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First year results of monitoring bird disturbance around the Solent, in the presence/absence of rangers

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Summary

This report provides results from bird disturbance fieldwork, undertaken during the winter 2016/17, comparing visitor behaviour, bird numbers and the response of birds when rangers were present and when they were not present. The data forms baseline data for monitoring mitigation around the Solent, and the need for the monitoring was identified as part of the Solent Recreation Mitigation Strategy (now the Solent Bird Aware Initiative). Rangers are a key component of a package of mitigation measures relating to recreation pressure from new housing. The winter of 2016/17 was the second winter that rangers have been deployed around the Solent. The Bird Aware Solent Ranger team comprised 3.6 (full-time equivalent) rangers over the winter and their work has involved showing people birds and raising awareness among visitors of the conservation issues.

Ten survey points¹ were selected, through discussion with the steering group and the ranger team. These were locations which matched the areas targeted for ranger presence over the winter 2016/17. A total of 148 visits were made to these locations, with visits paired to allow direct comparison between visits with and without a ranger. Paired visits were on subsequent days with the timing adjusted on the second day to match the tide state of the previous day. Survey visits focussed on a set recording area and recorded (over a period of 105 minutes): the level of human activity (as a 'diary'), the numbers of birds present and the response of birds present.

Ryde, East Head and Portchester were the busiest locations in terms of access, while Calshot, Bosham and Newtown were the quietest locations. Across all locations, dog walking was the commonest activity recorded, accounting for 54% of diary entries. Particularly high numbers of dog walkers were counted at Ryde, Portchester and East Head.

There was no significant difference in the number of diary entries logged when rangers were present compared to when they were absent, suggesting the presence of rangers did not result in people avoiding sites. Similarly, there were no significant differences in the number of dogs off lead, indicating that the ranger presence has yet to make a difference in terms of the people putting their dogs on leads (note that the rangers do not directly ask people to put their dogs on a lead).

Across all sites, during the visit when rangers were present, 41% of groups passed within 100m of the ranger and a fifth (20%) of groups had a conversation with the rangers. Newtown, Hayling Oysterbeds, Calshot and Portchester were the sites where the highest proportion of groups spoke to the ranger. Portchester was notable in that there were high numbers of groups recorded within 100m of the ranger and a high proportion of groups

¹ At Portchester; Bosham; Newtown; Ryde; Pennington; Calshot; Bunny Meadows; Milton; East Head; Oysterbeds, Hayling

talked to the ranger, indicating that even at very busy sites it is possible for the rangers to talk to a reasonable proportion of visitors.

A total of 42 bird species were recorded in the focal areas – these included a range of waders (19 species) and wildfowl (16 species). Hayling Oysterbeds was markedly different from the other sites, with high numbers of waders (particularly Dunlin), using the site as a roost. Bosham was the site with the most wildfowl, with Brent Goose being the main species here. There were no significant differences in the numbers of waders, wildfowl, gulls/terns or 'other' species present when a ranger was present compared to when there was no ranger.

Across all sites there were 7,447 species-specific observations where people and birds were present, and of these 90% resulted in no visible change in behaviour or any kind of response from the birds, while 10% involved birds changing their behaviour. Around 4% of observations involved birds being flushed and undertaking a major flight (displaced more than 50m). There were slight differences when rangers were present (9% of observations involving birds changing their behaviour when rangers were present compared to 11% when rangers were absent).

Looking at the number of birds responding to people, differences were more pronounced when a ranger was present. Fewer birds responded to disturbance (for example being flushed) when a ranger was present at Bosham, Bunny Meadows, Hayling Oysterbeds, Milton, Newtown, Pennington and Portchester (seven out of the ten locations). The difference in the number of birds disturbed with and without a warden was particularly striking at Bosham and Milton.

At Bosham, Bunny Meadows, Milton, Newtown, Pennington, Portchester and Ryde the proportion of birds disturbed (i.e. any behavioural response) was significantly lower when a warden was present. Activities where the proportion of birds disturbed was less when a ranger was present were dog walking, walking, jogging, and 'other' (i.e. activities that did not fit with our standard categories). These are potentially some of the activities that would be most easily intercepted by the rangers.

