ Data collection must be carefully undertaken to gain a representative sample.	▪ [Objective 3] To asses and analyse Langstone Harbour recreationists' awareness in terms of applying regulations and present environmental designations, perception on the impact they believe their activities have, and opinions on which mitigation measures they would support as users.
Interviews	▪ Targeted: focuses directly on case study topics; ▪ Insightful: provides perceived causal inferences and explanations.	▪ Bias due to poorly articulated questions; ▪ Response bias; ▪ Inaccuracies due to poor recall; ▪ Reflexibility: interviewees give what the interviewer wants to hear.	▪ [Objective 4] To investigate recreational activities management in Langstone Harbour, and assess views and opinions on the problem of relevant managers and interest groups. ▪ Data concerning past and current status on bird populations in Langstone will also be presented and analyzed.

Source: Author's own. Adapted from: Yin, 2009; Guillham, 2010

3.3.2 Location of the case study: Langstone Harbour, UK.

Langstone Harbour was chosen for this study for several reasons.

First of all, as part of the Solent European Marine Sites (see Figure 3.1), the Harbour is recognized by its importance as a bird protection area, and is accordingly protected by different designations at national and European level. Particularly, in contrast to other Solent areas, Langstone Harbour has been considered to require further research in terms of bird population trends and disturbing activities (Armitage et al. 2002).

Secondly, it is considered a popular destination for water-based recreational activities, including kayaking/canoeing, whose increasing presence has been noted in the last five years.

In addition, the particular shared jurisdiction among different authorities and organizations present in Langstone Harbour, makes it an interesting research site to evaluate integrated coastal zone management in terms of recreation and wildlife conservation.

Finally, other practical reasons such as its proximity and accessibility to the researcher that could facilitate data collection also resulted important when selecting the case study location.

3.3.2.1 Langstone Harbour features of interest

Langstone Harbour is one of the inlets of the English Channel, lying between Portsmouth Harbour to the west and Chichester Harbour to the east (Figure 3.1a). It is part of the Solent, the body of water that separates the Isle of Wight from the mainland in the south of England. The Solent is a "low lying, low energy, sediment dominated estuarine complex" (Fletcher, Johnson & Hewett, 2007, p.585), unique in Britain and Europe for its complex tidal regime. It possesses a particular diversity of habitats; important sources of food, nesting and breeding sites for birds (Bayliss, 2002a; Coyle & Wiggins, 2010). Accordingly, it is internationally recognized and designated as a European Marine Site (SEMS), that collectively describes Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) of European importance, as well as a Ramsar Sites (Figure 3.1b). In addition, at a national level, the harbour is also designated as a marine Site of Special Scientific Interest (SSSI) and presents three Local

Nature Reserve (LNR) and (Figure 3.1c). The following table (Table 3.2) simplifies the relation between coastal/marine protection schemes applied at a European and UK level.

Table 3.2. UK designations towards coastal and marine protection. Blue cells correspond to EU policies, transposed to UK legislation, and white cells identify national legislation. Notice that EMS (marine-based) and SSSI (land-based) overlap in the intertidal zone.

Marine Spatial Planning and ICZM= Directive proposal, brings together common objectives of other directives and integrates different aspects of coastal management	MSFD = maintain or achieve 'good environmental status' (GES) in the marine environment by 2020
	UK= Marine Coastal Access Act (MCAA) + Marine Strategy Regulations 2010 + Wildlife and Countryside Act 1981 Local Nature Reserves (LNR) = planning tool for nature conservation that identifies wildlife or geological features that are of special interest locally
	Marine Protected Areas (MPA) = Coastal and marine areas where wildlife is protected from damage and disturbance, a MPA network will satisfy different international agreements[3] -It includes six different designations
	1. European Marine Sites= part of the Natura 2000 sites. Protected under Habitat and Bird Directives Marine areas above Mean Low Water Line Habitat regulations + Offshore Habitat regulations -SPA = Covers rare and vulnerable birds, and migratory species. -SCA= Covers habitats and non-bird species.
	2. Ramsar = conservation of wetlands and their resources of international importance 3. Marine Conservation Zones (MCZs) = protect nationally rare or threatened marine habitats and/or species as well as those representative 4. SSSI = protects species, habitats and geological features of national importance (above Mean Low Water Mark) 5. Scottish Marine Protected Areas 6. Northern Ireland: Marine Bill

Source: Author's own. Adapted from: EC, 2008; EC, 2013; JNCC, 2006; NE, n.d.b; NE, n.d.c.

The connection of Langstone Harbour with the neighbouring Portsmouth and Chichester harbours provide shelter for the development of fisheries and numerous recreational activities (Langstone Harbour Board [LHB], 2012a). As a leisure estuary, conflicts emerging between wildlife and visitors are present in a frequent basis, (Morris, 2008). The Solent has also a strategic role as a shipping waterway and trade, military activity and defence, which have supported its industrial development, launching its economy and attracting a continuously growing population and tourism (Fletcher et al. 2007).

[3] OSPAR Convention, World Summit on Sustainable Development and Convention on Biological Diversity.

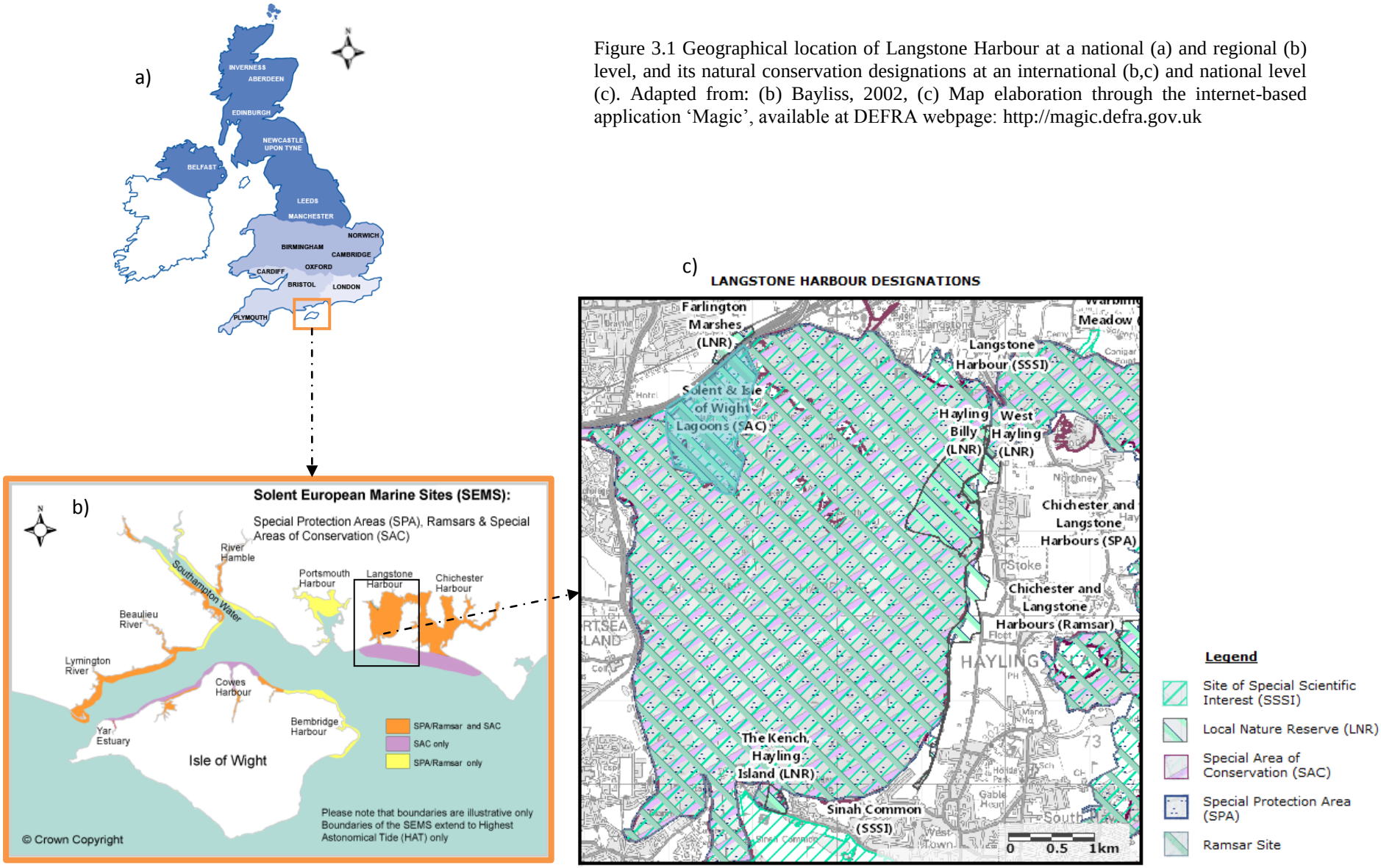


Figure 3.1 Geographical location of Langstone Harbour at a national (a) and regional (b) level, and its natural conservation designations at an international (b,c) and national level (c). Adapted from: (b) Bayliss, 2002, (c) Map elaboration through the internet-based application 'Magic', available at DEFRA webpage: http://magic.defra.gov.uk

3.3.2.2 The Solent Disturbance and Mitigation Project

The SEMS has the aim to "maintain the favourable condition of the site through the sustainable management of activities" (Solent Forum, 2011a, p.3), and therefore identification of potential detrimental activities and establishment of mitigation measures are among its objectives (Solent Forum, 2011a). The current SEMS management scheme was produced in 2011, and used Natural England European Marine Site risk review (commissioned by DEFRA) (Coyle & Wiggins, 2010) to inform its objectives. Accordingly, activities ongoing within the SEMS were assessed upon their likely impact on SEMS features, being water sports, kayaking and canoeing included and classified as "high risk" activities in the Solent (see Figure 3.2), requiring further management in order to comply with the Habitats regulations (Coyle & Wiggins, 2010; Solent Forum, 2012b).

Three Risk Tiers for the Solent European Marine Sites (SEMS)

Activities, plans and projects (identified in the first SEMS management plan) are classified into three tiers, according to "the risk they are considered to pose to the SEMS (i.e. high, medium and low risk tiers)" (p. 9). This classification is the result of considering:
-DEFRA's EMS risk review for the SEMS;
-Natural England's draft condition assessments;
-Results from annual SEMS monitoring reports;
-Discussions with some of the Responsible Authorities.

	Tier 1: High Risk	Tier 2: Medium Risk	Tier 3: Low Risk
ACTIVITIES	▪ Access/Land recreation ▪ Bait digging ▪ Fishing (commercial including shellfisheries) ▪ Water sports (hovercraft, kayaking and kite surfing)	▪ Agricultural run-off ▪ Airborne sports ▪ Anchoring ▪ Oil spill and clean up ▪ Recreational boating (power and sail)	▪ Angling ▪ Barrage/sluice operation ▪ Beach cleaning ▪ Boat repair/maintenance ▪ Education/ scientific study ▪ Egg harvesting ▪ Grazing ▪ Moorings (management) ▪ Navigation (maintenance) ▪ Slipway maintenance ▪ Wildfowling

Figure 3.2 Three risk tiers for the SEMS. Source: Solen Forum, 2011a.

These and other activities have been recently studied within the Solent through the "Solent Disturbance and Mitigation Project"[4], focusing on overwintering bird populations, indentifying additional mitigation measures to be applied in the Solent in response to the predicted housing development in the area. Responsibility to implement mitigation measures is given to Natural England and local authorities, although there is no time scale for their application. By having restricted the research to winter activities, this study has considered essential to also include breeding birds and recreational activities during other times of the year.

3.3.3 Documentary Analysis

Document evidence was used to back up, corroborate and argument evidence from the primary sources (Yin, 2009). It had a main role in the exploration of Langstone Harbour jurisdiction and policies affecting its management in terms of recreation, conservation and planning; approach for which different advantages and disadvantages have been identified (Table 3.3).

Tabla 3.3. Advantages and disadvantages of secondary data

Advantages	Disadvantages
• Scale and size; • Professional quality; • Accessibility; • Association with spatial referencing.	• May limit the scope of research, as existing data must be reinterpreted to fit own research data; • Must therefore be used as a compliment to primary data.

Source: Martin & Pavlovskaya, 2010.

3.3.4 Quantitative primary research: Questionnaires

Questionnaires were identified as a suitable mean of data collection (Table 3.4) that could provide factual information and explore the usage of the harbour, users' awareness of designations and rules governing in Langstone Harbour and opinions about recreational impacts and management techniques.

[4] Phase I: Stillman et al., 2009. Phase II: Fearnley, Clarke & Liley, 2010; Liley, Stillman & Fearnley, 2010; Stillman, West, Clarke & Liley, 2012. Phase III: Liley & Tyldesley, 2013.

Table 3.4 Types of survey-data methods of collection.

Unstructured	Listening to other people's conversation; a kind of verbal observation
↕	Using 'natural' conversation to ask research questions
	'Open-ended' interviews; just a few key open questions, e.g. 'elite interviewing'
	Semi-structured interviews, i.e. open and closed questions
	Recording schedules: in effect, verbally, administered questionnaires
	Semi-structured questionnaire: multiple choice and open questions
Structured	Structured questionnaires: simple, specific, closed questions

Source: Gillham, 2010, p. 60

As a scientific instrument, questionnaires allow gathering information about a 'population' (group of individuals under examination) through the use of a standardized set of questions administered to a number of respondents (Gillham, 2010). Table 3.5 outlines the advantages and disadvantages encountered when using questionnaires as a research tool.

Table 3.5. Advantages and disadvantages of questionnaires

Advantages	Disadvantages
• Low cost	• Non-flexibility
• Each respondent receives identical set of questions, phrased exactly in the same way, providing standardized responses	• Difficult of securing an adequate response
• No recording errors	• Sampling problems, inability to learn reasons of non-responses
• Respondents are free to answer in their own time and at their own pace (if self-administered)	• Complex instrument, questionnaire design will determine the quality of responses
• Confidentiality guaranteed within questionnaires may elicit more truthful responses	• No opportunity to obtain supplementary observational data
	• Possibility of misinterpretation of the questions by the respondents

Adapted from: Burns, 2000.

3.3.4.1 Sample

Questionnaires were aimed at water-based recreationists of Langstone Harbour present during the summer months. One hundred questionnaires were handed at the Portsmouth Watersports Centre with the manager's consent, aiming to increase the response rate and minimize interviewer bias (Oppenheim, 1992). However, the low response rate

encountered in the first week led to use other data collection techniques: face-to-face questioning. Because the study was dealing with a specific subset of the general population and contact details were unavailable, non-random quota sampling was used to select participants. This sampling method seems useful when time is limited, a sampling frame is not available, or when detailed accuracy is not important, as in exploratory studies (Visser & Jones, 2010a).

Nevertheless, the use of this technique presents some limitations. Only those individuals that were available or willing to participate constituted the sample. This convenience or volunteering sampling implies the obtaining of a non-representative sample of summer recreationists in Langstone Harbour, and under represents other unavailable/inaccessible visitors. In addition, interviewer bias was likely to affect participants' responses. Ensuring properly worded questions that avoided leading the respondent was applied to compensate this issue. Section 3.5 tackles how the study will meet validity and reliability challenges.

3.3.4.2 Questionnaires content and design

The contents of questionnaire were based on the research objectives that were sought through the method, acceptability for participants and ability for their subsequent analysis and interpretation (Bell, 2010). The questionnaire used counted on 13 different types of short closed-ended questions, which although appear difficult to construct, provide relatively easy analysis and generates less coded variance (Bradburn, Sudman & Wansink, 2004; Gillham, 2010). The following table (Table 3.6) demonstrates different advantages and disadvantages of using open and close questions.

Table 3.6. Advantages and disadvantages of open and close questions.

Type of question	Description	Advantages	Disadvantages
Open question	Questions are not followed by any kind of choice	Freedom and spontaneity of the answers; Opportunity to probe; Useful for testing hypotheses.	Time-consuming; Costly and slowly coding; Demand more effort from respondents.
Close question	Respondents are offered a choice of alternative replies	Require little time; Easy to process; Make group comparisons easy; Useful for testing specific hypothesis;	Loss of spontaneous responses; Bias in answer categories; Sometimes too crude; May irritate respondents.

Source: Oppenheim, 1992.

The design of the questionnaire followed the internal logic of inquiry and the likely reactions of respondents (Oppenheim, 1992), as presented in Figure 3.3. A variety of question types were used, including multiple-choice questions, rating scales, grids, use of a map or checklists among others (a questionnaire copy is available in Appendix C). It was designed to take participants a maximum of five minutes to complete. Confidentiality and anonymity of respondents was emphasised in order to achieve a higher response rate (Gillham, 2010).

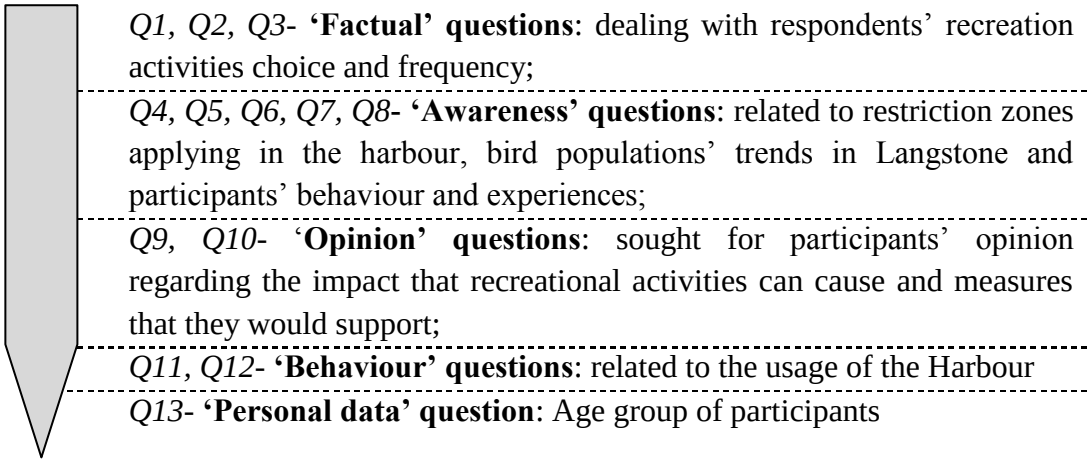


Figure 3.3. Design of the content of the questionnaire. Q12 was accompanied with the use of a map that permitted participants to localize the areas of the harbour they used. In addition, space for further comments was allowed.

The sequence used responds to a 'funnel approach', which progressively narrows down the scope of the questions until achieving specific points (Oppenheim, 1992).

3.3.4.3 Pilot Study

Before starting to collect information it was important to pilot the data-gathering instrument in order to test its duration and check if instructions and questions were clear (Bell, 2010). Ideal pilot studies are tested on a group similar to that at which the research aims (Bell, 2010). Accordingly, the questionnaires were piloted using local people, volunteers who were subsequently asked to inform about the time they had needed to complete them, the clearness of the instructions and questions, potential questions that could find objectors and layout. The feedback provided a useful evaluation of the instrument and changes were made to improve its attractiveness and clearness.

3.3.4.4 Procedure

Self-administration of questionnaires at the Portsmouth Watersports Centre (PWC) allowed respondents to complete them at their own convenience. Located at the entrance of the establishment, questionnaires and a participant information sheet were made available. After a week of a zero response rate, a colourful poster was used to draw attention over the participants; With the purpose of obtaining more returns, questionnaires were given personally at the Portsmouth Watersports Centre (PWC) slipway and Oysterbeds water-access area (Hayling island) (two of the five harbour slipways, where access for the researcher is facilitated, and probability of encountering water-based recreationists is high). Each visitor met at the survey spot was asked to participate, being the refusal rate very low (2/53<4%). This procedure allowed completing the questionnaire on the spot and explaining the purpose of the study, although not in full detail, only referring it as a study of 'your visit today'. It was preferred against telephone, postal or online distribution because of the specific target group and the increased likelihood to get better cooperation.

Data collection finished the 19th August 2013, when a sample of around 60 participants was achieved (detail of survey days are illustrated in Table 3.7).

Table 3.7. Survey days. Includes detail of date, time, location and number of participants. There was an average number of two visits per week in both Oysterbeds or PWC, being the latter the most visited due to accessibility and cost reasons. Participants were approached during two different sets of time ranges (Morning: 10-13 am; Evening 16-19 pm). Note that the first and final day face-to-face questionnaires were not distributed.

Date	Day of the week	Time range	Location	Nº Participants
16/07/2013	Tuesday	-	PWC	0
20/07/2013	Saturday	10-13 am	Oysterbeds	8
22/07/2013	Monday	16-19 pm	PWC	4
25/07/2013	Thursday	10-13 am	Oysterbeds	5
28/07/2013	Sunday	16-19 pm	PWC	8
01/08/2013	Thursday	16-19 pm	Oysterbeds	5
05/08/2013	Monday	10-13 am	PWC	4
07/08/2013	Wednesday	10-13 am	PWC	4
10/08/2013	Saturday	10-13 am	Oysterbeds	7
13/08/2013	Tuesday	16-19 pm	PWC	5
19/08/2013	Monday	-	PWC	9 (PWC bucket)

Source: Author's own

3.3.4.5 Statistical treatment

The use of statistics was merely descriptive, providing accumulated data summaries in tables, graphs or charts (Guillham, 2010; Robbins, 2010). Statistical tests were casted aside because, in general, significance testing cannot be justified in quota sampling (Gschwend, 2005), and especially because the sample size could not provide enough frequency data to compare results among user groups.

Data was processed using Excel 2010 and was supported by a data base or 'code book' (Oppenheim, 1992) that included the text of the original questionnaire complete with filter questions, probes and pre-codes and production of tabulate data, following the process outlined in Figure 3.4.

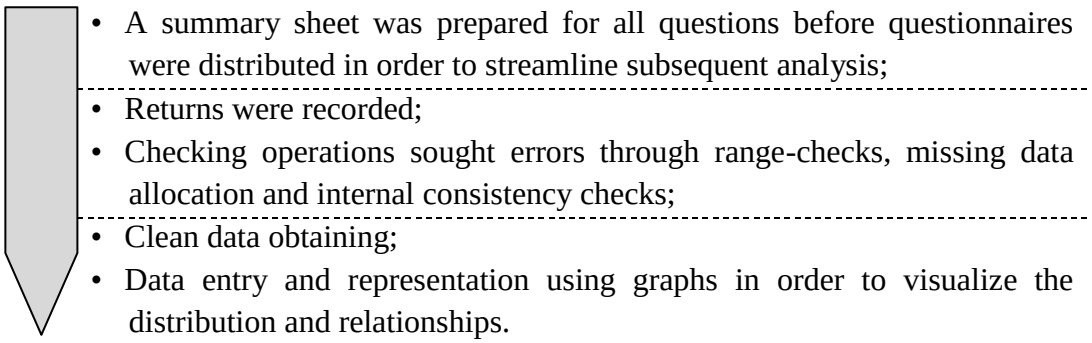


Figure 3.4 The process of analysis of quantitative data. Adapted from: Bell, 2010; Visser & Jones, 2010a

Tabulate data, including frequency distribution, is available in Appendix D, whereas graphic representation is used for analysis and included in Chapter 4.

3.3.5 Qualitative primary research: Interviews

Interviews were selected as the second means of primary data collection. Aimed at harbour managers and interest groups, qualitative data provided useful insights into the topic: management of the harbour, past and current status of bird populations in the harbour, and opinions on potential impacts and management issues. Data collection through interviews proved to confirm theoretical advantages and disadvantages stated for the method (Table 3.8).