The results provide the initial findings of monitoring that is anticipated to run for a number of years. The results from this year are therefore not intended to provide comprehensive findings or complete results. The results show slight positive effects of ranger presence, particularly in terms of the overall number of birds disturbed, rather than the proportion of events that cause disturbance. It is important to note this is only the second year of the ranger team and other mitigation measures are also only just being established. The Bird Aware branding (including the new website and leaflet) and key messages for the project have only just been developed over the winter. The ranger team is small and the 2016/17 winter was the year in which the public profile was launched. The monitoring is intended to provide baseline results for comparison with future years and to guide how the rangers are deployed. Implications are discussed but key recommendations are:

S o l e n t b i r d d i s t u r b a n c e m o n i t o r i n g

- For each site, a target is set for what the rangers are aiming to achieve, and this is communicated directly to visitors. Targets would relate to visitor numbers (e.g. fewer visitors walking in a particular area), visitor behaviour (e.g. fewer dogs off lead), bird numbers (e.g. increased use of an area by birds) or bird behaviour (e.g. fewer birds flushed). Ranger effort would then become focussed to specific spots and targets and the monitoring could also, in part, directly report against those targets.
- The reach and effectiveness of the rangers is increased through temporary signs (e.g. 'A' boards that can be put out at key locations), temporary fencing etc. that can help influence people besides the rangers simply speaking to them. An example is a roost on a linear section of beach where people can approach in either direction. As the ranger can only stand on one side of the roost, the use of temporary signage/fencing etc. on the other side could make a major difference.

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Fieldwork was undertaken by: Dave Chown, Nick Hopper, Neil Gartshore and Durwyn Liley. Data were entered by Debbie Blake.

1. Introduction

- 1.1 This report provides results from bird disturbance fieldwork, undertaken during the winter 2016/17, comparing visitor behaviour, bird numbers and the response of birds when rangers (part of the Bird Aware Solent Ranger Team) were present and when they were not present. The data forms baseline data for monitoring mitigation around the Solent and is necessary as part of the Solent Bird Aware Initiative.
- 1.2 The Solent shoreline between Hurst Castle and Chichester Harbour, including the north shoreline of the Isle of Wight, measures some 250km in length. The wintering bird interest includes three Special Protection Areas (SPAs): the Solent & Southampton Water SPA, Chichester and Langstone Harbours SPA and Portsmouth Harbour SPA. The shoreline is heavily populated and new housing levels, as summarised in the Partnership for Urban South Hampshire ('PUSH') statement from 2016, indicate a level of 104,350 dwellings in the period through to 2034², much of it concentrated in the coastal strip.
- 1.3 The existing high local population and level of expected growth has prompted concern regarding likely significant effects to the European sites, as a result of increased recreation and disturbance to wintering waterbirds. Visitor surveys (Fearnley, Clarke & Liley 2010, 2011), bird fieldwork (Liley, Stillman & Fearnley 2010) and modelling work (Stillman et al. 2012) provide the background and evidence. Further work developed an approach for a mitigation strategy (Liley & Tyldesley 2013), providing a strategic solution whereby development could come forward. An interim mitigation strategy³ was produced by the Solent local authorities in 2014. The package of mitigation measures included ranger presence on sites; initiatives to encourage responsible dog ownership; appointment of a project officer to coordinate the work and contribution to a pilot project (the Alver Valley) to test the effectiveness of providing alternative spaces for recreation.
- 1.4 Deployment of rangers is a mitigation approach generally recognised to be effective (Ross *et al.* 2014). Rangers were first deployed during the 2015/16 winter, with a level of ranger effort of 2.6 (full-time equivalent posts). Over the 2016/17 winter, 3.6 (full-time equivalent) rangers were employed. Rangers visited sites on their own and initially the aim has been to establish

² http://www.push.gov.uk/work/planning-and-infrastructure/push_spatial_position_statement_to_2034-2.htm

³ <http://www.birdaware.org/strategy>

a ranger presence, showing people birds and raising awareness about the issues of disturbance. While some of the sites where the rangers work are formal nature reserves, many of the locations have no infrastructure or interpretation that might convey they are important to wildlife. Visitors use sites as they are their nearest greenspace and many parts of the shoreline are popular for a range of activities including dog walking, walking, bait digging and watersports (see Fearnley, Clarke & Liley 2010). It is anticipated that the rangers – as part of a wider package of mitigation measures – will influence visitor behaviour.

1.5

Integral to any such mitigation strategy is monitoring. Monitoring data provides a check as to how well different approaches are working and allows mitigation to be honed, for example through targeting resources slightly differently. A monitoring strategy (Liley *et al.* 2015) recommended a range of data gathering and included a recommendation for targeted work to test the effectiveness of rangers. The aim of the work was to collect data over a number of years to enable checks relating to the level of ranger effort, the locations targeted and the rangers' approach to be considered. This report summarises the results of the first year of that monitoring.

2. Methods

2.1 Ten survey points were selected through discussion with the steering group and the ranger team. These were locations which matched the areas targeted for ranger effort over the winter 2016/17. The points are summarised in Table 1 and Map 1. The survey points fall into two groups:

- Open mudflats where birds feed, spread out at low tide (four survey points);
- Mudflat and adjacent saltmarsh/islands/banks where birds roost, such areas will be used by birds at all tide states, but visits will be focussed around high tide, ideally on rising⁴ tides when birds are gathering to roost and feed pre/roosting (six survey points);

2.2 The latter group, roost sites, will be one of the locations where a ranger would be expected to be most effective – as the birds are concentrated in very specific locations, it should be easier for rangers to target visitors most likely to cause disturbance. Milton is perhaps an exception as the roost site (which has not held a roost for a number of years) is a small spit. Ranger effort during the surveys was focussed on the opposite (northern) shore, away from the spit, while the surveyor was based on the road (surveys conducted from the vehicle/road pavement) relatively close to the spit.

2.3 The areas of open mudflat will be perhaps more challenging for rangers to be successful, and within the four locations a range of access types and levels of access is to be expected. In this latter group, Ryde is slightly different from the other three locations as people tend to walk out on the sandflats, whereas the other sites have much softer sediments and therefore visitors tend to be more concentrated on the shoreline. As such the ten locations provide a range of locations and types of access and can be grouped, allowing the potential to directly compare within groups.

⁴ Rising is targeted, especially at potentially busy locations as there is less risk of birds being disturbed and moved on before the survey work takes place.

Table 1: Overview of survey locations.

ID no. (see Map 1)	Location	Surveyed in 2010?	Habitats present	Tide states at which to survey
Areas of open mudflat/sandflat where birds feed				
4	Portchester		Mudflats	Low/rising/falling
8	Bosham		Mudflat, saltmarsh, includes roost site west of Colner Creek	
9	Newtown	✓	Mudflat, lagoon, saltmarsh	
10	Ryde	✓	Sandflat	
Areas of mudflat and saltmarsh where birds feed and gather to roost				
1	Pennington		Saltmarsh, mudflat, lagoon, shingle beach/chenier banks	Rising
2	Calshot		Saltmarsh, mudflat, shingle banks	Rising
3	Bunny Meadows		Saltmarsh, mudflat, shingle beach	High/rising/falling
5	Milton (Eastney)		Shingle bank, roost site, mudflats used for feeding	Low, Rising
7	East Head		Mudflats, saltmarsh, sand dune	High/rising/falling
6	Oysterbeds, Hayling		Mudflat, lagoons, saltmarsh	High/rising/falling

Survey visits and effort

- 2.4 The four points that are open mudflat were each surveyed 16 times and the other six survey points were each visited 14 times, giving a total of 148 survey visits across the ten locations. This break-down ensured an even number of visits to each survey point and matched the available budget. Visits were paired, with the intention of one visit in each pair coinciding with a ranger being present and the other visit being at a time when rangers were not present, allowing direct comparison. The paired visits were undertaken on subsequent days, with the timing on the second day matched to ensure the tide state was comparable (i.e. on the second day surveys usually started around an hour later) ensuring a close match for each pair in terms of tide. Pairs also were consistent in the type of day, such that the pair was either over a weekend or over two weekdays. The two visits within each pair were undertaken by the same surveyor (this ensures the visits are matched as carefully as possible) and the order within each pair (in terms of ranger present vs not present) was varied (i.e. ensuring that for around half of the pairs the first visit of the pair was when a ranger was not present).
- 2.5 Survey visits were spread evenly across the period late November 2016 – end March 2017 and around a quarter of all pairings were at weekends (i.e. one visit on a Saturday and one on a Sunday).