Tabla 3.8. Advantages and disadvantages of interviews.

Advantages	Disadvantages
• Adaptability; • High response rates, permitting longer questionnaires; • Interviewers can observe the surroundings, and can use nonverbal communication and visual aids; • Explores stories and perspectives of informants; • Respondents are free to answer according to their own thinking, not being constrained by few answers; • Suitable for exploratory and inductive types of study.	• Time-consuming (transcription, long period for collecting the data); • Subjective technique and therefore there is always the danger of bias; • Not all participants are available or accessible; • Some participants are unwilling to talk to strangers; • Difficult to interpret and analyze data; • Questions may be altered or participant coached by interviewers.

Adapted from: Bell, 2010 & Burns, 2000.

3.3.5.1 Subjects

There were seven interviews conducted in total. Participants were selected by their occupation, targeting relevant authorities identified in the Langstone Management Plan (LHB, 1997), which are presented in Figure 3.5. The interviewees were considered 'experts' in different issues tackled by this study "from whom you hope to learn how certain practices, experiences, knowledge, or institutions work" (Secor, 2010, p.199).

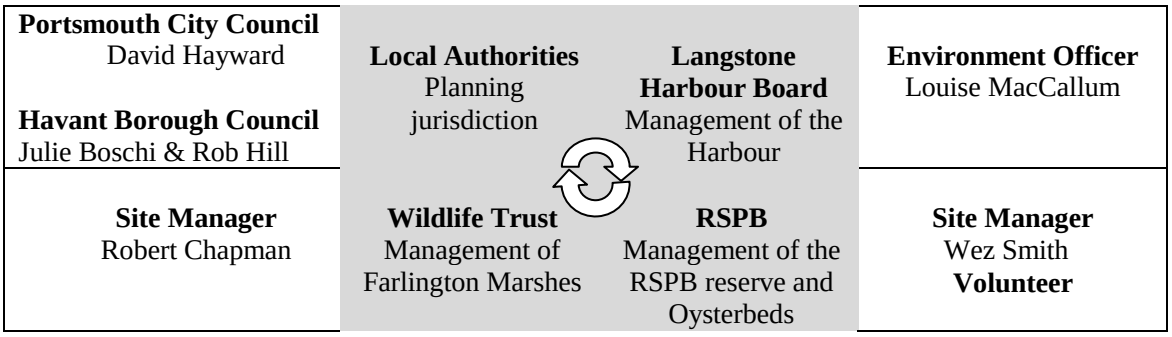


Figure 3.5 Interview participants at a management level. Source: Author's own

In addition, the study counted with the collaboration of Peter Bisset, old member and current chairman of the Portsmouth and District Canoe Club, which undertakes numerous activities within the site of interest.

Refusals where obtained from the Portsmouth Watersport Centre manager and Natural England, although the latter's role is analyzed in Chapter 6.

3.3.5.2 Materials

There are different types of surveys that can be undertaken according to the nature or type of questions used (see Table 3.3). Semi-structured interviews were employed in order to "conduct discussion not only to reveal and understand the 'what' and the 'how' but also to place more emphasis on exploring the 'why'" (Lewis et al. 2003, p.248). The form of this type of interviews allowed certain questions to be adapted or omitted, depending on the individual approached, particularly relevant to this study, where each target sample is somewhat different in context. Interviews were conducted face-to-face in order to make the most of the communication richness (Guillham, 2010), and locations were a choice for the participants in order to ensure their availability. Tape-recording allowed keeping eye contact during the interview (Bell, 2010).

The interview content (Appendix F) counted on six different sections, that had different types of questions depending on the sought information: experience, knowledge or opinion-based; In order to avoid a difficult post-analysis, the interviews derived from a common and general set of questions (Figure 3.6) that were subsequently modified in order to fit interviewees characteristics (Gillham, 2010).

Common set of Interview Questions

- Icebreak questions;
- Role of the authority/organization in Langstone Harbour;
- Collaboration with other authorities/organizations;
- Knowledge of the current status of bird populations in Langstone Harbour;
- Solent Disturbance and Mitigation Project, recreational activities potential to bird disturbance in Langstone Harbour;
- Views on the issue;
- Proposed mitigation measures;

Figure 3.6 Common set of interview questions. Source: Author's own

3.4.5.3 Pilot interview

A pilot interview was used to test the questions effectiveness and improve the method; a research assistant was invited to participate for this aim. The main modifications that were made to the first interview draft are listed in the following figure (Fig. 3.7).

Pilot interview outcomes

- Requirement of introduction questions
- Focus the interview topics, elaboration of more concise inquiries
- Improvement of the structure for a 'more natural' conversation interview
- Decide on 'prompts' as issues that may need to be reminded to the interviewee

Figure 3.7 Main modifications pursued after piloting interview questions. Source: Author's own

Subsequently, each interview served to some extent as a pilot for the following, considered as 'pilots for the real thing' (Gillham, 2010).

3.3.5.4 Procedures

Participants were initially contacted by e-mail in order to introduce the project and arrange a convenient date for the interview to be conducted. In the first instance, face-to-face interviews were suggested, although the participants were also provided with the option of telephone or email interviews in order to ensure a better response rate.

Ethical issues were also taken into account. Accordingly, participation sheets and consent forms were facilitated (Appendix E), and participants could agree to be recorded and named, as part of the study. By letting the participants know about the content of the interview, some provided documentary evidence or suggested valuable reading. In another case, one of the participants (Boschi, HBC) invited a second interviewee to participate in the discussion (Hill, HBC).

Interviews were conducted during July and August 2013 and lasted between 35 minutes up to an hour.

3.3.5.5 Information treatment

Interviews were recorded while taking notes and subsequently transcribed verbatim, only abridged when encountering non relevant data to the study. Transcription was carried out no later than two days after the actual interview. It served to identify sequences of related talk, examine how speakers took on certain roles or identities through their talk and look for particular outcomes (Silverman, 2005). Subsequently, substantive statements were highlighted and repeated topics were categorized for further analysis. Accordingly, a classification scheme or 'code' was designed after obtaining all returns, enabling a narrowed focus to significant areas (David & Sutton, 2011). A

database of all documentation was created in Microsoft excel in order to maintain a chain of evidence, it included information collected from the internet, provided by the participants or other sources, such as leaflets and newspaper articles. The collection of these data permitted the comparison and contrast of interviewers responses, analyzed in four different sections (Chapter 5). Quantitative data such as working experience or disturbing activities ranking permitted graphic representation.

3.4 Case study analysis

Case studies use a narrative form that follows the logic of the investigation, led by evidence (Stake, 2000). The case study analysis was based on the using of both qualitative and quantitative data, strategy considered to be analytically strong (Yin, 2009).

The three sources of information were used to provide a consensus and reveal similarities and contradictions among the data sets. Typically, strong similarities can be considered as a validation of the data and conclusions, whereas incongruities indicate methodology failure and identifies areas that require further research (Guillham, 2010). Triangulation also permitted the identification of key variables that assist in the explanation of certain phenomena (Yin, 2009). Overall, two key themes are drawn from the overall discussion: potential bird disturbance that kayaking/canoeing may have in Langstone Harbour and effective measures applicable in the site, permitting to achieve the aim of the study.

3.5 Validity and reliability

A common concern applies to the poor basis of single case studies for generalization (Gomm, Hammersley & Foster, 2000; Stake, 2000). Nevertheless, the case study strategy aims to "achieve generalizable additions to knowledge which have implications for theory" (Gillham, 2010, p.15), it allows the reader to recognise essential similarities to cases of interest to them and establish a basis for comparison and 'naturalistic generalization' (Stake, 2000).

In order to obtain sound and reliable data, important quality criteria must be met; and can be evaluated through four different design tests, summarized in Table 3.9 where strategies developed to overcome the limitations of the study are also referred.

Table 3.9 Case study tactics for four design tests and application in Langstone Harbour Case Study.

Design Tests	Case study techniques	Strategy developed
Construct validity	• Use multiple sources of evidence Triangulation of data, methodology & theory	• Use of documentary analysis, questionnaires and interviews; development of converging lines of inquiry;
	• Establish a chain of evidence	• Repetitive reference to objectives and evidence findings that permits following the derivation of evidence from research questions to final conclusions. Final discussion where the three sources of information converge;
	• Have key informants review the draft case study report	• Review of study draft by project supervisor if possible;
Internal validity	• Pattern Matching	• Pattern Matching: comparison and contrast of the three sources data to draw conclusions and identify variables, used to compare the case study pattern with theoretical predictions;
External validity	• Use theory in single-case studies	• Analytic generalization from the set of results to some broader theory;
Reliability	• Use a case study protocol	• Project proposal design elaborated in March 2013 and reference to research methods literature;
	• Develop a case study data base	• Separate collections of evidentiary base and report; Access to the case study database permitting to follow the derivation of evidence from research questions to final conclusions;

Source: Author's own, adapted from Yin, 2009, p. 41.

3.6 Summary

This chapter has indentified the methodology to be used in this study, exploring a wide range of research methods, their strengths and weaknesses, and selecting those that are practical and relevant to the research questions. Accordingly, the study utilises short closed questionnaires aimed at Langstone Harbour recreationists, and semi-structured interviews aimed at relevant authorities and interest groups influencing Langstone Harbour management, supported by documentary evidence.

Triangulation methods are used to increase the validity and reliability of the results, permitting the obtaining of evidence that permits definition of further research and best practice for recreation management in the Harbour.

Chapter 4. Questionnaires: Results and Analysis

4.1 Introduction

This chapter reviews the responses to the questionnaires delivered to Harbour users during the months of July and August 2013. It summarizes the quantitative data through the use of different graphics, permitting a visual presentation of the outcomes and further analysis, using references to similar past studies. A copy of the questionnaire used is available in Appendix C, and tabulated results can be found in Appendix D.

4.2 Response rate

Although one hundred questionnaires were made available at the Portsmouth Watersports Centre for self-administration, there were only 12 returns by the end of August (4 of which were invalid).The low rate was therefore compensated through face-to-face delivery of questionnaires. Consequently, the overall number of respondents reached 59, corresponding to a 59% of response rate, a figure that was considered to illustrate information of Harbour users.

4.3 General characteristics of participants: Age

Participation was categorized by participants' age in 4 different groups, being the age group 18-34 the most present in the Harbour (47%), followed by older adults from 35 to 55 years old (34%), as illustrated in Fig. 4.1. This section was included in the questionnaire in order to ensure that the population sample could be deemed representative.

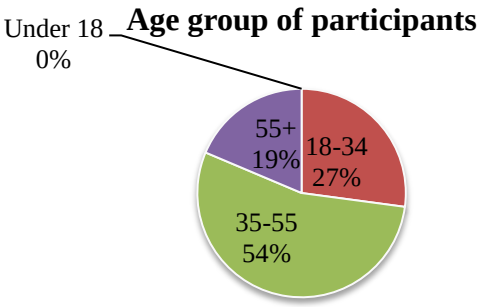


Figure 4.1 Age group of participants. Age groups are presented as a proportion of the total number of participants.

Results coincide with the national trend as presented in the 'Watersports and Leisure Participation Survey 2012' (Arkenford, 2012), which states that the 18-34 age group is showing the most favourable long term growth in participation for canoeing. However, the 'Under 18' group appears underrepresented, mainly due to the difficulty to approach them, as they were mostly seen partaking water-based activities in big groups and under surveillance of the Portsmouth Watersports Centre staff. As a matter of fact, the British Canoe Union [BCU] indicates that 50% of their participants in England are aged 11-15 and a 28% are aged 16-24 (BCU, 2009). The results will be therefore limited to express information about adult paddlers.

4.4 Recreational activities in Langstone Harbour: Presence and frequency

The first three questions were aimed at obtaining information about the popularity of certain recreational activities in the harbour, times of the year when they were practiced and reasons that had led participants to choose the harbour.

In the first place, it is recognized that not all users were equally accessible and thus results are only used to justify the strong presence of paddlers in the harbour, representing the most popular activity among participants (55%), followed by windsurfers (22%) and sailors (15%) (See Fig. 4.2). There are no available data concerning levels of participation in the Harbour to compare with, as the Langstone Harbour Board monitors a limited number of activities.

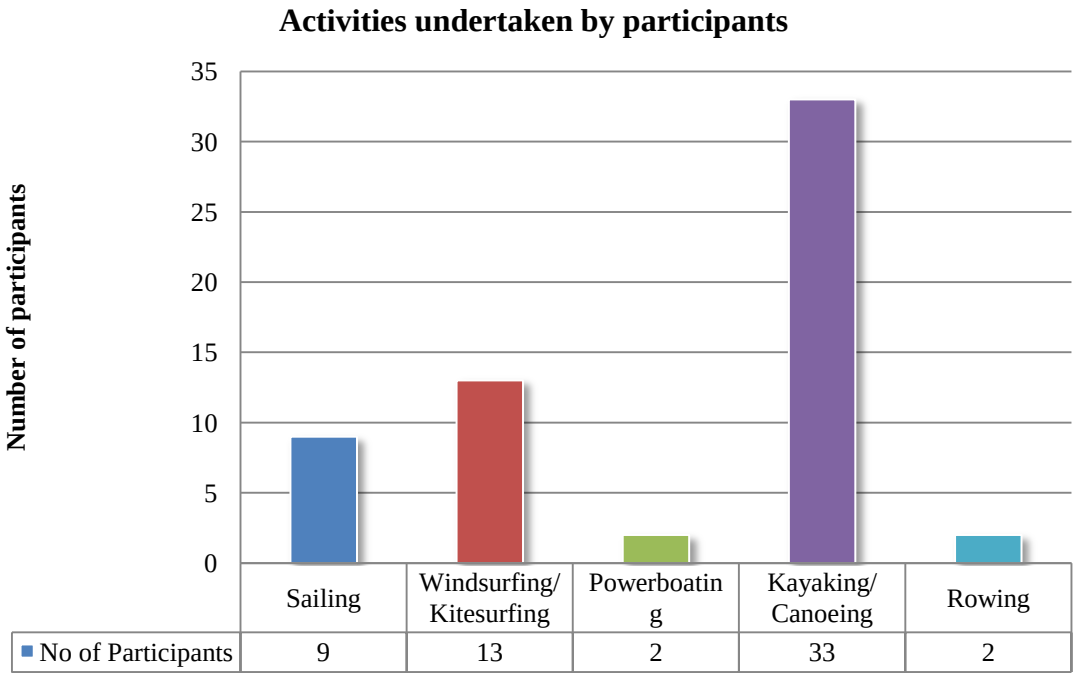


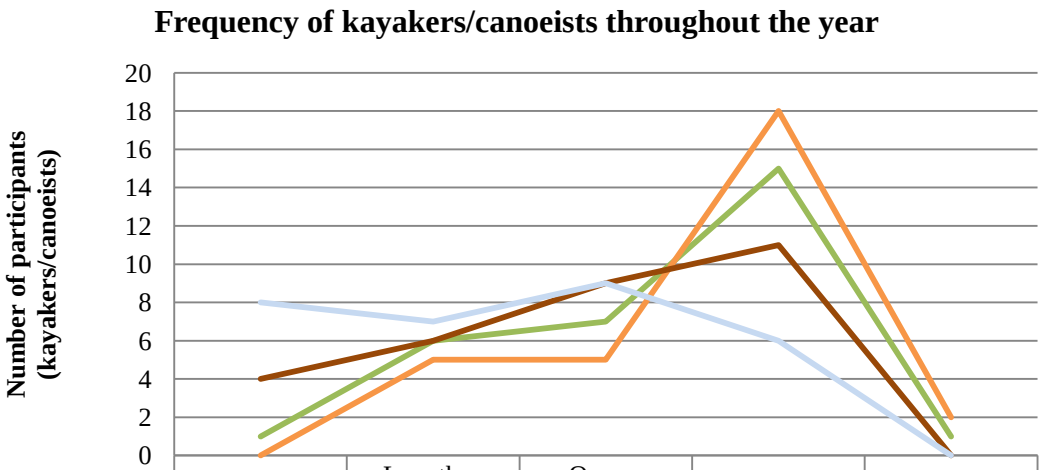
Figure 4.2 Number of participants and associated recreational activities. Activities put on choice were selected according to those offered by the Portsmouth Watersports Centre, as it was considered the first main location to establish contact with participants.

Regarding the frequency of practice of these recreational activities, at a national level it is claimed that the majority of water-based activities are mainly concentrated in the summer, including canoeing (BCU, 2011; Arkenford, 2012). The same results were provided by a visitor survey undertaken in the Solent region during the winter 2009/2010 (Fearnley, Clarke & Liley, 2010).

However, Langstone Harbour presents participation levels throughout the year, showing the peak of activity during the summer and a reduced presence during winter months, when the 'never' category is mostly chosen by participants (see Figure 4.3). Chung (2009) explains that urban areas are characterized by a weaker seasonal fluctuation than remote locations, as well as sites which are not specialized in tourism (e.g. beach resorts).

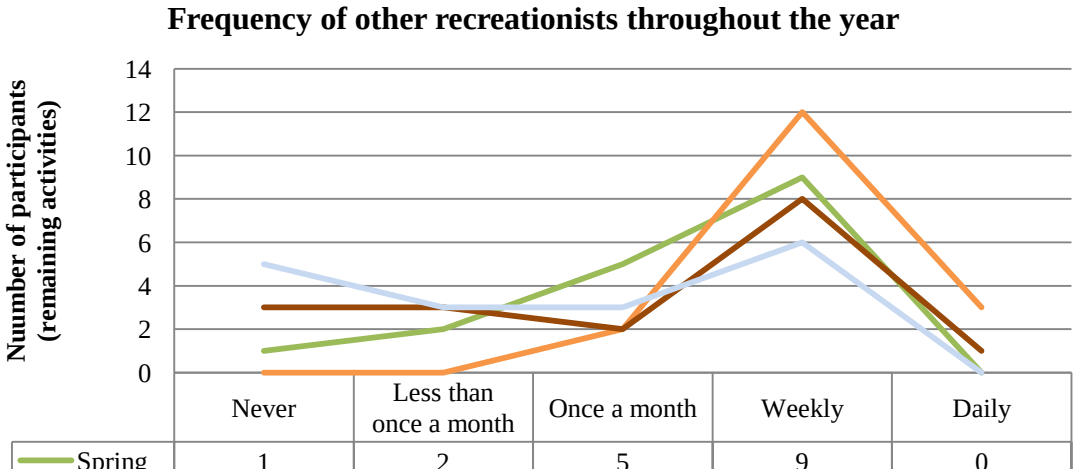
Twelve participants were first-timer visitors and did not contribute to provide information about the frequency of their participation. From the remaining 47, 30 accounted for kayakers/canoeists, indicating a strong presence of experienced paddlers in the Harbour. The following graphs (Figure 4.3 and 4.4) depict the frequency of

paddlers and the rest of the considered activities respectively[5], being the former more present during autumn and winter months, whereas spring and summer season show similar proportions of recreationists in both figures.



	Never	Less than once a month	Once a month	Weekly	Daily
Spring	1	6	7	15	1
Summer	0	5	5	18	2
Autumn	4	6	9	11	0
Winter	8	7	9	6	0

Figure 4.3 Frequency of participants undertaking kayaking/canoeing in Langstone Harbour.



	Never	Less than once a month	Once a month	Weekly	Daily
Spring	1	2	5	9	0
Summer	0	0	2	12	3
Autumn	3	3	2	8	1
Winter	5	3	3	6	0

Figure 4.4. Frequency of participants undertaking windsurfing, sailing, powerboating and rowing in Langstone Harbour.

[5] A bigger sample size would allow comparing both groups and identify statistical significant differences.

If first visitors are included in the summer category, a stronger seasonal variation is perceived.

Nevertheless, these results indicate the exposure of bird populations to water-based recreational activities throughout the year, as there is a strong presence of regular recreationists. The summer would be the most susceptible time of the year to these activities, when the proportion of first-timers rises.

Considering the features making Langstone an attractive place for water-based recreation, participants provided different reasons that had brought them to the site. Results demonstrated the variety of preferences that visitors had (Figure 4.5). Over a quarter of respondents qualified Langstone harbour as the right place for undertaking their activity. A significant proportion of participants (66%) had selected the site for its proximity to their homes, indicating that over a half of respondents lived in the local area. Attractive views were also valued by 51% of the respondents, whereas 22% showed that a particular interest for wildlife had led them to the site, which can refer to both bird populations and seals present in the Harbour.

Parking and launching facilities, together with choice of routes summed around 20% of responses respectively, whereas other type of facilities (e.g. toilets, rest places, benches...) were only valued by 8% of participants, indicating a lack of visitor facilities that would probably discourage more people to come, as suggested in Fearnely et al. (2010) visitor survey. Nevertheless, it can also be related to visitor capacity management, a control technique commonly used in marine protected areas (Pike, Johnson, Fletcher, Wright & Lee, 2010). Further study of motivational factors bringing users to Langstone could be used to better understand seasonality and tourism (Chung, 2009).

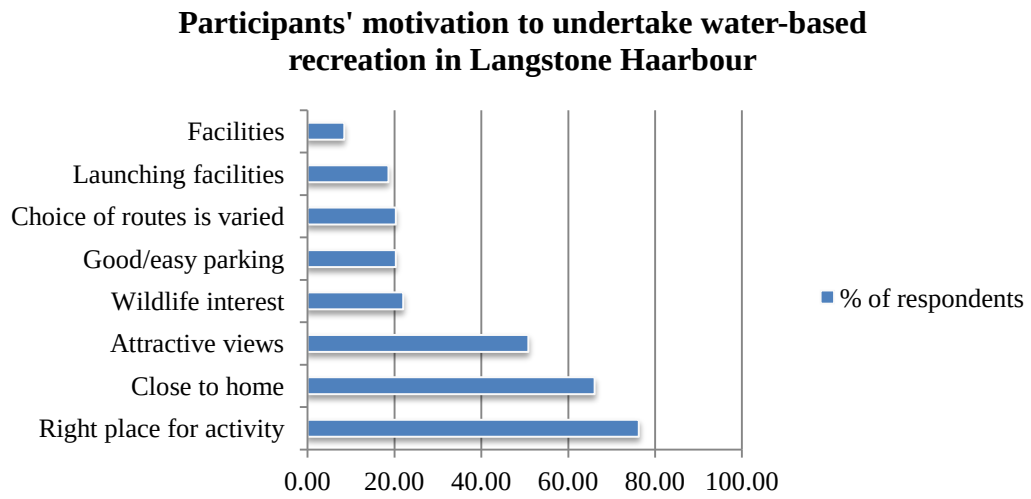


Figure 4.5 Participants' motivation to undertake water-based recreation in Langstone Harbour.

4.5 Participants' awareness on Langstone Harbour access and bird populations

Participants were asked about their knowledge on restriction access areas applying in the Harbour (referring to the banning of access to the Langstone Harbour reserve islands). A significant proportion of respondents (29%, N=59) admitted not to be aware of these, although kayaking/canoeing practitioners (n=33) showed a greater awareness than other users, being almost 80% of paddlers 'aware' against a proportion of 61% of other users (n=26) (see Figure 4.6). Considering the length of time the restriction has been in operation and the amount of regular recreationists, it is interesting to note that nearly a third of the sample were found to be unaware.

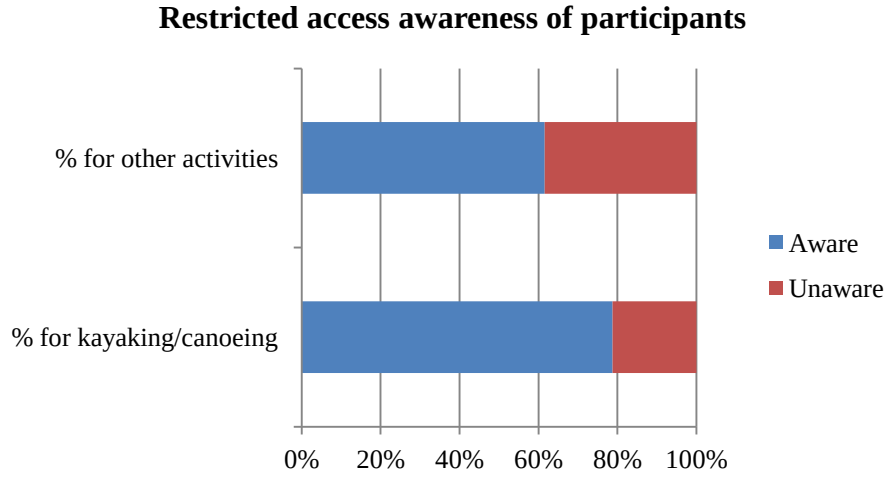


Figure 4.6 Restricted access awareness of the participants.

The distinction between ‘aware’ (n=42) and ‘not aware’ (n=17) recreationists will serve to identify awareness on other aspects of the harbour in subsequent sections.

Own compliance with access restrictions (see Q6, Appendix D) was evaluated as ‘good’ by most of ‘aware’ respondents (74%), and only two participants admitted accessing the islands by mistake: “I landed on the wrong island and did not notice the sign” or for having “technical problems” respectively.

Considering ‘aware’ participants’ experience with observing non-compliance events, 14% of respondents confirmed wrong behaviour sighting at least once, whereas 48% reported that non-compliance had been observed more than once (see Figure 4.7)

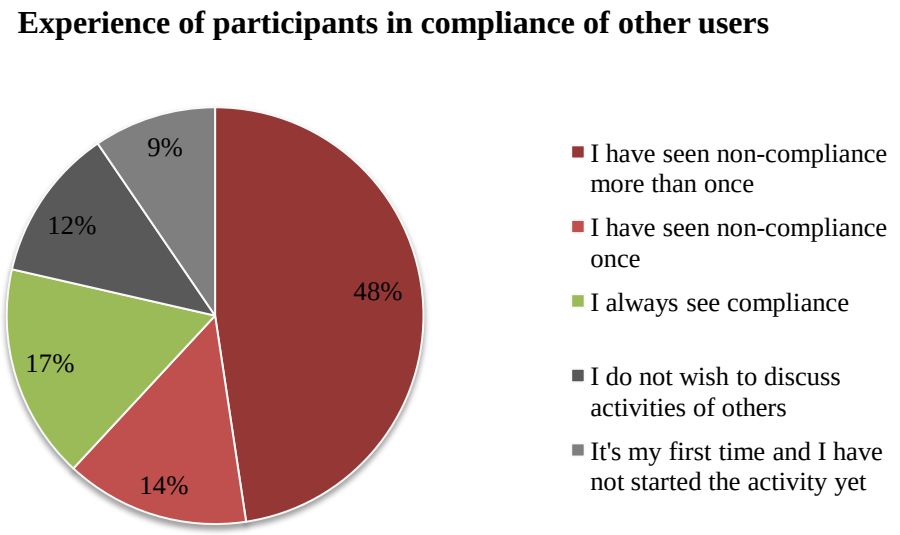


Figure 4.7 Experience of participants in compliance of other users.

Although ‘frequent non-compliance’ response option was not chosen by any participant, the proportion of occasional non-compliance is high, indicating a misuse of the available information and failure of current management measures.

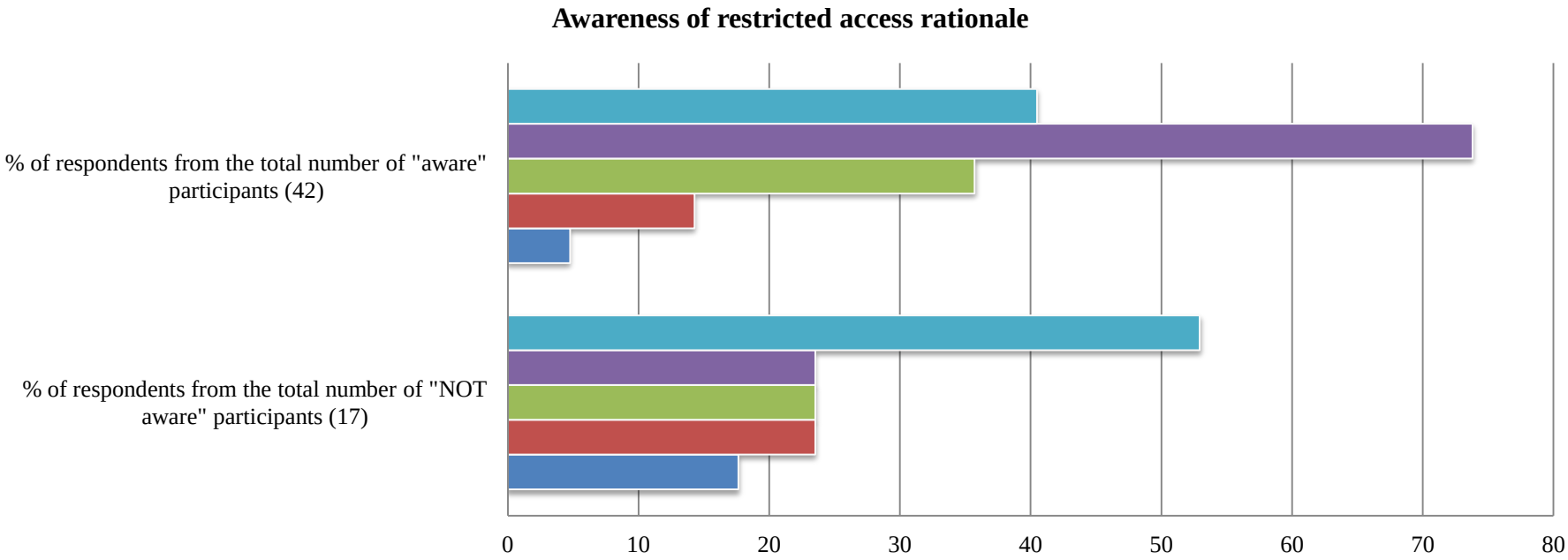
All participants were also questioned about the reasons they thought that could have led to implement restricted areas in the harbour. The only correct answer was ‘important habitats and species conservation’, for which only 4 out of the 59 participants marked as correct, being all of them paddlers. Recreationists are not prohibited from entering ‘unsafe zones’ or areas marked out for alternative watersports and, although there are

byelaws which require small craft not to impede the navigation of vessels, these are not prescribed zones (LHB, 1993).

Figure 4.8 shows that around 74% of ‘aware’ respondents (n=42) considered habitats and species conservation as one of the causes why restriction access was present, and although it may intuit a general degree of awareness, responses were given in conjunction with other options. In addition, it limits drawing conclusion of whether participants have actually seen compliance or not.

In the case of ‘unaware’ participants (n=17), more than half of respondents thought that ‘unsafe zones’ was a more likely cause of restricted access over conservation.

In this context, the use of false response options permitted to investigate the actual knowledge of users on the harbour regulations, showing a surprising low level of awareness, and hindering to obtain conclusions regarding compliance and incompliance sighting.



	% of respondents from the total number of "NOT aware" participants (17)	% of respondents from the total number of "aware" participants (42)
Unsafe zones due to sea currents or tidal reasons	52.94	40.48
Important habitats and species conservation	23.53	73.81
There are main navigation channels	23.53	35.71
Other water-based activities take place	23.53	14.29
I don't know	17.65	4.76

Figure 4.8 Awareness of restricted access rationale in Langstone Harbour by ‘aware’ and ‘unaware’ recreationists.

In order to enquire the causes of such low levels of awareness, participants were asked about the means they had used to be informed of access restrictions (Figure 4.9). It is recognized that the harbour counts on posters and signposts at some of the Harbour access points, and 'No landing' sings on the islands, as well as leaflets available in the Portsmouth Watersports Centre. However, there are a limited number of websites covering this information and referring to birds' conservation (see Appendix G).

'Aware' participants recognized signposting as the most popular mean of information, chosen by 62% of respondents. 'Other harbour users' were also referred as means of learning about restricted access (40%).

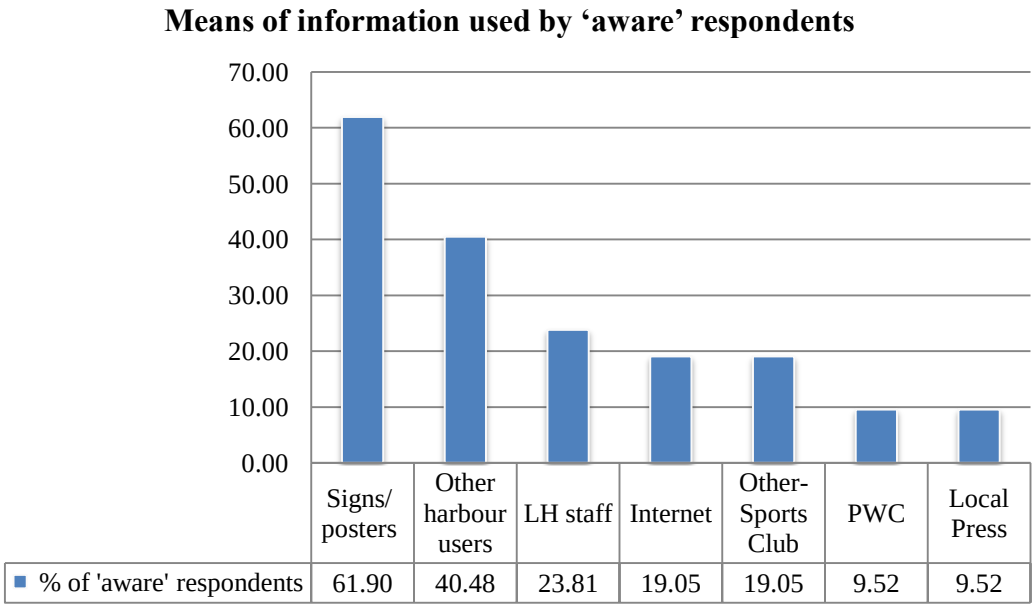


Figure 4.9 Means of information used by 'aware' respondents.

It was also suggested that sports clubs played a significant role in delivering information to their members, recognized as "novel channels of communication" (Whitfield & Roche, 2007, p.564), 19% of participants filled the response choice 'others' with the name of their club or association, including the Portsmouth District Canoe Club and the Sailing Club. However, the Portsmouth Watersports Centre (PWC) did not stand out for its information delivery.

These findings demonstrate a lack of availability of appropriate information: signage, interpretation and publicity (Pike et al. 2010).

The final 'awareness' enquiry assessed knowledge of the users about the bird population trends in the Harbour (see Figure 4.10). Whereas 100% of 'unaware'

respondents admitted to ignore bird population trends, 25% of 'aware' respondents believed that bird populations were stable, with comments such as "I haven't notice any difference in the last 10 years", an almost 14% (6 participants) claimed to have read about Little terns and their breeding problems and answered the question correctly, and almost 7% thought that populations were increasing: "the harbour is full of gulls".

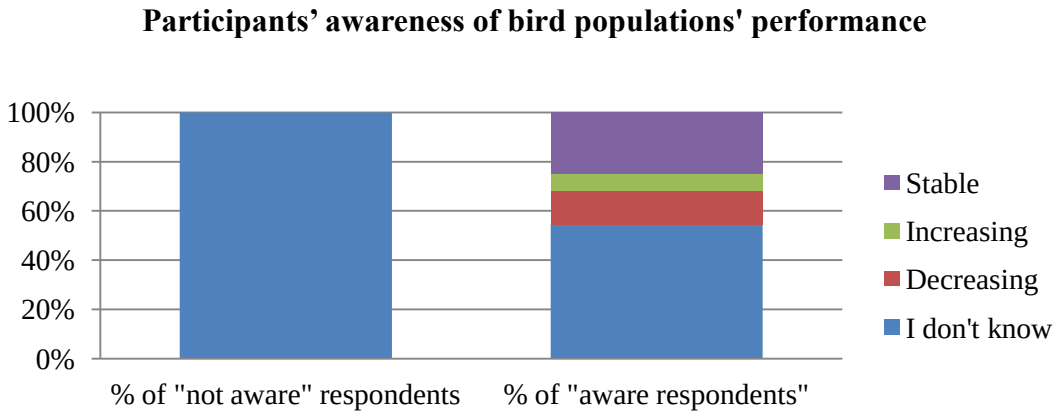


Figure 4.10 Participants' awareness of bird populations' performance in Langstone Harbour.

Appropriate answer for this question was "declining", in accordance to the Solent regional trend (Natural England, 2013), although it is true that trends depend on considered bird species and spatial scale (see Figure 4.11).

Nevertheless, the general level of ignorance may be a cause of respondents' little concern or interest in wildlife, but also indicates the lack of communication tools concerning local environmental problems.

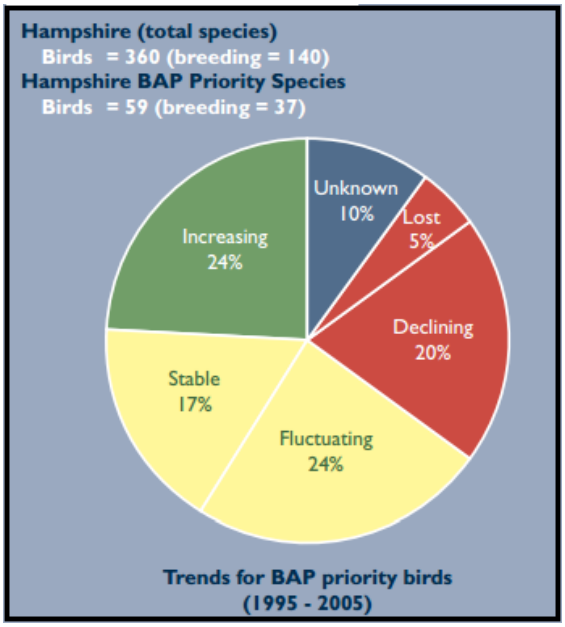
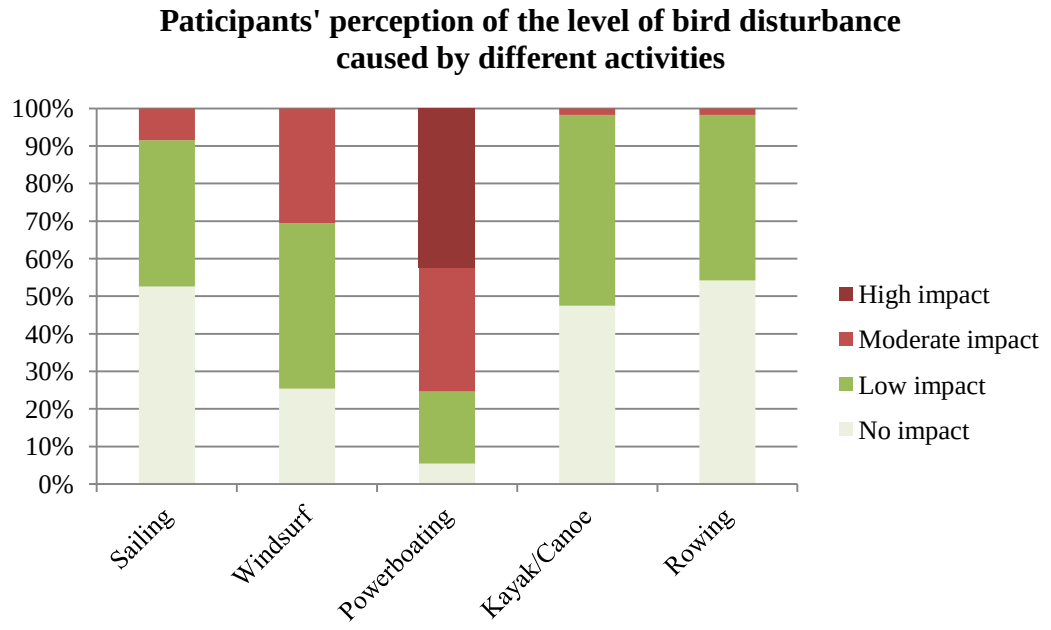


Figure 4.11 Trends for Biodiversity Action Plan priority birds. Main factors underlying the declines shown by many of Hampshire's birds are related to agricultural intensification, woodland and water management, coastal squeeze and recreation disturbance. Source: Hampshire Biodiversity Partnership, 2006.

All respondents were also given the chance to express their opinion regarding disturbing potential that different recreational activities could have (Figure 4.12)



4.12 Participants' perception of the level of bird disturbance caused by different activities.

Findings correspond to the general public feeling that recreation has a low level of impact on wildlife (Flather & Cordell, 1995; Taylor & Knight, 2003). Rowing, kayaking/canoeing and sailing were considered the least disturbing activities whereas powerboating and windsurfing were assigned the highest impact scores. It can be assumed that powerboating is related to the higher speed, noise, vibrations and oil spills associated with a motorized activity (Priskin, 2003), whereas reasons to rate windsurfing as a 'moderate impact' activity may be not that clear. It is probable that users relate windsurfers with close approach to the islands and an unstable activity for first-timer recreationists. However, further research would be needed to provide a coherent answer for these response patterns, as others studies have shown that socioeconomic characteristics of visitors or type of activity undertaken can be strongly influential on visitors' perceptions. (Priskin, 2003; Le Corre et al. 2013).

In addition, if further analysis (with a bigger sample size) were made to these results (Q9b, Appendix D), it would be very likely to find that users consider their own activities and presence the least disturbing (Mounet, 2007; Sterl et al. 2008).

In general, findings in literature indicate a low awareness of recreational impacts by both regular and punctual visitors (Orsini & Newsome; Sterl et al. 2008).

4.6 Mitigation measures supported by the harbour users

Unsurprisingly, around 24% of respondents indicated that further management measures against bird disturbance were unnecessary, being coherent with the low awareness rates. The most popular tools for recreational management (Figure 4.13) included further signposting and restriction of access to certain areas, selected by 66% and 47% of participants respectively. Education resources were only favoured by 29% of participants, and although some participants viewed educational courses as positive, others stated that they would refuse to participate if existed. The results correlate to other studies that explain the lack of support as a dependent variable of understanding the impacts that recreational activities have on wildlife (Taylor & Knight, 2003).

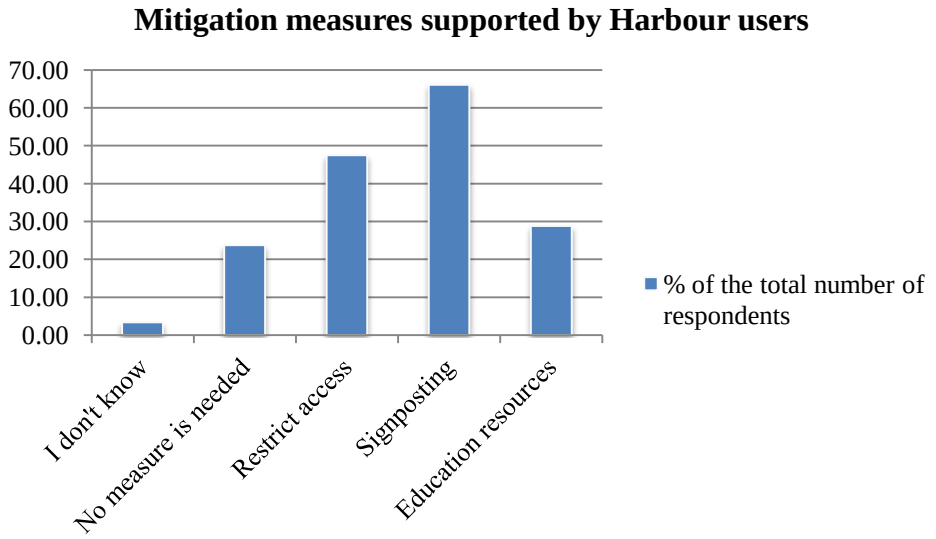


Figure 4.13 Mitigation measures supported by Harbour users.

4.7 Usage of the harbour

The two final questions were directed at exploring the usage of the Harbour. Participants were questioned about the areas they were planning to access or had already visited, supported with the use of a map. Whereas most of participants would just stay on the water, around a quarter of respondents chose the beach/mudflats as a point of access (Fig. 4.14). At the same time, a significant proportion (14%) stated that they had planned to visit the small islands. Unfortunately, it is not possible to identify the visited islands (Long Island is a landing zone), as most of participants indicated broad approached areas, instead of specific points in the harbour map.

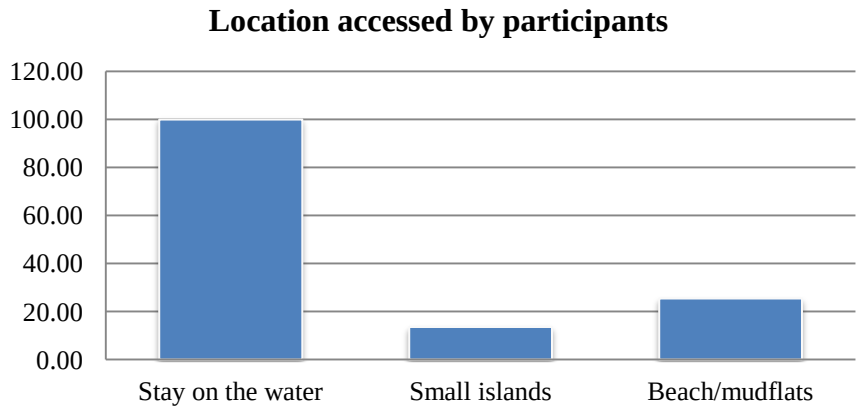


Figure 4.14 Location accessed by participants in Langstone Harbour.

In general, recreational activity is present in the whole harbour, although it shows to be concentrated around launching points; the Oysterbeds and the main navigation channels are also characterized by a strong recreational presence.

Finally, although it cannot be concluded that 'no landing' areas were actually accessed by participants, access to Long Island can also result detrimental due to its proximity to the other islands.

4.8 Summary

This chapter has presented and analyzed the questionnaire outcomes.

The sample population consisted of 59 harbour users, 33 of which practised canoeing/kayaking in the Harbour. Although the sample size has not permitted statistical comparisons among groups, results have shown that paddlers are one of the most aware groups in terms of regulations applying in Langstone Harbour, probably related to their involvement with sport clubs. Nevertheless, a need to improve information deliver and management of these activities has been evidenced through the general experiences and perceptions of the recreationists.

By understanding the awareness, perception and opinion of harbour users, effective management measures will be designed to suit the needs of the site (objective 3). Suggestions for improving future research in the social field of recreation management are discussed in following chapters.

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Chapter 5. Semi-structured Interviews and Documentary Evidence. Results and Analysis

5.1 Introduction

This chapter combines the input from the interviews inquiries and the analysis of relevant documentation.