2.6 Visits were targeted as far as possible to avoid poor weather. In some cases, visits failed to coincide with ranger presence, due to unforeseen circumstances, changes due to weather etc. The number of 'valid pairs' from the fieldwork are summarised in Table 2: these are the number of paired comparisons for each site where the survey work involved paired visits that were reasonably matched and where a ranger was present for one of the pair and not the other.

Table 2: Total number of paired visits made to each location, each pair consisting of a ranger present simultaneously with the surveyor presence.

Location	Number of paired visits
Bosham	8
Bunny Meadows	8
Calshot	8
East Head	6
Hayling Oysterbeds	7
Milton	7
Newtown	5
Pennington	7
Portchester	7
Ryde	6
Total	69

Fieldwork Details

2.7 Each visit to a survey point lasted around two hours and involved the following elements:

- Two counts of birds, one count was made at the start and one at the end of the survey period.
- A diary of all potential disturbance events observed during the 1 hour and 45 minutes following the first count.
- A record of the response of selected bird species to each of the potential disturbance events recorded in the 'diary', including counts of birds present and the number of birds flushed etc.
- Additional information.

2.8 These different elements are described in more detail below. Recording was focussed around a fixed recording area within which birds were counted and behavioural data were collected. People data (the 'diary') logged events that took place within and outside this recording area. The recording areas are mapped and detailed accounts of each location are provided in Appendix 1. Details of the dates, times and weather conditions for all visits are listed in Appendix 2.

Bird count

2.9 At the start of each two-hour survey, a count of the birds present within the fixed recording area was conducted. The count included all waders, gulls, terns, wildfowl and herons/egrets. The count only recorded the birds present within the pre-defined recording area, and this extended to a maximum of 500m from the watch point (500m providing a reasonable distance at which data could be collected with reasonable accuracy). The mapped area only included areas where there was a clear sight line and all areas (within 500m) are visible to the recorder from the fixed watch point. Each fixed watch point needed also to be at a point where any disturbance caused by the presence of the surveyor was minimised/avoided. At each location, this mapped area varied in size and shape.

Diary

2.10 All recreation events during the following 1 hour and 45 minutes were recorded in a diary form. This diary logged all events within a pre-defined recording area. This encompassed a wider area than the 500m count area used for the birds, as people above the Mean High Water Mark (MHW) and events outside the recording area could disturb birds. Regardless of whether birds were present or not, all events were recorded in this diary – this allowed us to directly compare levels of human activity in different areas.

2.11 The diary was set up as a recording form, with each row in the ‘diary’ corresponding to an event and assigned a letter – “A”, “B” etc. These same letters were used to cross-reference different events. For each entry in the diary, details were recorded that included activity (categorised to standard codes, see Table 3), group size, zone (intertidal, on water or above MHW), length of time present in area and notes relating to behaviour.

2.12 Where the activity or event did not fit with the pre-determined categories or was in some way unusual, additional notes were recorded in the field. Subsequent checks and (as necessary) further classification was then carried out once all data were compiled. Events that involved multiple activities were classified to a single activity, selecting the one potentially likely to be in the closest proximity to the birds or most disturbing, as follows:

- A cyclist and a horse-rider together were classified as horse riding
- A dog walker and a cyclist together were classified as dog walking
- A walker and a cyclist together were classified as walking
- A cyclist and a jogger together were classified as jogging
- A lone observation of a dog off-lead without an owner visible was classified as dog walking

2.13 Events that did not fit the predetermined categories were classified as ‘other’; these were varied and included: gunshots; a gas gun/bird scarer; a drone

operator (separate to the presence of the drone, which was 'Airborne'); people waiting for the bus (at Milton); a walker with a cat; photographers; litter picking and a school group.