A first section presents interviewees and introduces Langstone Harbour management. Consequently, each authority's role is described and implications for recreation management are outlined supported by participants' commentaries. A second section summarizes and analyzes past evolution and current status of bird populations in Langstone Harbour in order to find evidence pointing to the potential impacts of water-based recreation on bird populations. Lastly, the final section focuses on interviewees' opinions regarding canoeing and kayaking disturbance potential and management measures applicable in the case study. A summary of participants' comments elaborated when answering the related question is detailed in Appendix F.

5.2 Langstone Harbour Management

5.2.1 Interviewees information

Interviews began by asking the participants on their position and years of experience (Table 5.1). Over half of the interviewees have been working in their present role for more than 10 years, demonstrating a great experience in the field of environmental and recreation management. Nevertheless, the rest of participants work closely in Langstone Harbour issues or have been involved in the Solent Disturbance and Mitigation Project (SDMP).

Table 5.1 Interviewees' position and years of experience in their current position. Together with position and years of experience, the table indicates the code that will be used to refer comments elaborated by each participant, as well as the relevance to the case study.

Code	Name of participant	Position	Relevance to the case study	Years of experience
Hayward, PCC	David Hayward	Senor Planning Policy Officer in Portsmouth City Council	Relevant authority and role in local planning, dealing with conservation issues at a strategic level. He has also collaborated in the SDMP.	6.5

Boschi, HBC	Julie Boschi	Senior Landscape Architect in Havant Borough Council	Relevant authority. She has also been the Havant Borough Council representative in the SDMP.	22
Hill, HBC	Rober Hill	Open Spaces Technical Officer in Havant Borough Council	Relevant authority. Experience with the West Hayling Nature Reserve management.	23
MacCallum LHB	Louise McCallum	Environment Officer in Langstone Harbour Board	Relevant authority. Works in the harbour monitoring activities, providing education resources and as consultant, protecting the features of the SPA and SSSI. Represents the harbour authority (e.g. Solent Forum).	>3
Smith, RSPB	Wez Smith	Langstone and Chichester Harbour site Manager	Langstone Harbour Reserve Manager.	<1
Anon, RSPB	Anony-mous	RSPB Volunteer	Volunteer present in Oysterbeds and with past experience in the RSPB working as the reserve warden.	-
Chapman, WT	Robert Chapman	Reserves Officer East Solent	Farlington Marshes Reserve Manager.	16
Bisset, PDCC	Peter Bisset	Chairman of the Portsmouth District Canoe Club	Club undertaking canoeing and kayaking in Langstone Harbour	3 chairman; 15 (member)

5.2.2 A shared area of jurisdiction

The Langstone Harbour management plan (LHB, 1997) defines its overall aim as the promotion of "the sustainable use of Langstone Harbour by managing human activity in and around the Harbour so as to maintain the value of its natural resources, especially those identified as of national and international significance" (LHB, 1997, p.8). This overall aim and the means to achieve it (Figure 5.1) are still maintained today, and its emphasis of considering both the surroundings (land) and the harbour itself highlights the significant need to achieve an effective collaboration between relevant authorities.

Objectives of the Langstone Harbour Management Plan

1. To conserve and enhance the nature conservation value of the Harbour and its surroundings;
2. To accommodate the recreational use of the Harbour on a scale and at an intensity consistent with the overall goal;
3. To accommodate the commercial use of the Harbour in so far as it is compatible with the overall goal;
4. To involve Harbour users and those interested in the study of its natural resources in the work of the Harbour Advisory Committee and in programmes of monitoring, interpretation and environmental improvement;
5. To improve the quality of the water in the Harbour;
6. To preserve and improve the landscape of the Harbour and of the surrounding area visible from the water, including the built environment;
7. To protect features of historic and archaeological significance in and around the Harbour;
8. To encourage land use and management practices on land around the Harbour that will maintain and enhance its value to nature conservation and the quality of its landscape;
9. To encourage interpretation, and an understanding, of the natural history and landscape of the Harbour as a means of achieving responsible use of the Harbour's resources;
10. To establish a monitoring programme to provide information about the health of the Harbour's natural resources, recreation and commercial life.

Figure 5.1 Langstone Management Plan objectives. Source: LHB, 1997, p. 8-9.

Coastal areas protected under the Birds and Habitats Directive are usually managed on a partnership basis for both legal (authorities with a statutory duty of management within or adjacent to the site have a management responsibility) and practical reasons (stakeholder involvement and networks) (European Commission, 1992; Bayliss, 2002; Taussik & Gubbay, 1996). Accordingly, Lansgtone Harbour is currently managed by different bodies (Table 5.2) that have different geographical and role jurisdictions (Figure 5.2).

Table 5.2 Responsibilities over Langstone Harbour (RA, Regional Authority; LA, Local Authority; LHB, Langstone Harbour Board; RSPB, Royal Society for the Protection of Birds; HIW WT, Hampshire and Isle of Wight Wildlife Trust; NEG, Natural Environment Group; NE, Natural England; MMO, Marine Management Organization; EA, Environmental Agency).

BODY	RESPONSIBILITY
RA	Planning jurisdiction (at a regional scale) and land owner;
LAs	Planning jurisdiction and land owner;
LHB	Statutory and competent harbour authority, and statutory consultee.
RSPB	Ownership and management of Langstone Harbour Reserve. Management of West Hayling Island Local Nature Reserve (3-year management agreement with Havant Borough Council);
HIW WT	Management of Farlington Marshes (Long-term lease from Portsmouth City Council);
Solent Forum	Facilitate integrated planning. The NEG sub-group complements the work of these agencies relating to nature conservation management regimes.
NE	Natural England advise relevant authorities to conservation objectives of European marine sites and any operations which may cause deterioration to habitats or disturbance to species for which it has been designated.
MMO	Under DEFRA, the Marine Management Organisation concentrates on maritime planning and grants consents for works to be carried out in the coastal zone.
EA	Under Defra, EA duties include pollution control, flood defence, and river management.

Source: LHB, 1997; DETR, 1998; DEFRA, 2010; EA, 2013; Solent Forum, 2013. For a complete list of responsibilities of each authority see Bayliss, 2002.

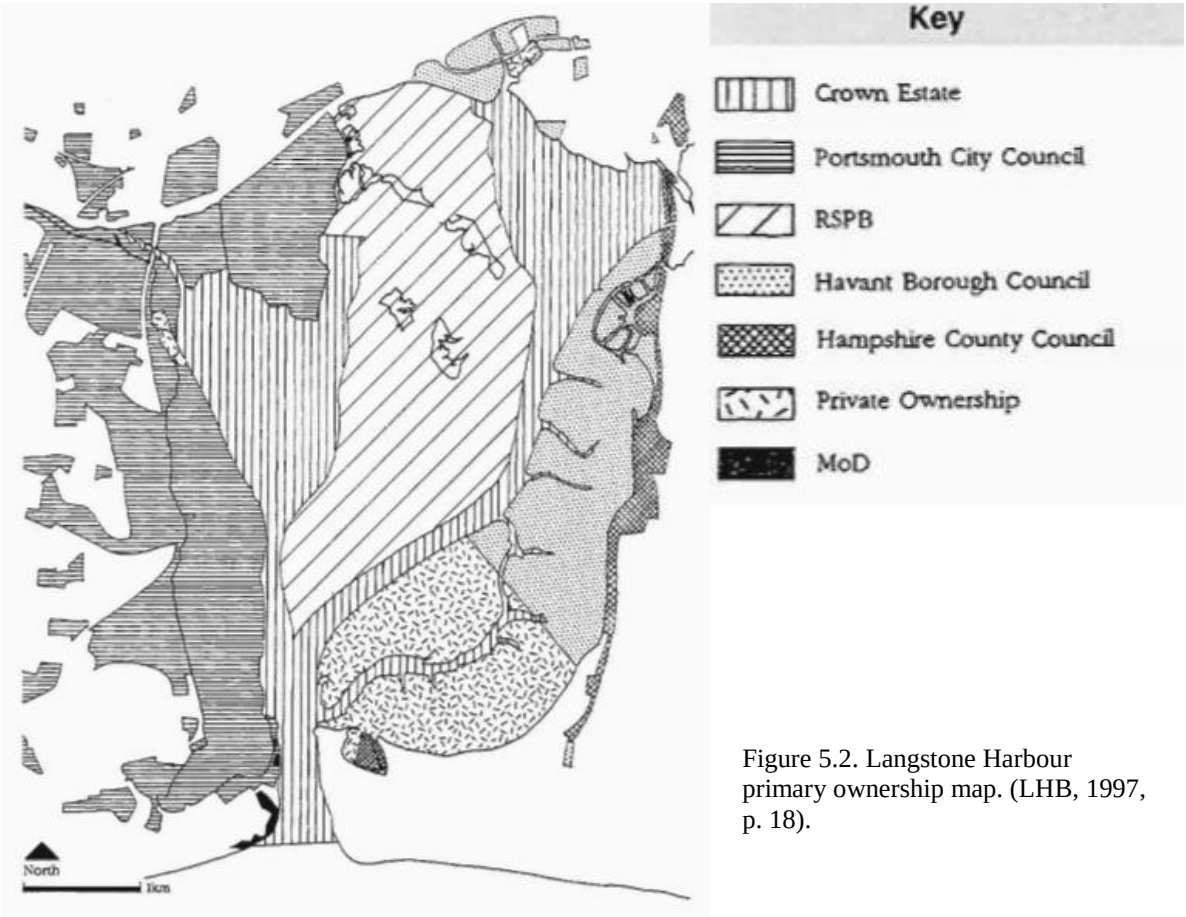

Figure 5.2. Langstone Harbour primary ownership map. (LHB, 1997, p. 18).

5.2.2.1 Local Authorities

Langstone Harbour is one of the inlets of the English Channel located in the County of Hampshire (HCC). It partly lies within the boundaries of Portsmouth City Council (PCC) and Havant Borough Council (HBC). The centre of the Langstone Channel and Russell's Lake separates both authorities' jurisdiction (LHB, 1997).

The three authorities: HCC, PCC and HBC have planning jurisdiction over the Harbour, owning land from which craft can be launched, as well as functions over environmental health, education, some aspects of provision for leisure and waste management (LHB, 1997). Accordingly it is their legal duty to avoid adverse effects on the integrity of the European Sites through their consideration in strategic plans or planning decisions (Table 5.3) (Liley & Tyldesley, 2013). LA actions can also focus on setting byelaws related to mooring places, codes of conduct and/or fixing required qualifications of recreationists (Solent Forum, 2011a).

Table 5.3. Planning strategies at regional and local level affecting Langstone Harbour.

Authority	Planning Document	Relevance to Langstone Harbour	Relevant policies/objectives considering development, recreation and nature conservation
Hampshire County Council	South East Plan (2009)	South Hampshire sub-regional strategy	Core Policy [SH1] Development in South Hampshire will be led by sustainable economic growth and urban regeneration. "Portsmouth and Southampton will be dual focuses for investment and development as employment, retail, entertainment, higher education and cultural centres for the sub-region" (p. 190)
Portsmouth City Council	The Portsmouth Plan, Portsmouth's Core Strategy (2012)	Recognized for its amenity and quality of environment. Commissions the Solent Disturbance and Mitigation Project.	"To make Portsmouth an attractive and sustainable city (…)protection of biodiversity and nature conservation areas will be included, and where possible improving their condition, in particular Portsmouth and Langstone Harbours, which are internationally designated" (p. 13)
Havant Borough Council	Havant Borough Core Strategy. Local development Framework. (2011)	Recognized as a key area for leisure and recreation. Provision of housing/employment whilst also protecting the landscape and managing the impacts of climate change.	• [CS1]Planning permission will not be granted for new jetties and slipways, as are identified as sensitive for landscape and/or nature conservation reasons. • [CS5]Encouragement of small scale development and sustainable recreational facilities. • [DM9] "Planning permission will only be granted for development which has no harmful effects on local, national or international designations"

Sources: Government office for the South East., 2009; Havant Borough Council [HBC], 2011; LHB, 2012; Portsmouth City Council [PCC], 2012

By virtue of these policy objectives, Langstone Harbour can be seen as a site where preservation prevails over further development. Nevertheless, regarding the potential of recreation to impact over designated areas, planning strategies have to consider a broader scale than a single harbour, as features of interest, such as birds, are dynamic, able to exploit close but different sites (Hayward, PCC). The habitat regulations are worded from a precautionary principle perspective, which means that it is necessary to demonstrate a lack of impact rather than the potential presence of impacts. Natural England collaborates as an advisor in this case for regional or local councils in order to comply with European legislation and local plans will require having mechanisms in place to secure mitigation in conjunction with planned new residential development (ABP Marine Environmental Research Ltd, 2012).

The complexity of planning decisions is therefore overwhelming, and the importance to determine which activities are critical for conservation purposes arises.

5.2.2.2 Langstone Harbour Board

The Langstone Harbour Board (LHB) is the statutory and competent harbour authority, and it is responsible for the management of the area covered by water at mean high-water springs, extending to the Harbour mouth and excluding the shore and islands within the Harbour (LHB, 1997). Responsibilities relate to the provision of navigation and moorings, as well as other aspects in the harbour management (see Figure 5.3), with an overall aim of managing the harbour in an efficient and cost-effective way, considering its conservation interests and regulating the harbour to national safety standards (LHB, 2012b).

Functions of the Langstone Harbour Board

- Ensure funding for safety, conservancy, education and interpretation functions;
- Navigational and safety functions;
- Regulation of activities, including the movement of vessels and the laying of moorings, by means of byelaws, licences and harbour directions;
- Provision of Pilotage Service;
- Prevention of Pollution;
- Participation in appropriate local, regional and national consultation;
- Environmental Management, environmentally responsible and sustainable management due to its designations as LNR, SSSI, Ramsar, SPA and SAC.

Figure 5.3Main functions of the Langstone Harbour Board. Source: LHB, 2012b.

In terms of recreational management, whereas certain recreation activities, such as jet skiing or waterskiing, are strongly regulated through licensing, zoning and permitting schemes (LHB, 1993), there is a gap on regulation for the rest of water-based activities, and in particular, kayaking and canoeing are not considered into Langstone harbour regulations. MacCallum (LHB) admitted that those activities were regulated in a first place due to safety reasons and the conflict they created with the rest of users rather than 'conservation issues'. The process of developing a new byelaw would require a harbour revision order, which is currently undertaken through the Marine Management Organisation (MMO) and that would demand evidence concerning the detrimental character of such activity (MMO, 2011), entailing moreover a "long time process and high cost" (MacCallum, LHB). Accordingly, the SEMS management scheme only contemplates the use of byelaws when all other options have been considered and it is the only effective solution (Bayliss, 2002a).

5.2.2.3 The Royal Society for the Protection of Birds (RSPB)

The RSPB is a UK registered charity, considered the largest wildlife conservation organisation in Europe. Among its functions appear wildlife conservation and management, research and provision of advice to landowners and authorities at different levels (RSPB, n.d.a). Its active role in the UK makes it an influential group for both the community and decision-makers at a national and European level (Fairbrass & Warleigh, 2004).

The RSPB owns and manages the Langstone harbour reserve, which occupies one third of Langstone Harbour and includes five small islands, selected as breeding sites by terns, gulls and wading birds during the summer, and feeding and roosting sites by waders and Brent geese during the winter. Access to the reserve is restricted with the exception of one of the islands, used as a landing area for water-based recreationists (Long Island) (RSPB, n.d.b).

Moreover, the RSPB is also responsible for the management of the West Hayling Local Nature Reserve, for which a management agreement exists with the Havant Borough Council (landowner). HBC relinquished these functions in response to the "expertise and specialization of the organization", and oversees its plans in a weekly basis (Hill, HBC).

5.2.2.4 Hampshire and Isle of Wight Wildlife Trust (HIW WT)

HIW WT is another UK conservation charity. They manage Farlington marshes, owned by Portsmouth City Council, which is located on the northern shore of the harbour, and it is the Trust's oldest nature reserve (HIW WT, n.d.). The site counts on different management plans for different purposes (Land and environmental management, satisfaction of the HLS[6] terms, management statement for the SSSI, etc.), being the overall aim related to the coastal graze marsh conservation, while bird conservation remains in the background (Chapman, WT).

5.2.3 Required collaboration

Due to the shared jurisdiction present in the Harbour it appears essential to ensure an efficient integration between the different authorities and organizations in order to achieve a sustainable development in the harbour.

Participants agreed that collaboration in Langstone Harbour was mainly met through the Advisory Commitee (see Table 5.4), although the Solent Forum was also referred as a key player for stakeholder networking and cooperation at a regional level. The approached authorities and conservation charities are all members of these panels, and have agreed in their effectiveness, being communication and consultation clear and present in general. Estuary Partnerships are therefore an important component of public engagement through user groups and special interest groups, advisory groups are said to be highly efficient in the case of for European marine site management plans (Morris, 2008).

Table 5.4. Organizations that work as collaboration centres for authorities in Langstone Harbour.

The Advisory Committee	The Langstone Harbour Advisory Committee meets five times in the year in order to provide information and debate on every aspect of the harbour, including financing, planning and development proposals that can potentially affect the harbour (LHB, 2012a). It represents the interests of a broad range of stakeholders and joins members for collaboration (MacCallum, LHB).
The Solent Forum	The Solent Forum is a coastal partnerships formed by relevant stakeholders that ''broadly aim to achieve a more integrated approach to coastal issues by facilitating co-operation between different organisations, raising awareness of local issues, collecting and distributing information, and discussing issues of local concern'' (DEFRA, 2006). In addition, it counts on the Natural

[6] HLS- Higher Level Stewardship. Aims to deliver significant environmental benefits in priority areas, involving more complex environmental management (NE, n.d.a).

[redacted]	Environment Advisory group, considered as "an important component of public engagement through user groups and special interest groups" (Morris, 2008), and is the secretariat of the SEMS management group.

Nevertheless, further collaboration is sought in terms of an improved communication or economic investment in the harbour with some authorities (Chapman, WT; MacCallum, LHB & Smith, RSPB). For instance, the RSPB suggests that collaboration could be improved through a stronger link between them and the LHB, joining patrolling forces to control recreational activities (Smith, RSPB).

Natural England is also named here as a potential player in regulating recreational activities taking place within designated sites; an organization that could develop common regulations at a national level (Anon, RSPB; Smith, RSPB).

Leaving management aside, the relation between the management level and the users' level was also evaluated as positive (Bisset, PDCC). Both the LHB and RSPB contribute to provide information and advice to canoe/kayak users through their clubs.

5.3 Status of bird populations in Langstone Harbour

In order to assess whether kayaking and canoeing can be considered a threat to Langstone Harbour bird populations it is essential to look back into populations' variations and their related causes.

Qualifying features for the Chichester and Langstone SPA designation show how overwintering birds outnumber breeding birds (Table 5.5), a coincident proportion in the Solent European Marine Sites. This is in fact the main reason why the Solent Disturbance ad Mitigation Project chose to focus on overwintering birds and winter activities (Boschi, HBC & Hayward, PCC).

Table 5.5. Qualifying features of the Chichester and Langstone Harbours SPA. Boundaries for the Portsmouth Harbour and Chichester and Langstone Harbour SPA and Ramsar sites are concurrent. Chichester and Langstone Harbours SPA are characterized by three main features: importance for regularly occurring Annex I species, importance for regularly occurring migratory species and importance for internationally important addemblage of waterfowl.

BREEDING	OVER WINTERING		ON PASSAGE
Little tern *(Sterna albifrons)* **Sandwich Tern** *(Sterna sandvicensis)* **Common Tern** *(Sterna hirundo)*	**Bar-tailed Godwit** (Limosa lapponica) **Black-tailed Godwit** *(Limosa limosa islándica)* **Dunlin** *(Calidris alpina alpina)* **Grey Plover** (*Pluvialis squatarola)*	**Common Redshank** *(Tringa totanus)* **Dark-bellied Brent Goose** *(Branta bernicla bernicla)* **Little Egret** *(Egretta garzetta)*	**Little Egret** *(Egretta garzetta)* **Ringed Plover** *(Charadrius hiaticula)*
Waterfowl assemblage:		**Red-breasted merganser** *(Mergus serrator)*	
		Northern shoveler *(Anas clypeata)*	
Rudy turnstone *(Arenaria interpres)*		**Northern pintail** *(Anas acuta)*	
Eurasia curlew *(Numenius arquata)*		**Eurasian wigeon** *(Anas penelope)*	
Sanderling *(Calidris alba)*		**Common shellduck** *(Tadorna tadorna)*	

Source: JNCC, 2001; Bayliss, 2002a

The following sections present the evolution of overwintering and breeding bird populations since 1975 (2013 data is not yet available) in both Langstone Harbour RSPB reserve and Langstone Harbour as a whole. Supported by previous reviewed studies, drops and peaks are carefully described following RSPB information (Anon, RSPB), for which mean monthly measure values (MMM) are used, "giving you a better feel throughout the years" (Anon, RSPB).

5.3.1 Overwintering bird populations

The following graphs (Figure 5.4) present wildfowl and wader populations' evolution since 1960 and 1969 respectively. Both figures illustrate great fluctuations during the considered period of time, being growth a common trend for both groups running up to the 90's. If attention is focused on the subsequent years, a different inclination between the species is noticeable.

On the one hand, due to lower disturbance susceptibility for wildfowl species than for waders (Koepff & Dietrich, 1986; Avocet Research Associates, 2004), wildfowl

populations have remained practically stable, whereas waders show an overall trend of decline in the case of the reserve, and increase in the case of the harbour as a whole. This responds to the choice of waders to feed or not on the reserve islands, which is strongly unpredictable and where human disturbance could be considered as a key player in habitat selection (Bratton, 1990; Riffell, Gutzwiller & Anderson, 1996; Kloubec, 2007). Unfortunately, evidence to confirm this assertion is not available (Anon, RSPB).

Other factors that have been identified by the RSPB as influencing population trends in overwintering species include poor arrival status of some species (e.g. Brent geese), change of migration routes (e.g. Dunlin) or interspecific conflicts (e.g. Oystercatcher).

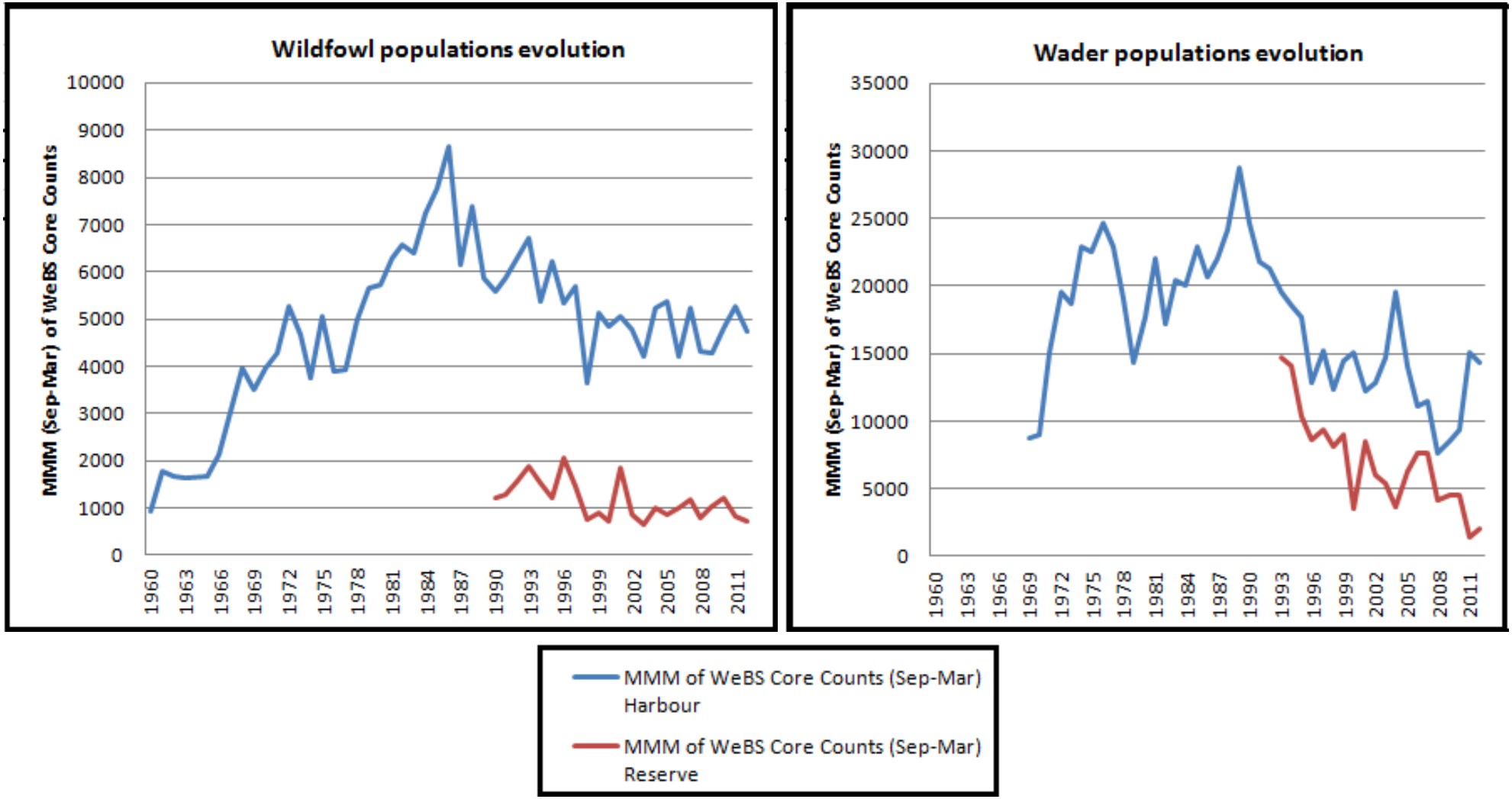

Figure 5.4. Wader and wildfowl population evolution in Langstone Harbour and RSPB Reserve. Data for the RSPB reserve dates back to the early 90's, as the reserve was not acquired by the RSPB until 1979 (Cockburn, n.d.).

5.3.2 Breeding bird populations

The small islands of the RSPB reserve are the nesting sites par excellence in Langstone harbour. It coincides with breeding birds' island selection criteria occurring in other coastal areas (Goutner, 1990; Burger & Gochfeld, 1991; Fasola & Canova, 1991). At the same time, Oysterbeds are preferred by breeding gulls, providing refugee against disturbance and weather conditions.

Prior to 1979, a small number of attempts to breed on the islands were recorded, being breeding failure considered to be caused by human recreational disturbance (Cockburn, n.d). Thanks to the RSPB's restricted access policy, colonization of the reserve's islands has increased in the last 30 years (Cockburn, n.d). The following graphs depict this trend, represented in gull (Figure 5.5 and 5.6) and tern populations (Figure 5.7).

In the case of black-headed and Mediterranean gulls, there is an overall growing trend in the number of breeding pairs. However, productivity, measured by fledged young individuals per pair, show three sharp drops in 2002, 2007 and 2011. Whereas in 2002, the dramatic fall is attributed to human disturbance (e.g. shell gatherers), main causes in 2007 and 2011 are of natural nature (fox and peregrine predation, and harsh weather conditions respectively).

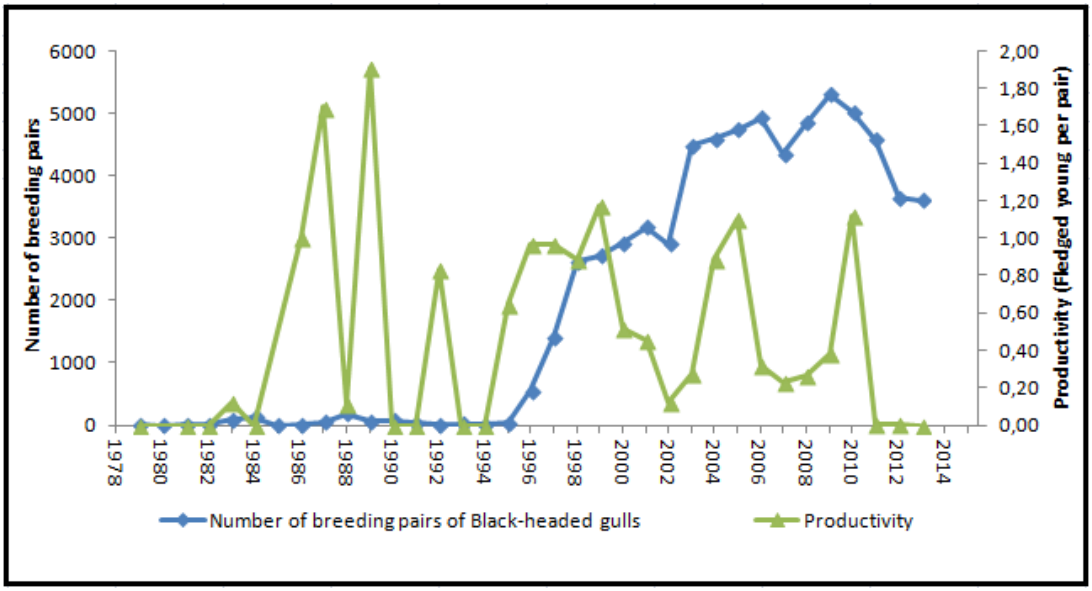

Figure 5.5. Evolution of breeding black-headed gulls and productivity in the RSPB Reserve, Langstone Harbour.

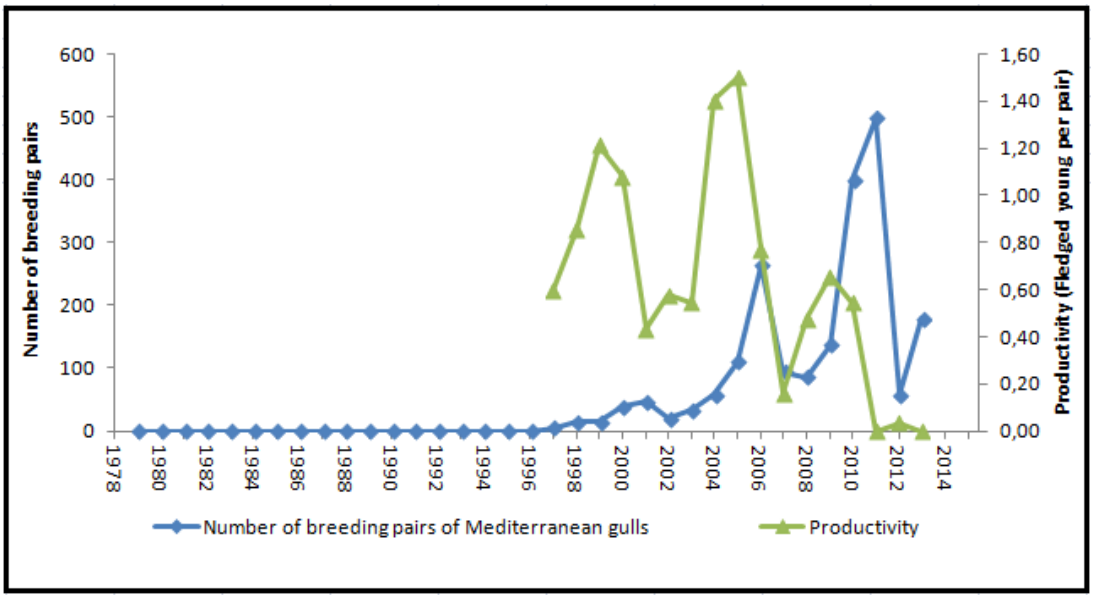

Figure 5.6. Evolution of breeding Mediterranean gulls and productivity in the RSPB Reserve, Langstone Harbour. Note that the Mediterranean gull is a recent addition to the species of seabirds breeding in Langstone and the south of England in general. Regionally, there has been an increase in the number of breeding pairs from 100 in the year 2000 to 700 in 2010 (JNCC, 2013).

Terns show a strongly fluttered trend in productivity, varied among the three different species (Figure 5.7). However, a clear decrease in the number of breeding pairs can be noted, starting in the early 90's for Little terns and in 2004 for Sandwich and Common terns. Like in the case of gulls, steep drops in productivity occurred in 2002, 2007 and 2011, provoked by same causes. Nevertheless, the location of the nests in the small islands, makes these birds more vulnerable to water-based recreation, where disturbance is difficult to police. Accordingly, the number of incidents of disturbance of breeding colonies is increasing; most of these are related to recreational activities like canoeing and kayaking, being 2013 an example (Anon, RSPB). Terns also face an increasing displacement caused by stronger bird species such as gulls.

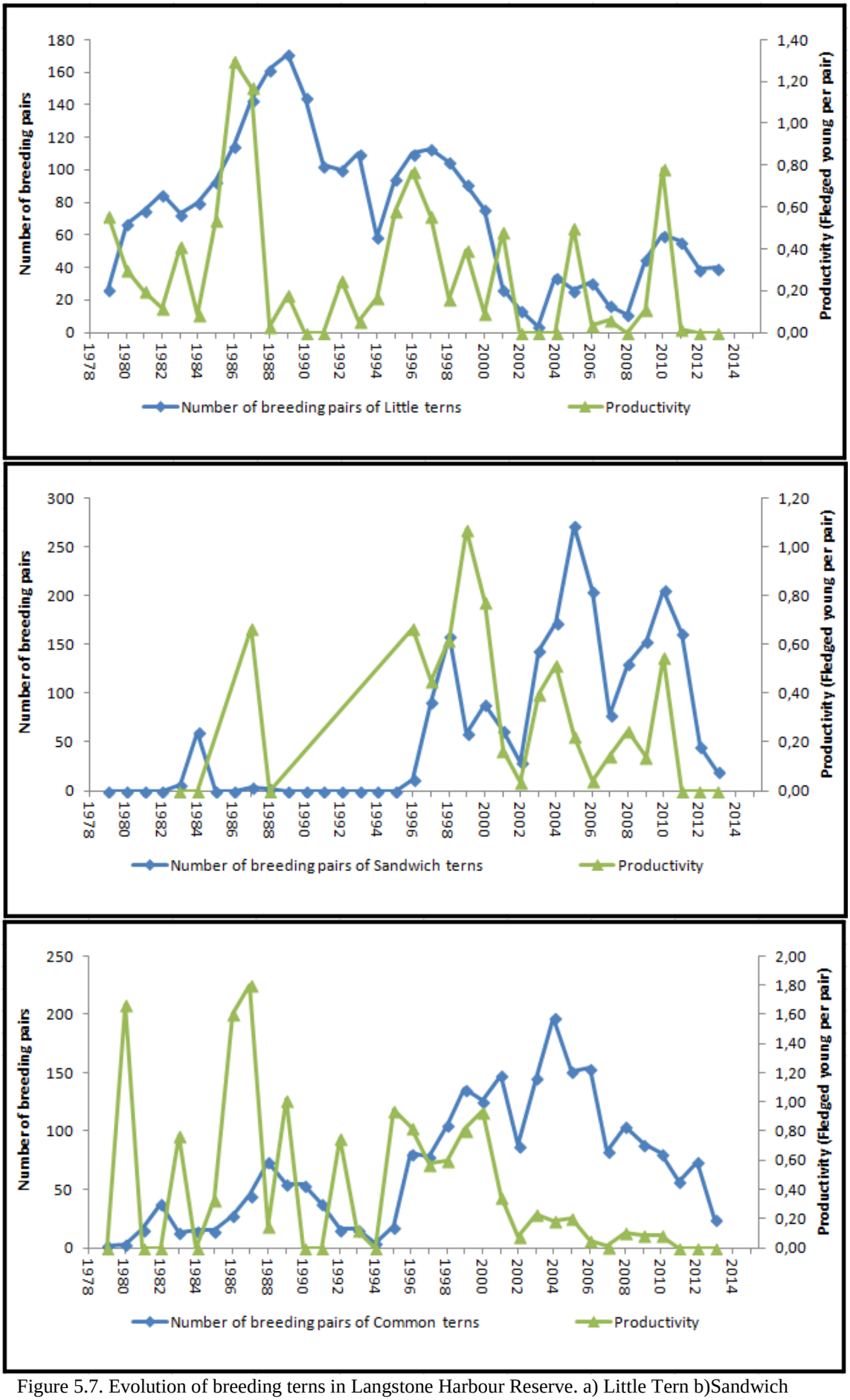

Figure 5.7. Evolution of breeding terns in Langstone Harbour Reserve. a) Little Tern b)Sandwich Tern c) Common tern.

5.4 Recreation as an issue in Langstone Harbour: Participants' opinions

Recreation has been recognized as an issue in the Harbour by six of the interviewees (being Bisset, PDCC an exemption), although location in the Harbour determined the level and nature of disturbance. For instance, in the case of Farlington marshes, Chapman (WT) claimed that water-based recreation was not present, as recreationists barely used the marshes to access the water.

The most disturbing activities present in Langstone Harbour, as declared by interviewees, include irregular water-based recreation activities in general, canoeing and kayaking in particular, shellfish gathering (strongly recorded during the summer 2013) and dog walking as a land-based activity (Figure 5.8), which coincides with those activities classified as 'high risk' in the Solent (Figure 3.3).

There is therefore a clear consensus on the significant presence of paddlers in the Harbour and a negative association to their impacts on bird populations in comparison to other water-based recreational activities.

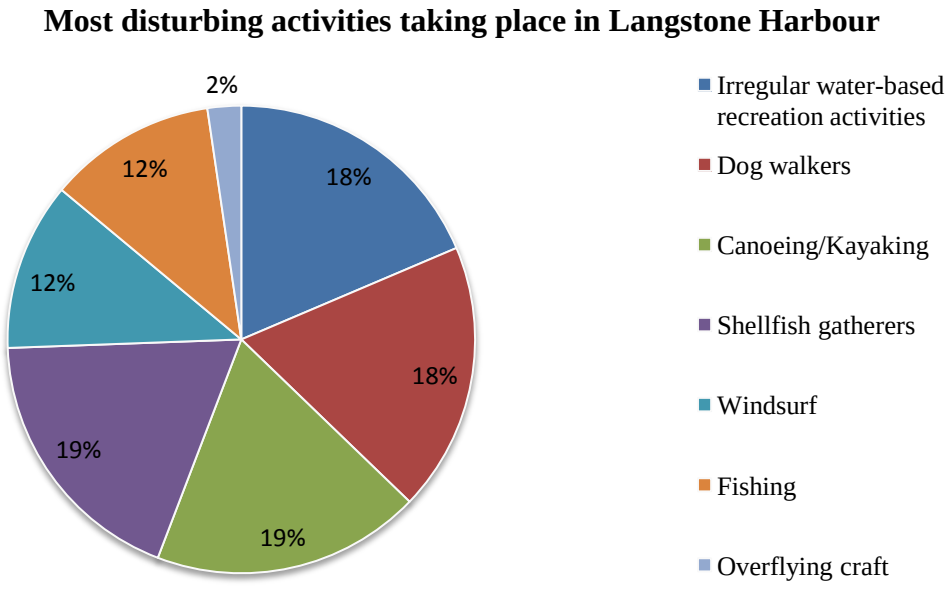

Figure 5.8 Most disturbing activities present in Langstone Harbour from interviewees' opinion. The graph uses the percentage for each activity from the total number of responses (see Appendix F).

5.4.1 Canoeing and kayaking in Langstone Harbour

Focusing on canoeing and kayaking, respondents believed that disturbance was mainly caused by the crafts ability to approach "roosting sites" and creeks (Hayward, PCC),

paddling near the islands shore or even accessing them (Anon, RSPB; MacCallum, LHB; Smith, RSPB). Irregularity of the activity hindering approach from the wardens or accessibility to signs and interpretation posters was also indicated as a likely cause of recreationists' lack of awareness and resulting irresponsible behaviour (Hayward, PCC; Anon, RSPB; Smith, RSPB), consistent with related studies (Whitfield & Roche, 2007). In addition, Smith (RSPB) admitted that intercepting paddlers' wrongful behaviour was not easy when patrolling in the Harbour, and that policing the activity was significantly challenging, being enforcement non-present (e.g. ticketing). In addition, the approach of the patrol boat to warn the recreationists can often result more disturbing than the users on their own.

In general, interviewees agreed that recreationist do not have 'malicious' intents, being the lack of awareness and knowledge about the impact that disturbance has on birds the main reason of disturbance events.

5.4.2 Current management of recreational activities.

There are two key players in the management of recreational activities in Langstone Harbour.

On the one hand, the Langstone Harbour Board regulates certain conflicting activities that respond to permission schemes, being also monitored through patrolling. In the case of canoeing and kayaking, it is necessary to highlight the role of the Environment Officer, who encourages education to harbour users through different means, including leaflets production, articles publication for the local newspaper and LHB webpage, school talks and supporting the RSPB through patrolling and signposting (MacCallum, LHB).

On the other hand, the RSPB and its volunteers team (which account for around 40 people) are responsible for creating awareness. Based on the Oyserbeds (West Hayling LNR), volunteers are present with available observation tools for the public and engage with the community through education (Chapman, 2004) (see Figure 5.9). Until last year, the RSPB also counted on a warden that specifically looked out for the islands through patrolling. However, a recent change of roles makes the current manager to spend less time on this duty (around once or twice per week during the summer) (Smith, RSPB).

Figure 5.9. RSPB volunteering spot in Oysterbeds. Source: Author's own. Taken the 11th May 2013 in Oysterbeds, Hayling Island.

In addition, the RSPB has also been responsible for the creation/amelioration of nesting areas (mainly aimed at Little Terns, see Figure 5.10), protecting them from natural predators and adverse weather conditions (Smith, RSPB). Nevertheless, presence of disturbance may be one of the reasons why past habitat works have not fulfilled RSPB's expectative for the last breeding season (Liley et al. 2012).

Helping Havant's Little Terns project

RSPB is involved in a three-year project (2013-2016) aimed at restoring and protecting little tern colonies around Langstone harbour and Hayling Island. In the first place, the recreation of nesting sites would increase the breeding chances of this species, assisting them to fight against adverse weather conditions and isolating them from natural predators.

-Phase I concluded with the introduction of 200 tonnes of shingle in south Biness Island (February, 2013);
-Phase II finished with the final 300 tonnes in the same island (April, 2013).

Figure 5.10 Helping Havants Little Terns project. Soruce: Smith, RSPB; The Langstone Blog (http://www.rspb.org.uk/community/placestovisit/langstoneharbour/b/weblog/default.aspx)

Current management was evaluated as 'improvable' (Anon, RSPB; MacCallum, LHB & Smith, RSPB). It is also planned to introduce a new volunteer team to patrol the Harbour and inform the users about the islands' importance.

5.4.3 Mitigation measures

"The flexibility of use and the islands attraction to users make people able to turn up almost anywhere unpredictably, making these activities very difficult to manage" (Chapman, WT).

Participants proposed a different series of mitigation measures that could be applicable in Langtone Harbour against canoeing and kayaking disturbance.

On the one hand, the introduction of buffer zones (mainly around the islands) was dismissed due to the associated violation of the public rights of navigation (Anon, RSPB; Hayward, PCC & MacCallum, LHB), as demonstrated in Figure 5.11, and the associated responsibility of costs and maintenance.

Common Law Rights: Right of navigation

- Public right to navigate in tidal waters (i.e. the sea and tidal navigable rivers), and no grant of the seabed or banks can interfere with this;
- Extends to certain ancillary rights (such as anchoring, mooring, grounding and landing) which are necessary to ordinary course of navigation;
- No defined course is necessary, but requires planned movement between 2 places for transport of persons or cargo;
- Right is not suspended when tide is out, can ground until next tide;
- Paramount to Crown rights (and therefore Crown leases and licences);
- Owner of the foreshore must do nothing that interferes with right of navigation;
- It is unlawful without statutory authority, to place in such waters anything which is an obstruction to navigation. Any such action constitutes a public nuisance.

Figure 5.11. Public rights of navigation. (Source: Gibson, 2010; H. Glenn, personal communication, November 15, 2012).

Nevertheless, as a Harbour user, Bisset (PDCC) believed that using buoys around the islands could be a successful initiative to define 'no landing' zones and that establishing a 50m set-back distance would not obstruct with navigation rights due to the impregnable nature of the islands surroundings for big crafts.

The creation or restoration of habitats to offset human disturbance was not considered in this case due to the limited size of the harbour and the persistent access from paddlers that would probably continue. For instance, shingle replenishment in South Binness island has increased the nesting area for Little terns, helping them to fight against adverse weather conditions and prevent mammalian predation. However, access to the island is still possible from a small craft.

Participants, therefore, agreed that education and management of visitor access were the best approaches to manage paddling activities in the Harbour (Appendix F).

In terms of education, all participants emphasized the significant role of a Harbour warden, from which friendly conversations may arise and communication results

effective “just being there taking and showing can make a big difference” (Anon, RSPB). A related disadvantage of this measure was given to the difficulty of approaching all visitors, due to the lack of ability to predict visitors’ access points, and the difficulty to communicate from the water (Anon, RSPB; Chapman, WT; Smith, RSPB). Consequently, a stronger relation with local water sports clubs and associations were proposed by the participants, where target groups can be found and information is more easily reached by the Harbour users.

Smith (RSPB) also stressed the importance of volunteers in rising awareness, engaging and educating the community, as many harbour users recognize Langstone Harbour natural values thanks to volunteers’ presence. At the same time, MacCallum (LHB) and Hayward (PCC), recognized this valuable resource and proposed to join volunteer teams coming from different organizations to work together for this common conservation purpose.

Another way of education, through further signposting, was encouraged by both RSPB representatives, claiming that a greater number of signs on the islands (see Figure 5.12), easily from long-distances and different access points, would be highly effective, as experience has demonstrated in several cases that paddlers noticed the presence of a sign after spending certain time in one of the reserve’s islands. In agreement, Bisset (PDCC) stated that a different wording referring to birds’ protection could also be useful, as conflicts with landowners in rivers and coasts are becoming increasingly popular. User groups feel that the extent and permanency of access to inland water for recreation is inadequate, leading to tension and conflict, consequently there is a common tendency to relate access restrictions to landownership and ignore them (Church et al., 2001).

Figure 5.12. ‘No landing’ signage. Source: Author’s own. Taken the 7th August 2013 in Langstone Harbour Reserve on board of the RSPB patrolling boat.

Conversely, signs or interpretative posters on the entering points were not strongly supported by the interviewees, agreeing that the proportion of visitors reading these was likely to be low, and again the uncertainty of launching points makes difficult to make information available to all users.

Considering visitor access management, spatial and temporal access restriction was suggested by Hayward (PCC), a management measure that would be in accordance with most sensitive times of the year for bird populations and the precautionary principle approach. Nevertheless, a conflict with recreational users, so popular during the summer months, would easily arise and it would be difficult to find support from the community.

5.5 Summary

In this chapter, information collected through semi-structured interviews and documentary evidence has assisted to achieve a thorough understanding of the management of Langstone Harbour, highlighting the need of effective integration between authorities. Opinions on the issue and concerns of the responsible authorities and interest groups have also been identified (objective 4).