Table 3: Pre-determined categories for diary events, as used in the field

LAND/INTERTIDAL BASED
Dog walking
Bait digger (person standing on mud flats using shovel/fork to dig)
Cockle Raking (person standing on mud and using a hand rake to pull out cockles)
Cycling (mountain bike, beach bike, road bike etc.)
Jogger
Fishing (from shore)
Walking / rambling (without dog)
Kids playing (with or without parents)
Picnic/Sitting on beach/Sitting on bench etc
Motor vehicle (ATV, car, campervan or similar)
Birdwatching/wildlife watching (e.g. seals)
Horse Riding
Metal Detecting
Person accessing boat or water (e.g. windsurfers walking across mudflat)
WATER BASED
Windsurfing (on water)
Kitesurfing (on water)
Canoeing (on water)
Jet Ski (on water)
Water skiing (on water)
Rowing boat (on water)
Rib or similar fast small boat (on water)
Small sailing boat (e.g. Laser / dinghy) (on water)
Moderate – large sailing boat, not running motor (on water)
Large boat on outboard motor (on water)
Person working on boat (boat stationary)
Paddleboarding (on water)
Bait harvesting or similar from boat (e.g. dragging for bait)
AIRBORNE
Airborne (general category encompassing drones, planes etc.)
NATURAL EVENTS
Raptor
OTHER

Disturbance

2.14 We defined any event that was listed in the diary as a 'potential disturbance event' if:

- It coincided with birds being present within the count area and
- It occurred within 200m of birds within the recording area or
- Birds were disturbed (i.e. seen to become alert, change position or were flushed).

2.15 For each potential disturbance event, the response of birds was recorded on a separate recording form. This approach ensured that events that resulted in no response were also recorded – i.e. if the birds were not disturbed.

2.16 The disturbance data recorded the number of birds within 200m of the potential source of disturbance and the behaviour. Behaviour was categorised simply as feeding (F) or roosting / preening / loafing (R). The response of the birds was recorded using simple categories ('Alert', 'walk/swim', 'short flight (less than 50m)' 'Major Flight' or 'No Response'). For each activity/event where disturbance occurred, the maximum distance from the birds to the event was recorded, as the straight-line distance from the source of disturbance to the birds. If there was no response from the birds then the minimum distance from each species present to the disturbance event was recorded (i.e. how close the disturbance event was to the birds).

2.17 If the observation involved a tight flock or an individual then this distance is relatively easy to measure. If the birds were scattered over a wide area and all were disturbed, then the distance was based on the closest individual (if no response) or the furthest individual (if a behavioural response). To ensure consistency in recording distances we:

- Ensured accurate aerial photographs, with distances to key landmarks shown, were used during fieldwork.
- Used laser rangefinders to determine the distance to key landmarks/features and the birds.
- Triangulated or paced out some of the distances at the end of the survey – this was helpful where the distances were hard to estimate during the survey period (for example due to the angles between the observer, source of disturbance and the birds).
- Ensured observers were trained and occasionally undertook counts together to check that the data were collected in a standard fashion.

Additional Information

2.18 Information relating to each visit, such as tide coverage, weather and any details specific to the visit (e.g. events going on) are important. These were recorded on the same sheet as the bird count.

Data presentation and analysis

- 2.19 Our analysis focussed on the paired data, where the valid pairs allowed us to directly compare results with and without a ranger present. Paired comparisons typically took the form of Wilcoxon paired rank tests.
- 2.20 For 5% of species-specific observations, multiple behavioural responses were recorded, because the birds did not all behave in the same way (e.g. some might become alert while others were categorised as walk/swim). In some analyses, tables and figures we simplified the data to a single response. This single response was the most extreme, i.e. if some birds responded with a major flight and some with a minor flight, the single coding would be major flight, allowing us to highlight activities which cause particular effects. Where we summarise data in such a way it is made clear in the text/captions, as using single codes only.

Map 1: Overview



● Survey points

3. Results

Levels of human activity

3.1 Across all visits and all sites, a total of 3,712 diary events were logged. Data are summarised by site and broad categories in Figure 1 and it can be seen that Ryde and East Head were the busiest sites. Activities that were 'terrestrial' – i.e. dog walking, walking etc. – and took place on the shore or intertidal accounted for the majority (98%) of observations. Dog walking was the most frequently recorded event (2,000 diary events, 54%). Ryde, Portchester and East Head were notable for the large numbers of dog walkers. In Appendix 3 we provide a full breakdown of the counts by site and activity.