In addition, bird data provided by the RSPB has evidenced a relationship between breeding bird drops, overwintering bird displacement, and water-based recreation.

Interviewees agreed that management of the visitor access to the harbour and the use of educational resources constitute the best option for managing kayaking and canoeing in Langstone, information that, together with questionnaire data, will inform further measures introduction and recommendations in the following section.

Chapter 6. Overall Discussion and Recommendations

6.1 Introduction

This chapter compiles the analysis of the results displayed in Chapters four and five, and provides a critical discussion, comparing and contrasting the two common issues arisen through the recreationists' questionnaires and the managers' interviews: the consideration of kayaking/canoeing as a potential disturbing activity for bird populations in Langstone Harbour and the mitigation measures that can be adopted for its management. Following the discussion, a series of recommendations are elaborated.

6.2 Kayaking/canoeing: A disturbing activity for bird populations in Langstone Harbour?

Watersports, specifically kayaking and canoeing, have been recognized to be subject to an increased activity since 2007 at a national level (Arkenford, 2012), a concurring trend for the Solent region (Solent Forum, 2012a). With reference to Langstone Harbour, although no official monitoring has taken place (MacCallum, LHB), popularity of kayaking/canoeing has been corroborated through quantitative research, and interviewees have also reported anecdotal evidence of increasing paddling activities in the harbour.

Evidence of potential bird disturbance caused by kayaking/canoeing in Langstone Harbour has been found through different sources:

To start with, scientific data, informing on bird populations evolution and RSPB interpretation (section 5.3), relate breeding bird population drops to water-based recreational activities disturbance. In addition, terns, and especially Little terns, depend on habitat availability (in terms of size or quality), which added to the sensitive period of breeding make these birds highly susceptible to any type of human disturbance during spring and summer months (Fasola & Canova, 1991).

Overwintering bird data also suggest habitat displacement suffered by waders, which has also been linked to water-based recreation, consistent with previous research (see Section 2.3.2.3). Nevertheless, the extent to which this has an impact at a population level is arguable. As literature review summarized, presence of alternative resources may compensate recreational disturbance (Gill et al. 2001), or only high and frequent disturbing events can be actually damaging (Korschgen et al. 1985; Borgmann, 2010).

In order to explore the real intensity and frequency of these activities to which birds are exposed to in Langstone Harbour, monitoring of water-based recreational activities is seen as essential, as it would assist to accommodate recreation "on a scale and intensity that permit the conservation and enhancement of the nature conservation value of the Harbour" (Fig. 5.1; LHB, 1997), which is particularly of concern given the popularity of summer water-based activities and their potential to cause disturbance (ABP Marine Environmental Research Ltd, 2012).

Secondly, quantitative data indicates presence of kayaking/canoeing throughout the year, being recreational activity concentrated in the summer months. There has also been reference to existent access of recreationists to the islands, where disturbance to breeding birds is the most detrimental. More than half of 'aware' respondents (62%, n=42) witnessed incompliance once or more (see section 4.5), although low levels of restrictions understanding suggest limitations in these findings.

Nevertheless, the overall inability of participants to associate restricted access with habitats/species' conservation, and recreational activities with high levels of disturbance, indicate a high probability of general misunderstanding, and common incompliance, as supported by harbour usage data, which associates the Oysterbeds and islands' area with water-based recreationists access.

Lastly, Harbour managers and the Portsmouth District Canoe Club (PDCC) representative corroborated exposure of birds to water-based recreation throughout the year, and the poor effectiveness of mitigation measures in place, being paddlers members of associations like the PDCC, but also associated with irregular activities that can disturb bird populations (considered as one of the most disturbing recreational activities in Langstone Harbour by interviewees).

Different events have been held responsible for low numbers during overwintering birds season and breeding failure in Langstone Harbour; and the ability to separate these factors into those nature-related and human-based appears extremely difficult (Gill, 2007; Mallord et al. 2007). With the special case of kayaking and canoeing, for which available experimental studies result limited and contradictory (see section 2), and are not available in Langstone Harbour, where birds' habituation to paddling activities has not been assessed.

Nevertheless, the study of the users' awareness and opinions, together with the experience of the harbour managers, indicates that current mitigation measures are not resulting effective in Langstone Harbour. Harbour users do not generally understand the existence of restricted access zones, and the importance of avoiding birds' disturbance. This lack of awareness has the potential to jeopardise bird populations' stability, which can become critical with the increasing predicted levels of water-based recreation (Solent Forum, 2011b). The results of this study suggest that once human disturbance is considered one of the potential factors to disturb birds, measures should be introduced in order to avoid cumulative impacts, following the precautionary principle towards nature conservation (Fig. 2.5) (Blumstein et al., 2003; Beale & Monaghan, 2004; Bellefleur, Lee & Ronconi, 2009). At a regional level, the overall picture is encouraging, further steps must be taken in order to reverse bird declines (Hampshire Biodiversity Partnership, 2006).

6.3 Best approaches towards disturbance mitigation in Langstone Harbour

Previous analysis (section 5.4.2) has explored the presence of mitigation tools against bird disturbance in Langstone Harbour, its effectiveness and further improvements that could be applied. Table 6.1 summarizes these findings in order to explore what appears to be the best combination of measures that would result the most effective in this case study.

Table 6.1 Mitigation measures applied in Langstone Harbour. Current use, associated problems, overall effectiveness and support encountered from harbour managers and users. Green cells present the best approach towards mitigation in Langstone Harbour, whereas blue cells indicate options that should be considered if more funding is secured.

	Buffer Zones	Manage Visitor Access	Habitat creation	Education
Current use	Not applied.	Applied: Harbour users are prevented to access the RSPB islands (Langstone Harbur Reserve). There are signs in place and occasional presence of the RSPB patrolling boat.	Not applied as a resource against disturbance.	Information resources: LHB webpage, local newspaper, signposting, RSPB & LHB educational talks: Oysterbeds, schools and sports clubs.
Problems associated with the measure	Violation of the public rights of navigation. Need to invest on associated costs (e.g purchase and maintenance), uncertainty of who would be held responsible.	Problems to approach recreationists on the water. Signs can be misinterpreted as no reference to the cause of restriction is mentioned in the islets.	The small size of the Harbour is not compatible to further habitat creation. In addition, access from the water would still be possible. High costs associated.	Irregular activities make difficult to reach recreationists through these means. Signposting: wrong wording, absence of maps indicating the location of 'landing' and 'no landing' islands.
Effectiveness	Potentially high, would discourage recreationists to access islands in an effective way.	Currently low. Potentially high if combined with effective education and rising of understanding.	Effectiveness has barely been assessed making associated costs not compatible with potential benefits. The measure would have to be accompanied with restriction access measures.	Currently low. Potentially high if there is use of more educational resources: internet, further signposting, more volunteer teams approaching visitors.
Support by managers	No	Yes. Temporal restriction also proposed.	No	Yes, although it should be improved (e.g. more volunteering teams and patrolling)
Support by harbour users	Yes, (considering Bisset, PDCC opinion) "it would be respected by recreationists and would not be obstructive"	Yes (47% of respondents, N=59)	N/A (habour users were not given the chance to choose this measure).	Yes (Education courses: 29% of respondents; Further signposting: 66% of respondents, N=59).

Findings suggest that a combination of visitor access management and educational resources should be reinforced and applied in Langstone Harbour, consistent with previous studies recommendations, which indicate that no sole measure should be put into place (Liley et al. 2012). The following subsections discuss the requirements to make their implementation successful.

6.3.1 Visitor access management

Temporal restriction would be very difficult to apply in Langstone, given that the most vulnerable time of the year for breeding birds is the summer, which coincides with the peak of recreational activity. Spatial restriction on the RSPB islands and Oysterbeds, on the other hand, seems to be necessary, although there is a need to improve signposting and access to information (see section 6.3.2).

Although a significant proportion of respondents recognized species and habitats conservation as present in the harbour (59.32%, N=59), it is acknowledged that messages included in signs should be designed to increase comprehension of critical practices that are poorly understood (Cole, Hammond & McCool, 1997). It has been demonstrated that presence of "awareness-of-consequences" information promotes rule obedience, although informing on probable sanctions results more effective if dealing with low social-responsible visitors (Gramman, Bonifield & Kim, 1995). The combination of both types of messages, included in a simple design, is therefore encouraged by this study.

A second way of managing visitor access is through the use of patrols. Although approaching and warning visitors may result difficult and even disturbing, the mere presence of an authority on the water influences recreationists' behaviour (Whitfield & Roche, 2007; Jett & Thapa, 2010). In order to minimize costs, the use of volunteering patrols in suggested.

6.3.2 Educational resources

Although, on-water signposting may fail to make recreationists respect conservation rules, poor knowledge and understanding is considered the most likely cause of unwanted behaviour (Jet & Thapa, 2010).

First of all, the use of educational resources requires evaluating the knowledge of the public in order to undertake the most appropriate educational strategy (Sterl et al. 2008).

Education content is subsequently suggested to be focused on informing recreationists about the effects that their activities have on birds (Gramman et al., 1995; Cole et al. 1997). If recreationists become aware of flight distances and stress signals, they will become more respectful with conservation rules. Visitors also need to understand the management measures that are in place; knowing the location of those inaccessible islands or more vulnerable parts of the harbour can assist to this purpose (Laffoley, 1995), and therefore the use of maps is encouraged.

In the case of Langstone Harbour, there are four means that have been found to be easily and cost-effective to implement or improve education.

Firstly, there is a need to improve information access through the internet. The use of virtual forums, blogs and websites dedicated to kayaking/canoeing are popularly used by paddlers in order to find new routes and recommended spots (Gilchrist & Ravenscroft, 2008). Langstone Harbour managers could have easy access to these sites and raise awareness of the environmental designations present in the Harbour and restricted areas in place, which was found to be absent in the majority of websites (see Appendix G). The use of informative videos has also proved valuable (Animality productions, 2013).

Secondly, the use of land-based signposting must also be increased, especially in launching points (Whitfield & Roche, 2007), following the same recommendations as outlined in the previous section with reference to their content. Further information related to signage design can be found in DEFRA (2004).

In the third place, contact with relevant local clubs has proved to be useful (Whitfield & Roche, 2007), and therefore, it is also proposed to contact relevant sport shops or companies offering kayak/canoe hire or courses in the region. This could assist to reach individual recreationists, who would be informed through shop assistants and have access to leaflets about kayaking/canoeing in Langstone Harbour, increasing awareness before even arriving at the harbour (Harrison-Hill & Chalip, 2005).

Finally, the use of volunteering means must be combined with certain degree of enforcement. Codes of conduct would help to outline responsible behaviour expected from paddlers and the importance of maintaining an undisturbed harbour (Mason & Mowforth, 1996; DEFRA, 2003). In addition, the introduction of fines would result

effective with individuals considered as low social-responsible (Alder, 1996; Gramman et al., 1995).

Once these mitigation techniques are put into practice, medium-term monitoring would be needed to measure their effectiveness. If disobedience is still present, enforcement through byelaws and stricter penalties would have to be considered (Liley & Tyldesley, 2013).

6.3.3 Funding sources

The strategic mitigation approach across the Solent has identified funding as one of the major constraints in achieving a successful integrated coastal recreation management. Natural England has stated that the costs of establishment and baseline evidence can be high, and these are usually not met by the developer (Natural England, 2012). Liley & Tyldesley (2013) propose that costs towards mitigation should be shared between new developments and present activities, considering type, location, scale and forecasted recreational pressure. However, mechanisms to calculate needed costs and share have not been developed yet.

There is a need to ensure sufficient funding in the long-term in order to aim for a sustainable management of coastal resources (McGlashan, 2003; Cicin-Sain & Belfiore, 2005), which in this case will have to be directed at further research, implementation of measures and ongoing monitoring, and therefore, recreation management financing is recommended to be the result of a combination of instruments, including Liley & Tyldesley (2013) proposal, adding donor funding and user fees and charges, a collaborative approach that will add credibility and reduce costs (DEFRA, 2004). In addition, mitigation measures will have to be economically supported by governments at different levels if 'good status' for local, national, European and International designations is to be achieved.

6.4 Role of Natural England

Natural England (NE) can influence activities where they impact on an SSSI through byelaws for the protection of a European marine site (DEFRA, 2009). They have a crucial role in terms of recreation management enforcement, which is identified and summarized in Figure 6.1.

SSSI Legislative background

SSSIs are protected under the Wildlife and Countryside Act 1981 (as amended), a consenting regime that considers operations which might damage the special interest features of SSSI, including disturbance to wildlife by recreational activities.

Natural England (NE) may require from landowners specified actions to restore/conserve a site. On those SSSI where recreational activities take place and are likely to cause wildlife disturbance or other damages, NE recommends the use of 'Voluntary Codes of Practice', and only when voluntary means have been explored, and there is still a serious threat to SSSI, enforcement should be considered. For the latter action, NE is recognized to own powers to make byelaws, effective in controlling activities and modifying users' behaviour.

Figure 6.1 SSSI legislative background. Adapted from: Natural England, n.dd; DEFRA, 2004; DEFRA, 2009; Natural England, 2007.

Considering the influence of NE over SSSI's, it seems particularly practical and convenient to develop codes of conduct for kayaking and canoeing, which would take into account the potential effects on birds populations reviewed. If these are additionally launched at a regional level, English SSSI's would benefit from 'best practice' guidelines, preventing disturbance where canoeing/kayaking are not considered an issue yet, and promoting conservation rules where disturbance needs to be mitigated.

6.5 Recommendations

The summary and discussion of the key research findings (section 6.2 and 6.3) clearly point to recommendations for Langstone Harbour managers, possibly applicable in the Solent in general, or other coastal areas elsewhere. Although they mainly refer to kayaking/canoeing, it is true that they could also be extrapolated to other water-based activities.

The following table (Table 6.2) outlines key recommendations, including further research that would be needed to inform measures to be put into practice.

Tabla 6.2 Recommendations for an effective management of canoeing/kayaking in Langstone Harbour.

Categories	Key Recommendations
Further Research	1. Measurement of recreation activity levels and usage of the harbour in order to assess the level of exposure of bird populations to paddlers and other recreationists throughout the year; 2. Study of water-based recreationists access patterns, behaviour and previous knowledge in order to establish sensible interventions that influence visitor behaviour and promote wildlife conservation;

Management of Visitor Access	3. Improvement of messages used on islands' signposting, which must include 'awareness-of-consequences' and 'consequent-sanctions' information, being visible from different parts of the islands; 4. Use of volunteering patrols with advisory capacity and friendly manners, "more informative than reprimanding" to increase awareness among recreationists; 5. Use of patrols that monitor and detect incompliance, enforcing fines or other chosen regulations;
Education: Signposting	6. Increase the number of interpretative posters in launching points, including maps that indicate location of inaccessible islands and most vulnerable parts of the harbour; 7. Land signposting must also include 'awareness-of-consequences' and 'consequent-sanctions' information;
Education: Approaching interest groups	8. Use of internet resources to increase awareness; 9. Contact local relevant stores, facilitating and encouraging them to deliver environmental information to their customers; 10. Encourage education and facilitate material to be used in the Portsmouth Watersports Centre and others, emphasizing the need of informing about regulations when instructing new paddlers;
Collaboration between authorities	11. Joining of volunteering resources from different authorities to take part in the patrolling teams and approach of interest groups; 12. Joining of economic resources to face research gaps and introduce mitigation measures; 13. Elaborate a code of conduct for kayaking/canoeing at a regional level.

6.6 Summary

This chapter has examined and critically discussed common themes brought by both the quantitative and qualitative research, identifying the best approach towards disturbance mitigation that can be applied in Langstone Harbour (objective 5) and elaborating a list of recommendations for Harbour managers to take into account when considering kayaking and canoeing activities (objective 6).

Evidence that kayaking/canoeing can become a critical issue in Langstone Harbour has been corroborated, and it is the combination of visitors access management and education which will result in an effective management if further research is conducted and educational resources are fully exploited.

Chapter 7. Conclusion

7.1 Introduction

This last chapter provides a concise summary of the research conducted, bringing together the main areas covered in the study. A final comment outlines the implications of the findings on the field of study. This is followed by encountered research limitations and according additional research that could be undertaken in the future.

7.2 Summary of research

The overarching aim of this study was to investigate the potential disturbance that kayaking and canoeing can have over bird populations and determine whether additional mitigation measures are required in Langstone Harbour (UK).

In the first instance, the literature review critically discussed disturbance measurement methods and revealed a number of studies evidencing disturbance on bird population caused by water-based recreational activities. Overall, the lack of agreement concerning kayaking and canoeing potential impacts is overshadowed by the general assumption existing on the possible devastating effects that an increased number of human visitors using watercrafts for recreation, at a critical time of year, can have on bird populations, being the main impacts related to birds fitness (e.g. energy costs, time of feeding) and reproductive success or survival.

The literature review also permitted to identify current management measures applied to mitigate water-based recreation disturbance, considering crafts characteristics and species requirements; and it highlighted the need to combine different techniques to increase management effectiveness, being the use of educational resources an essential tool. For the development of the latter, it was found significantly important to undertake a social study within the considered site which would inform community awareness and receptiveness, supporting decision-making.

Accordingly, Chapter two outlines the study's strategy, the development of an insightful case study in Langstone Harbour, where harbour users were approached through questionnaires, and managers and other interest groups were selected for semi-structured interviews.

Analysis of results and deep discussion permitted to collect evidence that indicated kayaking and canoeing as a potential bird disturbance factor in Langstone Harbour, including literature review conclusions, bird data, Langstone managers' experiences in the past and present, and the relative low levels of awareness shown by the Harbour recreationists, which can be related to malpractice in the site.

It has therefore been identified that mitigation measures must be reinforced through educational but also regulatory means, being subsequent monitoring and collaboration among responsible authorities essential for its success, which will allow gaining a balance between tourism benefits and environmental conservation.

7.3 Implications of the study

The main implications from this study for Langstone Harbour water-based recreational activities management, and possibly for other coastal areas elsewhere, include:

• that impacts to bird populations caused by recreational activities must be understood before appropriate restrictions and other regulations are introduced;

• that education has to be considered as a key player in regulating designated sites in coastal areas;

• that such education will require to be supported by visible enforcement of regulations to be effective;

• that Governments must ensure that responsible management authorities receive adequate long-term funding, being conservation and enhancement of designated sites a responsibility at a national and international level.

The findings of this study will contribute to the implementation of proposed management strategies for recreational activities in the Solent (Solent Forum, 2012b). In addition, other researchers may use this study as a tool to examine their own site conditions, a first step towards finding appropriate solutions to achieve the two-fold purpose of facilitating recreational use and conserving wildlife resources.

7.4 Limitations of the study

The main limitations of the study are considered to be related to the data collection techniques, limited through time constraints, the relative lack of experience of the researcher, and the need to keep the analysis and size of the study to a realistic level.

Although the questionnaire response rate was adequate to undertake descriptive statistical analysis, results can only imply general trends, and it cannot be fully concluded that certain activities are more prone than others to neglect access restriction to the islands or to determine the degree of incompliance.

Accordingly, an increased number of participants would have allowed inference and statistical tests to be conducted, which would have provided deemed statistically significant information.

Limitations can also appear in the trustfulness of the answers, the possibility of participants not wanting to project a negative image of themselves or their activities.

7.5 Proposals for further research

In order to compensate limitation of this study, it is proposed to develop a similar study with an increased sample size and considering the different seasons throughout the year, which would confirm or challenge that the results obtained reflect those of the Harbour users as a whole. It would also permit to identify significant differences between user groups, and so assist in the way to approach each of them. The inclusion of further variables referring to participants, such as geographical location, economic and educational level, belonging to a sports club, etc., could provide better analysis and rationale behind the visitors' perception and attitudes. There is a need to collect enough disturbance evidence in order to introduce further enforcement measures.

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Appendix A. Literature focused on recreational activities disturbance affecting bird populations

This table identifies authors, location, methodology used, bird species and activities studied, results obtained and recommended measures. Blue cells indicate those studies focusing in paddling activities (canoeing and/or kayaking), green cells indicate studies that compare paddling activities with motor-based recreation.

Authors	Location	Methodology	Species studied	Activities studied	Results	Recommended mitigation measures
Avocet Research Associates, 2004	California, USA	Experimental: disturbance trials using kayaks	(Wintering) Waterbirds: Waders, divers, dabblers and gulls	Boating (kayaks)	Lack of observations of any large-scale movement. Waders, divers, and dabblers appeared as the most prone species to disturbance with no significant difference between the three ($P>0.05$), whereas gulls showed a high degree of habituation.	-Buffer zones; -Manage visitor access Using temporal and spatial factors; -Limit time on the water and number of boats.
Bellefleur, Lee & Ronconi, 2009	British Columbia, Canada	Experimental: disturbance trials using a small motorboat	(Breeding) Marbled Murrelets	Boating (small motorboat)	Faster boats caused a greater proportion of birds to flush, and at further distances, which was related with birds' energy expenditure. Weak correlation between variables and lack of knowledge on baseline conditions.	-Buffer zones; -Manage visitor access Number, speed, temporal and spatial variation for the use of boats.
Bratton, 1990	Georgia, USA	Experimental: disturbance trials using small motorboats	(Non-breeding) Ciconiiformes and wading birds	Boating (small motorboat)	Birds disturbed in the tidal creeks were more likely to leave the site where they encountered the boat and flew further than birds disturbed on the sound. Ciconiiformes showed more difficulty habituating to boat traffic in some habitats than in others.	
Burger, 1998	New Jersey, USA	Observation of behavioural responses	(Breeding) Common Terns	Boating (Motorboats, Personal watercraft (PWC))	Negative response to the presence of boats, significantly more to PWCs than to motor boats. Factors affecting behaviour included distance from the colony and the speed of the craft, although noise was not measured.	-Buffer zones; -Manage visitor access Regulations for PWC regarding access during the breeding season and speed limit.

Burger, 2003	New Jersey, USA	Observation	(Breeding) Common Terns	Boating (PWC and motorboats)	Terns were more sensitive to PWCs that raced by and circled the island, than to motor boats that travelled slowly and remained in the channel.	-Manage visitor access Zoning for PWC; -Education Public meetings, signposting, education campaign and wardening.
Burger, Gochfeld, Jenkins & Lesser, 2010	New Jersey, USA	Experimental: disturbance trials using a motorboat	(Breeding) Black skimmers	Boating (motorboats)	Reproductive stage was the most vulnerable to disturbance. Main factors inducing a response included the direction of approach, number of adults present at the colony, number of nests, and year.	-Buffer zones Considering behavioural response of highest concern, reproductive stage of highest concern, and an appropriate level of response at which to establish the buffer area.
Chatwin, Joy, & Burger, 2013	Vancouver Island, Canada	Experimental: disturbing trials using motor boats and kayaks.	(Breeding) Double-crested Cormorants, Pelagic Cormorants, Glaucous-winged Gulls, Pigeon Guillemots and Black Oystercatchers, Harlequin Ducks	Boating (Motorboat and kayaks)	At a distance of 40 m nesting Double-crested Cormorants, Pelagic Cormorants, Glaucous-winged Gulls, Pigeon Guillemots and Black Oystercatchers had less than an 8% chance of being agitated with either a kayak or motorboat approaching. Roosting birds had longer response distances. Harlequin Ducks were particularly sensitive with a 25% probability of agitation at distances less than 50 m.	-Buffer zones.
Cornelius, Navarrete, Marquet, 2001	Las Cruces, Chile		(Non-breeding) Different coastal bird species	Walking	Presence of visitors declined foraging time, even when activity took place outside the marine reserve. Interference was stronger for birds roosting on the supra littoral zone than for birds actively foraging on the intertidal zone.	-Habitat management Increase the size of the marine reserve.

Evans, 2009	California, USA	Observational surveys and Experimental: disturbance trials using kayaks	(Overwintering) Waterbirds: Ducks, geese, and swans, Loons, grebes, pelicans, cormorants, coots. Waders: herons and egrets. Shorebirds: plovers, oystercatchers, sandpipers.	Boating (kayaks)	Species specific flush distances: Birds flew, dove, or swam in response to disturbance. Larger flocks responded at a greater distance.	-Buffer zones 250 m to minimize effects of non-motorized small boats based on the recommended distance for the most sensitive species plus 40 m; -Manage visitor access Seasonal (winter closure); -Education.
Fernández-Juricic, Zollner, LeBlanc & Westphal, 2007	Chicago, USA	Observation. Measurement of behavioural responses	(Breeding) Black-Crowned Night Herons	Boating (canoes) and Walking	Behavioural responses to walkers and canoes presence included increasing vigilant and anti-predator behaviours, and decreasing maintenance behaviours. However, medium-term responses were insensitive to the frequency of disturbance, whereas spatial proximity to the source of disturbance strongly influenced birds' responses.	-Buffer zones 50 m around colonies; -Manage visitor access Restrict canoeing at the beginning of the breeding season.
Finney, Pearce-Higgins & Yalden, 2005	Peak District National Park, England	Bird surveys and behaviour observation	(Breeding) Golden Plover	Walking	Golden plovers tended to avoid areas within 200 m of the footpath during the chick-rearing period. No detectable impact of disturbance on brood survival.	-Manage visitor access Provision of defined access points.
Fitzpatrick & Bouchez, 1998	Belfast, Northern Ireland	Observation	(Breeding) Oystercatcher, Curlew and Redshank	Walking, jogging	Species specific feeding and flushing responses: Oystercatcher flushed more frequently than stopping its feeding: Curlew and Redshank stopped feeding more frequently than flushing In general, disturbance reduced feeding time.	

Gill et al 2001	East coast of England	Observation Survey of invertebrates in order to identify supporting sites in the absence of disturbance	(Overwintering) Black tailed godwit	Walking, aircraft and boating (motorboats and non-motor boats)	No evidence that human presence reduced the number of black-tailed godwits that were supported on coastal areas at a range of spatial scales. There was also no effect of the presence of marinas or footpaths on the number of godwits supported on the adjacent mudflats.	
Herrera et al. 2007	Cantabria, Spain	Experimental: disturbance trials using a motorized boat	(Wintering) Eurasian Wigeon, Eurasian Spoonbill, Eurasian Curlew, Black-tailed Godwit, Bar-tailed Godwit	Boating (motorized boat)	44% of perturbations were registered for the Eurasian Spoonbill and the Eurasian Coot, which were normally present in the narrowest channels through which the craft passed by, the rest of the species experimented sporadic disturbances. The effects on a population scale seemed very unlikely.	-Manage visitor access Limit entrance of crafts according to tidal regimes.
Hulbert, 1990	Narayani, Nepal	Observation	(Wintering) Ruddy Shelduck	Boating (canoes)	Disturbance provoked by canoes accounted for 11 min per day, and cannot be related with consequences in population size	-Manage visitor access Limit access to certain areas of the river.
Jung, 1991	Michigan, USA	Behavioural time budgets Experimental: disturbance trials approaching birds with kayaks	(Breeding) Common Loon	Boating (Motorboats, Kayaks)	Motorboats have been related with common loons reduced hatching success Canoeing activity did not have a significantly negative impact on reproductive success. Flush distance was approximately twice for kayaks than for motorboats.	-Buffer zones 150 m from shores or islands would help to ensure that adult loons are not ousted from their nests and that chicks are not separated from their adults; -Habitat management Artificial islands, which have proved to increase nesting success as much as 59%.

Kahl, 1991	Wisconsin, USA	Observation	(4 Seasons) Canvasback	Boating, fishing, hunting	Feeding interruption caused by boating activity was compensated by feeding at night; Energy costs resulted from Higher disturbance rates and fewer feeding areas; Impact was higher during spring, affecting productivity	-Buffer zones; -Manage visitor access Spatial and/or temporal restrictions; -Habitat management: Refuges; -Education: Public awareness.
Karp & Root, 2009	The Amazon, Peru	Observation Experimental: disturbance trials using canoes, playing recorded tourist conversations	Hoatzins	Boating (canoes)	Noise significantly altered Hoatzin behaviour, manifested by increasing FID and AID values with elevated volumes from canoeists, showing no habituation to noise.	
Klein, Humphrey & Percival, 1995	Florida, USA	Observation	(Migrating) Sanderlings, Western Sandpipers, Least Sandpipers Dunlin and Short-billed Dowitchers	Road vehicles and walking	Different levels of habituation: residents less sensitive than migrants. Herons, egrets, Brown Pelicans and Anhingas remained close to areas of high human activity. Shorebirds were displaced at intermediate distance and Mottled Ducks together with ardeids showed varying levels of sensitivity	-Education Public education, Guided tours; -Manage visitor access Definition of low-disturbance zones, especially when migrants arrive. Seasonal closure Limit number of visitors.
Knapton, Petrie & Herring, 2000	Ontario, Canada	Observation to record disturbing events	(Migrating) Diving ducks: Scaup species, Goldeneye, Merganser, Scoter, Ruddy Duck	Boating (motorboats)	Disturbance records were higher in autumn than in spring because birds tended to concentrate in few locations and develop group responses	-Habitat creation Provide refuges; -Manage visitor access Ban boat traffic during peak migration.

Koepff & Dietrich, 1986	Wadden Sea, Germany	N/A	Waders and shelducks	Boating (kayaks, small sailing boats, motorboats, windsurfers)	Ability of canoes to approach high tide roosts was related with stronger disturbance responses than those caused by the rest of activities.	
Korschgen, George & Green, 1985	Illinois, USA	Observation	(Migrating) Waterfowl	Boating (motorboats), hunting and fishing	Fishermen accounted for the majority of disturbances. Flushing distance extended as far as 1 km and increased as fall progressed.	
Lafferty, 2001	California, USA	Observation	(Wintering) Snowy Plovers	Beach recreation	Wintering plovers showed higher sensitivity than breeding snowy plovers, reacting at strongly different distances: 40 and 80 m respectively. Humans, dogs, crows and other birds were the main sources of disturbance, and no presence of these birds was found near trail heads.	-Buffer zones Calculating set-back distances through bird modelling, although additional measures to decrease difficulty of obtaining compliance should also be developed, especially during winter months.
Liley & Sutherland, 2007	Norfolk, England	Experimental. Understanding of density dependence	(Breeding) Ringed Plovers	Walking	Disturbance had a major impact on Ringed Plover population size (habitat loss), and those undisturbed subject to high levels of human activity could affect population size.	
Madsen, 1998	The Limfjord, Denmark	Observation: Mapping of waterfowl and recreational activities	(Waterfowl) Mute swan, Wigeon, Coot	Boating (sailing, windsurfing), Hunting, Fishing	Although windsurfing showed little spatial overlap with peak autumn birds, birds responded at greatest distances. Hunting was recorded to cause the longest disruptions of bird activity.	-Manage visitor access Zoning for certain activities -Habitat creation, use of refugees
Madsen, Tombre & Eide, 2009	Arctic archipelago of Svalbard, Norway.	Observation	(Breeding) pink-footed goose, the barnacle goose and the light-bellied brent goose	Walking	Disturbance effects varied between the species: pink-footed geese flushed resulting in a high rate of nest loss to avian predators, much higher than the recorded for Barnacle (4%) and Brent geese (0%).	-Manage visitor access

McIntyre, 1977	Minnesota, USA	Observation	(Breeding) Common loons	Boating (Canoes)	Canoes approach inducing flight responses has been related to a reduced chicks survival due to high predator exposure.	
Morse, Powell, & Michhael, 2006	Alaska, USA	Observation and monitoring of breeding birds and recreationists	(Breeding) Black Oystercatcher	Camping by sea kayakers	Annual productivity was not strongly affected by recreational disturbance, but by high tides and weather conditions.	-Preventive management Relocate camp sites away from nest sites.
Navedo & Herrera, 2009	Cantabria, Spain	Observation and monitoring	(Migrating) Eurasian spoonbills	Boating (Canoe) and celebrations (fireworks)	Disturbance was related with consequences on energy budgets and effect on 10% of the Atlantic population of Eurasian spoonbills.	-Manage visitor access Restrict access during migration time Use regulations for rowing.
Pearce-higgins et al., 2007	Peak District National Park, England	Observation	(Breeding) Golden Plovers and Dunlins	Walking	No evidence that nest location, clutch survival or chick growth rates were reduced close to the footpath. Only high pressure could impact habitat usage significantly	-Manage visitor access Keep people on routes.
Pease, Rose & Butler, 2005	Virginia, USA	Experimental	(Wintering) Dabbling ducks	Walking, cycling, vehicles	People walking and cycling disturbed ducks more than vehicles did. Ducks were more likely to fly when closer to sources of disturbance	-Manage visitor access Provide public transport through the reserve and limit number of visitors.
Peters & Otis, 2006	South Carolina, USA	Experimental: disturbance trials	(Non-breeding) Shorebirds and wading birds	Boating (motorboats)	Half of all individuals of all species except Snowy Egrets abandoned the tidal creek after experimental boat intrusion.	-Buffer Zones To be implemented in a species by species basis.
Peters & Otis, 2007	South Carolina, USA	Observation and mapping to calculate variability of roost selection	(Non breeding) Shorebirds in a wintering refuge: Red Knot, American Oystercatcher, Dowitcher and Ruddy Turnstone	Boating (motorboats)	Red Knots avoided roosts that had an annual high average boat activity within 1000 m, but disturbance did not appear to be a factor for other species. Dowitchers and whimbrels avoided prospective roosts when daily boat activity within 100 m was high.	-Buffer zones To onside species-specific differences in temporal- and spatial-scale; -Monitoring.

Quan, Wen & Yang, 2002	Lashihai Lake, China	Observation	(Migrating) Black Coot, Little Grebe and Common Pochard	Boating (fishing in canoes)	The degree of disturbances at each point usually changed with season, as did habitat quality; The distribution pattern of the waterbirds was influenced by human disturbance and not habitat quality. Direct mortality evidence was found.	-Manage visitor access; Limit number of canoes, zoning (a designated non-fishing zone, at least one-third of the lake), forbid fishing during winter; -Education.
Ream, 1976	Minnesota, USA	Observation	(Breeding) Common Loon	Boating (canoes)	Increasing numbers of canoeists was related with breeding failure.	
Rodgers & Schwikert 2003 .	Florida, USA	Experimental: disturbance trials using an airboat	(Breeding) Waterbirds: Pelecaniformes, Ciconiiformes, Falconiformes	Boating (Airboating)	There was considerable variation in the flush distances within species and among species	-Buffer zones To be site and species specific; -Monitoring.
Rodgers & Smith, 1995	Florida, USA	Experimental: disturbance trials using walkers, motorized and non-motorized boats (canoe and motorboat)	(Breeding) Colonial waterbirds: Great Egret, Snowy Egret, Brown Pelican, Double-crested Cormorant, Heron, and Least Tern	Walkers and boating (canoes and motorboats)	Response to disturbance was species specific. Colonial waterbirds exhibited greater flush distances in response to walking disturbance compared to motorboat disturbance. Great Blue Herons and Great Egrets were two of the species most sensitive to human and boat disturbances.	-Buffer Zones Most sensitive species should be used to establish buffer zones Recommended buffer zones: -Wading bird colonies: 100 meters -Mixed tern/skimmer colonies: 180 meters.
Ronconi & Cassady St. Clair, 2003	Bay of Fundy, Canada	Observation	(Breeding) Black guillemots	Boating (motorboats)	Speed and approach were the main factors eliciting approach distances, being the latter the most influential	-Buffer zones; -Manage visitor access Limit speeds though the use of regulations.

Schummer & Eddleman, 2003	Oklahoma, USA	Observation and monitoring in order to determine diurnal activity budgets and frequency of disturbance	(Migrating) Waterbirds: American coots, American white pelicans, Black terns, Blue-winged teal and Franklin's gulls	Boating (Boat fishing)	Recreation accounted for 86.7% of all disturbances (against natural disturbances 9.6%). Species specific response, increased alertness by American white pelicans; increased escape and alertness of American coots. No data about energy balance implications.	-Manage visitor access Consider habits and migration chronologies of waterbirds when setting seasonal recreation dates.
Sterl, Wagner & Arnberger, 2002	Danube Floodplains National Park, Austria	Observation	Grey herons, mallards	Paddling, walking, angling and swimming	Habituation of birds: The average flight distance of mallards and Grey herons has decreased in the last 10 years	-Manage visitor access Quantitative and temporal limitations of leisure time usage; signposting.
Titus & Van Druff, 1981	Minnesota, USA	Observation	(Breeding) Common Loon	Boating (canoe and motorboats)	Although boating activity appeared as disturbing, it did not show impacts on loon productivity. In comparison, motorboats appeared as more negative	-Buffer zones; -Manage visitor access; -Habitat management Creation of artificial islands.
Thomas, Kvitek & Bretz, 2003	California, USA	Observation	(Non-breeding) Sanderlings	Beach recreational activities	Number of people and intensity of activities significantly reduced sanderlings foraging time, being the most negative activity related with the presence of dogs.	-Buffer zones; -Manage visitor access Strict enforcement of leash laws.
Velando & Munilla, 2011	Galicia, Spain	Observation and development of a behavioural model	(Breeding) European shag	Boating (motorboat)	Boating activity caused avoidance behaviour that reduced foraging activity, excluding birds from the best feeding areas.	-Manage visitor access Restrict number of boats.

Appendix B. Participation Information Sheet used for Questionnaire participants

University of Portsmouth

Participant Information Sheet

You have been identified as a possible candidate to take part in a postgraduate research study. Please take the time to carefully read through this information sheet before deciding whether or not to take part in the study. It is important that you understand what is required of you and what the research is trying to achieve.

The aims of the study are as follows:

- To identify the type and frequency of water-based recreational activities undertaken within Langstone Harbour;
- To determine environmental awareness of the Harbour users, and of possible restricted access zones;
- To assess people's perception on the potential disturbance caused by water-based recreational activities in the Harbour;
- To identify which zones of the Harbour are most commonly used and assess if these are used by different user groups;
- To identify management measures to be supported by recreationists in the Harbour.

It is entirely up to you whether or not to partake in this study. You are under no obligation to take part and may withdraw from the study at any time without reason.

If you decide to take part in the study, you will be asked to complete a **SHORT QUESTIONNAIRE** that should need around **5 MINUTES** to complete. All information collected in the survey will be strictly confidential. The names and details of participants will never be recorded and no individual questionnaire will be referred to individually.

The results of the study will be used within a Masters Course dissertation, which forms a major part of the MSc Coastal and Marine Resource Management degree.

I am conducting the research as a student within the Department of Geography at the University of Portsmouth. The research has been approved by the University of Portsmouth.

THANK YOU for taking time to read this through and for considering being involved with this research project.

For further information please contact myself via the following e-mail:

Miss S. Méndez: sara.mendezroldan@myport.ac.uk

Appendix C. Questionnaire

LANGSTONE HARBOUR VISITOR SURVEY

Please, could you spare a few minutes to take part in a short survey about your visit today? Tick the circles that apply to your closest answer and check whether single or multiple answers are advised, including the **following statement**:

I have read the participant information sheet and I agree to take part in this study O (Tick)

Q1- What is the main activity you are undertaking today? (Tick only ONE)

O Sailing (Dinghy)
O Windsurfing/Kite surfing
O Powerboating
O Kayaking/Canoeing
O Rowing O Other/please specify……..

Q2- At which time of the year do you practice this activity (within Langstone Harbour) and how often? (Tick all that apply)

O I don't know/First visit

Season	Never	Less than once a month	Once a month	Weekly	Daily
Spring	O	O	O	O	O
Summer	O	O	O	O	O
Autumn	O	O	O	O	O
Winter	O	O	O	O	O

Q3- What makes you come here, specifically, rather than another local site? (Tick all that apply)

O I don't know
O Close to home
O Facilities (eg toilets, café)
O Particular wildlife interest
O Particular launching facilities
O Right place for activity (eg recreation)
O Good/easy parking
O Choice of routes is varied
O Attractive views
O Other (please specify)……..

Q4- Are you aware of any restricted areas for recreationists applying within the harbour? (Tick only ONE)

O Yes† O No. **IF YES, how did you learn about such areas?** (Tick all that apply)

O Signs/posters within the Harbour
O Informed by the Portsmouth Watersports Centre†
O Informed by Langstone Harbour staff
O Local Press†
O Internet†
O From other harbour users O Other (please specify)……..

Q5- In your experience, how do OTHERS comply with access restrictions? (Tick only ONE)

O I ignore access restriction regulations
O It's my first time and I have not started the activity yet
O I always see compliance†
O I have seen non-compliance once†
O I have seen non-compliance more than once
O Non-compliance is very frequent†
O I do not wish to discuss activities of others†

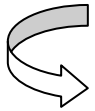
Q6- How well do you believe YOU comply with access restrictions? (Tick only ONE)

O I ignore access restriction regulations
O It's my first time and I have not started the activity yet
O Good compliance†
O Occasionally non-compliance†
O Frequent non-compliance†
O I do not want to discuss own compliance with regulations

Q7- In your opinion, why do you think there are restriction access areas? (Tick all that apply)

O I don't know
O Other water-based activities take place (e.g. windsurf)
O There are main navigation channels
O Important habitats and species conservation
O Unsafe zones due to sea currents or tidal reasons

Continue to next page



Q8- As far as you know, how well bird populations are performing in Langstone Harbour? (Tick only ONE)

O I don't know
O Bird populations are declining
O Bird populations are increasing
O Bird populations are stable

Q9- Rate the potential impact you <u>THINK</u> these activities can have on bird populations. (Tick all that apply)

Activity	No impact	Low impact	Moderate impact	High impact
Sailing	O	O	O	O
Windsurf/ Kite surf	O	O	O	O
Powerboating	O	O	O	O
Kayak/ Canoe	O	O	O	O
Rowing	O	O	O	O

Q10- What of the following actions would you support to minimize bird disturbance caused by water-based recreationists? (Tick all that apply)

O I don't know
O No measure is needed
O Restrict access to some areas
O Forbid activities in the entire harbour
O Further signposting
O Education resources

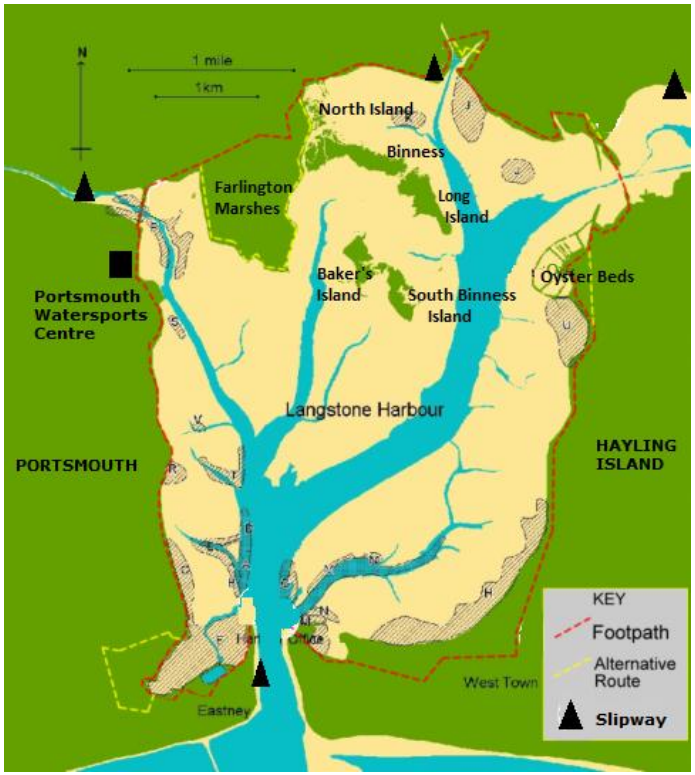
Use this space for further comments about the survey or Langstone Harbour:

……
……
……

Q11- Indicate where you go within Langstone harbour using your watercraft (Tick all that apply)

O Stay on the water
O Small islands
O Beach/mudflat
O Other (please specify)……

Q12- Looking at the area shown in this map, could you indicate the route planned or already undertaken? (Cross places out or draw the route you plan to visit or have already been to).



In order to check whether we have a representative sample, please answer the following:

Q13- Age category (Tick only ONE)
O Under 18
O 18-34
O 35-55
O + 55

THANK YOU VERY MUCH FOR YOUR TIME!

Appendix D. Tabulated responses from Questionnaires

Q1- What is the main activity you are undertaking today?					
	Sailing	**Windsurf/Kitesurf**	**Powerboating**	**Kayaking/Canoeing**	**Rowing**
Participants (No)	9	13	2	33	2
Participants (%)	15.25	22.03	3.39	55.93	3.39

Q2- (a) At which time of the year and how often do you practice this activity (Kayaking/canoeing)?												
	Never		Less than once a month		Once a month		Weekly		Daily		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Spring	1	3.33	6	20.00	7	23.33	15	50.00	1	3.33	30	100
Summer	0	0.00	5	16.67	5	16.67	18	60.00	2	6.67	30	
Autumn	4	13.33	6	20.00	9	30.00	11	36.67	0	0.00	30	
Winter	8	26.67	7	23.33	9	30.00	6	20.00	0	0.00	30	

Q2- (b) At which time of the year and how often do you practice this activity (Other activities)?												
	Never		Less than once a month		Once a month		Weekly		Daily		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Spring	1	5.88	2	11.76	5	29.41	9	52.94	0	0.00	17	100
Summer	0	0.00	0	0.00	2	11.76	12	70.59	3	17.65	17	
Autumn	3	17.65	3	17.65	2	11.76	8	47.06	1	5.88	17	
Winter	5	29.41	3	17.65	3	17.65	6	35.29	0	0.00	17	

Q3- What makes you come here, specifically, rather than another site?		
Response options	Responses(No)	Responses (%)
Right place for activity	45	26.95
Close to home	39	23.35
Attractive views	30	17.96
Particular wildlife interest	13	7.78
Good/easy parking	12	7.19
Choice of routes is varied	12	7.19
Launching facilities	11	6.59
Facilities	5	2.99
Total	167	100.00

Q4- (a) Are you aware of any restricted areas for recreationists applying within the harbour?						
[7]	Yes (T)	No(T)	Yes(K&C)	No(K&C)	Yes(O)	No(O)
Participants (No)	42	17	26	7	16	10
Participants (%)	71.19	28.81	78.79	21.21	61.54	38.46
First-timer recreationists (No)	4	10	1	2	3	8
First-timer recreationists (%)	28.57	71.43	3.03	6.06	11.54	30.77

[7] T- Total number of participants; K&C- Kayakers and canoeists; O- Other activities

Q4- (c) If yes, how did you learn about such areas?		
Response options	**Responses (No, n=42)**	**Responses (%)**
Signs/posters	26	61.90
Other harbour users	17	40.48
Langstone Harbour staff	10	23.81
Internet	8	19.05
Other- Sports Club	8	19.05
PWC	4	9.52
Local Press	4	9.52

Q5- In your experience, how do others comply with access restrictions? (Tick only one)		
Response option	Responses (No, n=42)	Responses (%)
I have seen non-compliance more than once	20	47.62
I have seen non-compliance once	6	14.29
I always see compliance	7	16.67
I do not wish to discuss activities of others	5	11.90
I have not started the activity yet	4	9.52

Q6- How well do you believe you comply with access restrictions		
Response option	Responses (No, n=42)	Responses (%)
Good compliance	31	73.81
Ocassionally non-compliance	2	4.76
I have not started the activity yet	4	9.52
I do not wish to discuss own compliance	5	11.90

Q7- How well are birds performing in Langstone Harbour?			
	'Not aware' respondents (%, n=17)	'Aware' respondents (%, n=42)	'Aware' respondents (No, n=42)
I don't know	100	54.55	24
Decreasing	-	13.64	6
Increasing	-	6.82	3
Stable	-	25.00	11

Q7- In your opinion, why do you think there are access restrictions?				
Response option	'Aware' respondents (No, n=42)	'Aware' respondents (%)	'Not aware' respondents (No, n=17)	'Not aware' respondents(%)
I don't know	2	4.76	3	17.65
Other activit.	6	14.29	4	23.53
Navigation channels	15	35.71	4	23.53
Habitats/sp	31	73.81	4	23.53
Unsafe zones	17	40.48	9	52.94

Q9- (a) Rate the potential impact you think these activities can have on birds populations								
Activity	No impact (No/%)		Low (No/%)		Moderate (No/%)		High (No/%)	
Sailing	31	52.54	23	38.98	5	8.47	0	0
Windsurf	15	25.42	26	44.07	18	30.51	0	0
Powerboat	4	6.78	14	23.73	24	40.68	31	52.54
Kayak/Canoe	28	47.46	30	50.85	1	1.69	0	0
Rowing	32	54.24	26	44.07	1	1.69	0	0

Q9- (b) Rate the potential impact you think these activities can have on birds populations, considering the main respondents' groups					
Activity	Group of respondents	No impact	Low impact	Moderate impact	High impact
Sailing	Kayakers/Canoers	13	15	5	0
	Windsurfers	11	2	0	0
	Sailors	7	2	0	0
Windsurf	Kayakers/Canoers	7	14	14	0
	Windsurfers	8	5	0	0
	Sailors	1	5	3	0
Powerboating	Kayakers/Canoers	3	7	12	11
	Windsurfers	0	4	7	2
	Sailors	0	1	6	2
Kayak/Canoe	Kayakers/Canoers	15	17	1	0
	Windsurfers	9	4	0	0
	Sailors	3	6	0	0
Rowing	Kayakers/Canoers	16	18	1	0
	Windsurfers	10	3	0	0
	Sailors	6	3	0	0

Q10- What of the following actions would you support to minimize bird disturbance caused by water-based recreationists?		
Response option	Responses (No)	Responses (%)
I don't know	2	3.39
No measure is needed	14	23.73
Restrict access to some areas	28	47.46
Forbid activities	0	0.00
Further signposting	39	66.10
Education resources	17	28.81

Q12- Harbour Usage				Q13- Age Category			
Options	**On the water**	**Small islands**	**Beach/mudflats**	**<18**	**18-34**	**35-55**	**55+**
Participants(No)	59	8	15	0	32	16	11
Participants (%)	100	13.56	25.42	0	54.24	27.12	18.64

Appendix E. Participation Information Sheet (a) and Consent Form (b) aimed at Interviewees

University of Portsmouth

a) Participant Information Sheet

Portsmouth, *(day)* of *(month)*, 2013

Study Title: Water-based recreation disturbance on coastal bird populations.
A canoeing/kayaking case study in Langstone Harbour, UK.

Name of Researcher: Sara Méndez Roldán

I would like to invite you to take part in my research study. Please take the time to carefully read through this information sheet before deciding whether or not to participate in the study. It is important that you understand what is required of you and what the research is trying to achieve. After you have read this information document you will be invited to complete a **Consent Form**.

The study is concerned with potential disturbance on bird populations caused by kayaking and canoeing activities in Langstone Harbour. It has been found that due to the increasing development within the Solent area, the rising number of visitors, mainly through water-based recreational activities, could cause severe impacts on the survival of bird populations.

You have been selected to participate in this study as an employer of (*to fill in*). Therefore, your experience will provide insights into (*to fill in, e.g. the harbour management, existent coordination with other authorities, as well as personal views and recommendations on the issue).*

It is entirely up to you whether or not to partake in this study. You are under no obligation to take part and may withdraw from the study at any time without reason.

Procedure

If you decide to partake in the study, you will be interviewed by the study's researcher during an estimated time of 40 minutes. The interview will involve questions about the role of (*to fill in*). With your permission, I will audiotape and take notes during the interview. The recording is to accurately record the information you provide, and will not be used for other than for the purposes described above and third parties will not be allowed access to them (except as may be required by the law). However, if you request it, you will be supplied with a copy of *your* interview transcript so that you can comment on and edit it as you see fit.

Confidentiality

Your study data will be handled confidentially. If results of this study are published or presented, individual names and personally identifiable information will not be used, unless you give explicit permission for this below. Results will be summarised into a form which will be accessible to participants, although access to the research study will also be possible under request.

The results of the study will be used within a Masters Course dissertation, which forms a major part of the MSc Coastal and Marine Resource Management degree.

I am conducting the research as a student within the Department of Geography at the University of Portsmouth. The research is not being funded by any group or organization, and has been approved by the University of Portsmouth.

Research in the University of Portsmouth is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given a favourable opinion by Malcolm Bray, Research Ethics Committee.

If you have a concern about any aspect of this study, you should ask to speak to the researcher or their supervisor, who will do their best to answer your questions.

-**Further information** (general/specific) about the research study may be requested to the researcher:

Sara Méndez Roldán: sara.mendezroldan@myport.ac.uk

Thank you for taking time to read this through and for considering being involved with this research project. You will be given a copy of the information sheet to keep and your consent will be sought.

b) Consent Form

Study Title: Water-based recreation disturbance on coastal bird populations.
A canoeing/kayaking case study in Langstone Harbour, UK.

Name of Researcher: Sara Méndez Roldán

1. I confirm that I have read and understand the participant information sheet dated dd/mm/yy (Version X) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.

3. I understand that data collected during the study, may be looked at by individuals from the University of Portsmouth, or from other authorities. I give permission for these individuals to have access to the information provided during the research interview.

I agree to take part in the above study and am willing to (please tick those you agree to):

☐ Be interviewed

☐ Have my interview audio recorded

☐ Being a named participant and quoted by name

☐ I request a transcript of the interview

You will be given a copy of this consent form to keep for your own records

Name of Participant: (*to fill in*)
Date: dd/mm/yy *Signature:*
Name of Person taking consent: Sara Méndez
Date: dd/mm/yy *Signature:*

Appendix F. Detail of some of the interviews questions and responses

What is the role of your organisation?	
Interviewee	**Response**
Hayward, PCC	Land of mean low water answers to the planning system, requests planning application, needs planning permission as well as EIA and habitats regulation assessments. "Planners work closely with Natural England. In Portsmouth, nature conservation is a big issue, tightly bounded with natural designations, and consequently any development in the city can have a potential impact on the nature conservation interest in the rest of the harbours, not always immediately apparent to our residents or members".
Boschi & Hill, HBC	The management of the West Hayling Local Nature Reserve was ceded to the RSPB as they own better resources, expertise and specialization. HBC also owns planning responsibilities.
MacCallum, LHB	Referred to the functions summarized in Figure 5.3.
Smith, RSPB	RSPB looks after their interest in Langstone Harbour, including bird populations' conservation. Currently, the Little tern project is the main focus of work at the moment, it's a 3 year funded project by the European Union and heritage lottery fund to bring the number of nesting little tern back to what is was historically (…), working with the community to raise awareness and getting them behind the project.
Chapman, WT	Management of the Farlington Marshes natural reserve, which counts on different legal designations. PCC have statutory duties to preserve the local nature reserve, but these duties are passed to the wildlife trust, which also had a lease with the previous owner, so we've managed the reserve for about 50 years.There are different management plans for different issues. The wildlife trust are consulted on a lot of planning (planning officers) and participates in Langstone advisory committee. Work with the community to raise awareness, but not as much as desired due to related difficulties (e.g.Funding, private close parking, etc).

How is collaboration with other authorities achieved in Langstone Harbour?		
Interviewee	**Response**	**Further commentaries**
Hayward, PCC	Collaboration is effective. Whereas the Solent Forum looks from a wider point of view, the Advisory Committee considers Langstone issues at a local level.	In addition, PCC collaborates with a range of local authorities very regularly, PCC is part of the: -Solent local enterprise partnership -Partnership of south Hampshire (Work in spatial planning matters, in combination assessment of development impacts in different places, and its meaning for the SPA designations).
Boschi & Hill, HBC	Collaboration is effective.	Regarding planning applications, consultation is automatic and the planning officer will consider everyone.
MacCallum, LHB	Advisory committee joins people, as well as the Solent Forum. Effectiveness of this collaboration depends on the authority. Communication and level of investment should be improved.	LHB is consulted in all applications taking place within the harbour boundary. Being the only person in the environmental team implies facing challenges that require support from other organizations. There is a great collaboration with IFCA (Inshore Fisheries and Conservation Committee), with who we share evidence and work together in fishing recreational activity matters.
Smith, RSPB	Collaboration could be improved through a stronger link with LHB, joining the patrols. More economic support from	RSPB works closely with WT, sharing information: or with the environment officer at LHB, in the past they have intervened on their behalf through patrolling. Another example includes IFCA, which have been very helpful this year supporting the RSPB with the shellfish

	different authorities would also be helpful.	gatherers issue.
Chapman, WT	"Largely efficient collaboration" through the advisory committee and Solent forum.	Close collaboration with the RSPB and other statutory bodies like NE, EA. In Farlington marshes the biggest issue is related to the conservation of the seawall circling the reserve that determines further funding and investment.

Which recreational activities do you consider to be more disturbing for bird populations in Langstone Harbour, during both summer and winter months?		
Interviewee	**Ranking**	**Commentaries**
Hayward, PCC	Both land and water-based recreational activities	"Most disturbing activities are those irregular, difficult to control and which are able to approach roosting sites". Kayaking/canoeing have the potential to be one of these activities, being summer the most vulnerable months for bird populations (higher levels of activity).
Boschi & Hill, HBC	1. Dog walkers 2. Windsurfers	"Main disturbance problems related with dog walkers, present both in summer and winter months. In the summer there are higher levels of activities but these are regulated through clubs and others".
MacCallum, LHB	1. Dog walkers 2. Canoeing and kayaking 3. Fishing	Canoeing and kayaking appear as disturbing activities because of the presence of small islands in Langstone harbour, attractive for paddlers. Water-based activities are more active during summer months but are still present in the winter.
Smith, RSPB	1. Shellfish gatherers 2. Angling 3. Kayaking/canoeing and windsurfers	Experience limited to spring and summer months, 2013. Believes that levels of disturbance should be reduced during the winter in terms of water-based recreation.
Anon, RSPB	1. Shellfish gatherers 2. Canoeing/Kayaking, paddle surfing 3. Windsurfing 4. Overflying craft	Long experience in the harbour, witnessed disturbing problems with paddlers and other activities such as powered parachuting. The ranking corresponds to summer months, during the winter there is a strong presence of dogwalkers.
Chapman, WT	1. Water-based recreation	No human disturbance in Farlington marshes, people stay on paths, "hardly anybody wanders across the fields". Considering the rest of the harbour, Chapman (WT) believes that water-based recreation is highly disturbing during high tides, when birds congregate in few sites, having the potential to make birds to change their habitat.

What makes canoeing/kayaking a potential disturbing activity?	
Interviewee	**Response**
Hayward, PCC	Ability to approach roosting mudflats and creeks. It's irregularity.
MacCallum, LHB	Paddling near the shore as islands appear attractive to visitors.
Smith, RSPB	Paddling near the shore, difficult to intercept during patrolling, approaching them for warning could be more disturbing than the canoes on their own.
Anon, RSPB	Paddling near the shore and access to the islands. Difficulty to approach the users and create awareness.

Which management measures do think could be effective in mitigating canoeing/kayaking disturbing effects?		
Interviewee	**Ranking**	**Commentaries**
Hayward, PCC	1. Education 2. Manage visitor access, spatial and temporal restriction	"Education seems the best approach. However, it is not possible to enforce it. Volunteers from different organisations should be put together for this common aim. Codes of conduct or bylaws defining 'no activity zones' would be difficult to implement due to current licensing regimes. "
Boschi & Hill, HBC	1. Education through wardening	"The different access points to the harbour available for paddlers makes difficult to ensure that signage and posters are read. Education through wardening seems like the best approach"
MacCallum, LHB	1. Education through wardening and educational resources	"The union of education resources from different entities could be of great help. Bylaws would need a harbour revision, which is not a straightforward process and implies a high cost. Buffer zones would conflict with rights of navigation, and maintenance costs would also have to be considered".
Smith, RSPB	1. Education (volunteers) 2. Manage visitor access (patrolling)	"Next year a strong volunteer team will be set up in order to reinforce the patrolling team, using friendly conversations with harbour users and pointing out nature with them, educating them for a 'keep a distance'. Further signposting should also assist for this aim.
Anon, RSPB	1. Education and management of visitor access (patrolling) 2. Additional signage	Approach users and create awareness about the importance of the site. Additional signage in order to cover as many access points as possible. Difficult to approach paddlers for education, as they use different access points. Buffer zones would conflict with navigation rights.
Chapman, WT	1. Wardening	The rising problem with recreation disturbance is related to its unpredictability and the lack of effective regulation. Users coming from clubs tend to be more organized. There is a great difficulty to communicate through signage or wardening due to the different access points, and the disturbance issue is not always straightforward to understand.

Appendix G. Web Sites relating to paddling activities to Langstone Harbour

The following table indicates web pages links that contains information for paddlers around Langstone Harbour, used by users that want to explore the area. It can be noted that most of them do not refer to islands' restriction access nor bird disturbing potential or advice.

Website name and URL	Reference to RSPB Langstone Harbour Reserve (Islands)	Reference to Oysterbeds Reserve	Notes
Sitons: http://www.sitons.com/kayaklocation/langstone/	NO	YES	As cited in the site: "Not sure what the rules are for kayaking in the Oysterbeds, but the look on twitcher's faces has always stopped me from exploring"
Canoe days out: http://www.canoedaysout.com/trip/154	NO	NO	Refers to the islands as sites for picnics.
Paddle points: http://www.paddlepoints.net/Water.aspx?WaterType=3&WaterId=241	NO	NO	It only indicates the location of the slipways.
Solent kayak pages: http://solentkayakpages.blogspot.co.uk/2007/02/langstone-harbour.html	YES	NO	Refers to RSPB protected islands but does not indicate restriction access regulations.
Share my routes: http://www.sharemyroutes.com/routes/United-Kingdom/Langstone-Harbour-Hampshire-England/Langstone-Harbour-Kayak/details.aspx	NO	NO	Refers to "having a trip in the islands".
Langstone Harbour Board: http://www.langstoneharbour.org.uk/environment-conservation.php	YES	YES	There is reference to the restricted access to the islands in the "environment" section, but maps are only available in the canoe leaflet (publications section) and do not refer to landing areas.

Appendix H. Research Ethics Form

University of Portsmouth, Faculty of Science
Initial Ethics Review Filter: Geography & Earth Sciences

To be completed by <u>all</u> MSc students undertaking research

- You are required to undertake an ethics review of your Research Proposal. Before completing this checklist please read through the guidelines entitled "*Research Ethics Guidance for Geography staff and students*" on MOODLE
- When you have completed the checklist, submit it via Dr Malcolm Bray
- *Ethical review is a University requirement for all research. This form constitutes a light touch mechanism to identify potential ethics issues.*

Name of Principal Investigator ...Sara Méndez.....
Name of Supervisor ...Jonathan Potts.....
Research Title: Potential disturbance of bird coastal populations by recreational activities. A case study of canoeing and kayaking in Langstone Harbour, UK.
Research Aims (give brief statement): Investigate potential disturbance of kayaking + canoeing on bird populations based on literature evidence. Determine whether further action is required in Langstone Harbour
Nature of data collection - give brief details:

Primary or secondary data;
Human data (questionnaire, observations or other – please indicate);
Measurements of physical or biological environment – indicate if "invasive" *e.g.* excavations;
Sampling of rocks, sediments or biological materials; Give field site locations.

Primary data will be collected through interviews aimed at managers and questionnaires aimed at kayak/canoe users in order to explore location of the most vulnerable areas and assess views and awareness of environmental issues in the harbour related to the research topic

(A) Please indicate Yes or No to the following:	Yes	No
Is the study likely to involve human participants? (participants are persons giving data, responding to interviews, or being experimented upon)	☒	☐
*If **'Yes'**, please go to **SECTION B***		
[2] Is the study likely to involve observations of people in non-public places?	☐	☐
*If **'Yes'**, please complete a full Science Faculty participant ethics review application*		

*If **'No'** to **all** of above please answer the following:-*

1) Will the research be conducted within or could it potentially affect a protected area (local, regional, national or international), designated heritage site, geological geomorphological or landscape site and/or vulnerable habitat?	☐	☐
2) Are there risks of damage to protected geological or geomorphological sites and/or habitats?	☐	☐

3) Are there risks of damage to features of historical or cultural heritage? ☐ ☐
4) Are there risks of harm to sensitive/protected flora and/or fauna? ☐ ☐

5) Could the conduct of the research and/or its outputs potentially be harmful to third parties? ☐ ☐

If you have answered 'yes' to a), b), c) or d), then please provide details (in the space below) of the specific risks and how you plan to minimise them. You may attach additional information if necessary.

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Now go to page 5 and sign the Declaration (Section E)

(B) You intend to involve human research participants or subjects. Will your data collection methods involve:-

TICK APPLICABLE BOXES

1. Secondary sources (i.e. data that have already been collected and are in the public domain such as the UK Census of Population, data from web-resources such as ONS Neighbourhood Statistics or the various Government Departments' statistical pages) ☑
2. Primary sources (e.g. face-to-face interviews or questionnaires, focus groups or observational methods)? ☑
3. Both secondary and primary collection methods:- ☑

*If you ticked statement **number 2 or 3**, please go to **SECTION C** on the next page (page 4).*

*If you ticked **number 1** then please indicate whether there are any other potential issues relating to research ethics:-*

Please indicate Yes or No :-	Yes	No
4. Will the research be conducted within or could it potentially affect a protected area (local, regional, national or international), designated heritage site, geological geomorphological or landscape site and/or vulnerable habitat?	☐	☐
5. Are there risks of damage to protected geological or geomorphological sites and/or habitats?	☐	☐
6. Are there risks of damage to features of historical or cultural heritage?	☐	☐
7. Are there risks of harm to sensitive/protected flora and/or fauna?	☐	☐
8. Could the conduct of the research and/or its outputs potentially be harmful to third parties?	☐	☐

If you have answered 'yes' to 4), 5), 6) or 7), then please provide details (in the space below) of the specific risks and how you plan to minimise them. You may attach additional information if necessary.

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Now go to page 5 and sign the Declaration (Section D)

[C] In terms of the primary data collection methods on human participants, please answer the following indicating Yes or No:-

	Yes	No
1. Will the study involve NHS patients, staff or premises?	☐	☑
2. Do human participants/subjects take part in studies without their knowledge/consent at the time or will deception of any form be used?	☐	☑
3. Does the study involve vulnerable (e.g. children or people with learning difficulties) or dependent participants (e.g. students or employees)	☑	☐
4. Does the study involve inquiry concerning participants' sensitive sexual, political, financial, ethnic, illegal behaviour?	☐	☑
5. Are drugs, placebos or other substances (e.g. food, vitamins) to be administered to participants?	☐	☑
6. Will blood or tissue samples be obtained from participants?	☐	☑
7. Is pain or more than mild discomfort likely to result from the study?	☐	☑
8. Could the study induce psychological distress or anxiety in participants, and/or third parties?	☐	☑
9. Will the study involve prolonged or repetitive testing of participants?	☐	☑
10. Will financial inducements other than reasonable expenses be offered to participants?	☐	☑

Please indicate whether there are any other general problems relating to research ethics:-

11) Will the research be conducted within or could it potentially affect a protected area (local, regional, national or international), designated heritage site, geological geomorphological or landscape site and/or vulnerable habitat?	☐	☑
12) Are there risks of damage to protected geological or geomorphological sites and/or habitats?	☐	☑
13) Are there risks of damage to features of historical or cultural heritage?	☐	☑
14) Are there risks of harm to sensitive/protected flora and/or fauna?	☐	☑
15) Could the conduct of the research and/or its outputs potentially be harmful to third parties?	☐	☑

If you have answered 'yes' to 2, 3, 4, 8, 9, 10, 11, 12, 13, 14, or 15 then you must provide additional details (in the space below) of the specific risks and how you plan to minimise them. Please attach any additional materials if necessary.

Although the questionnaires are intended to be answered by adults, it is possible that children or under 18 sense users have access to the survey sheets. Informed consent will be stated before starting the questionnaire. Anonymity will be guaranteed so parental permission will not be required. The questions will be adequate, avoiding offensive language.

Now go to page 5 and sign the Declaration (Section D)

[D] Declaration

I confirm that the information provided is a complete and accurate record of my plans at present and that I shall resubmit an amended version of this form should my research alter significantly such that there is any significant variation of ethical risk. I confirm that I have read the University Ethics Policy (2011) and have read "Research Ethics Guidance, Geography Staff and Students" available at: *K:\Student\Science\Geography General\Course Support Materials\Independent Study\level 5\Geography Ethics*

If I need to construct a questionnaire or set of questions to use in an interview, then I will seek my supervisor's approval of the final wording and format. Where necessary, I will also provide a covering letter/information leaflet or consent form using the University generic templates available on MOODLE

Signed ..... (Principal Investigator)

Date 26th June 2013

[E] REVIEW RECORD *(completed by Departmental Ethics Representative after you have submitted the checklist)*

Dr Malcolm Bray (Chair of Environment Research Ethics Committee will review your submitted ethics checklist and will tick one of the boxes below. If there is a recommendation to undertake clarification in terms of ethics consideration (e.g. undertaking to follow simple procedures to minimise risks) or undertaking a more detailed ethics review then instructions will be included with the returned form. If your proposal is not ethically viable then this will also be made clear and you will be asked to significantly amend and/or rethink your research.

Favourable opinion : INSIGNIFICANT risk/issues arising ☐

Favourable opinion : INSIGNIFICANT risks subject to comments listed below ☑

Risks assessed as SIGNIFICANT referred for FACULTY Ethics Review ☐

Opinion not possible, or referred for detailed review – reasons specified below ☐

for the questionnaires
The information is being recorded without any way of identifying individuals.
The questionnaire does not cover sensitive topics.
The questionnaire can be worked for use by those age 16 and above. As ensure that informed consent can be obtained. In case of youth groups - group leaders will be consulted.
Activity questionnaires need to be accompanied by a participant information sheet. Manager interviews make it difficult to record identities to consents (written) pre-loaded and participant information sheet too. Sensitive information should not be transcribed. If interviews appear sensitive offer the participant the opportunity to approve the transcript

Signed..... (Departmental Ethics Representative)

Date 16/07/13

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