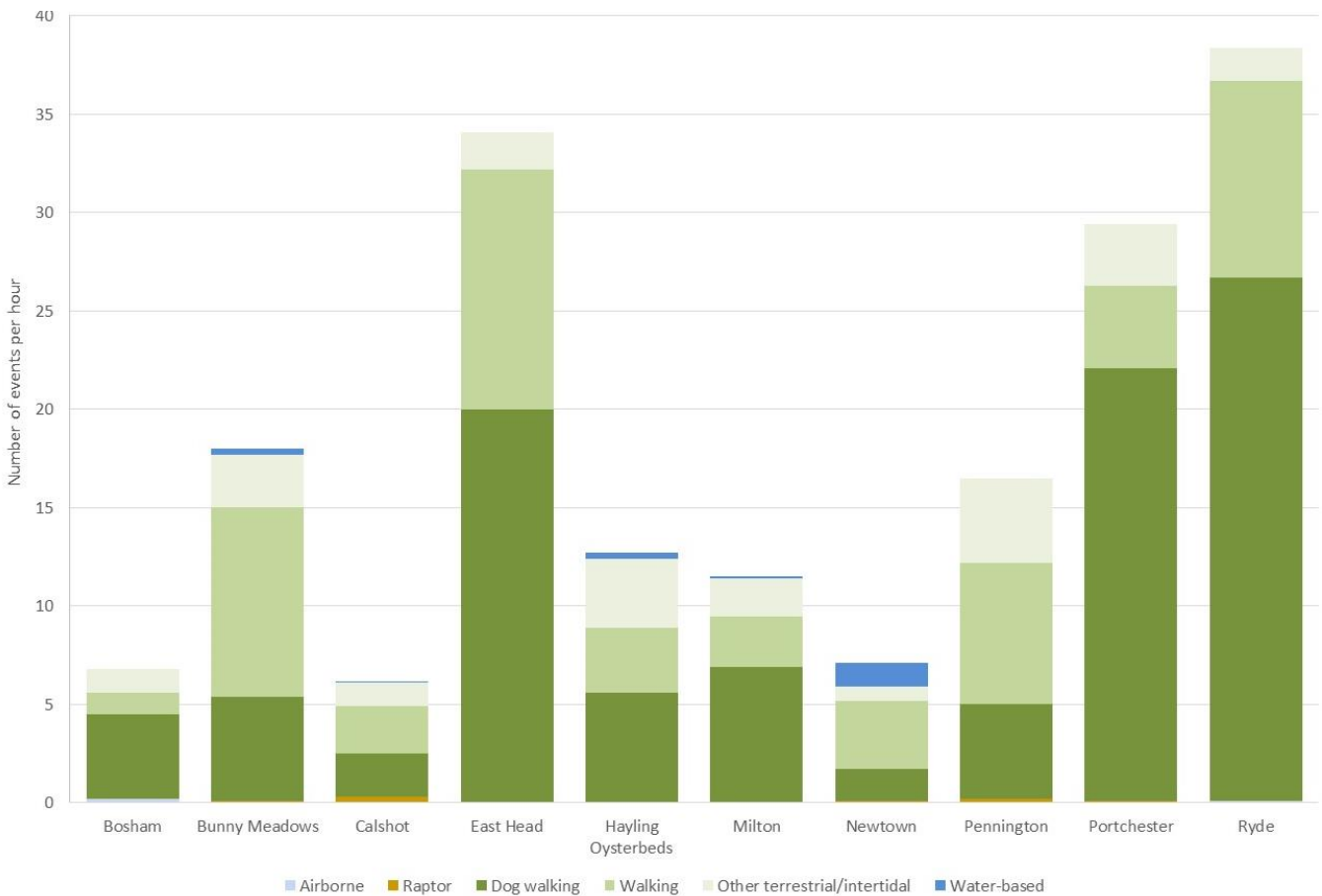


Figure 1: Diary data (all visits) adjusted to give events per hour. Activities are grouped into those that are terrestrial based (green), water-based (dark blue), airborne – i.e. planes, drones etc. (pale blue) or raptor (orange).

3.2 There was no significant difference in the number of diary entries (i.e. events occurring in and around the study area) when rangers were present compared to when they

were absent (Wilcoxon $T=1099.5$, $N=68$, $p=0.972$). This would suggest the presence of a ranger did not result in differences in visitor numbers. Similarly, there was no significant difference in the number of diary events that occurred within 200m of birds within the focal area (Wilcoxon $T=1021$, $N=68$, $p=0.902$). This would suggest that there was no effect of the rangers in terms of diverting people when birds were present.

- 3.3 The number of dogs on leads was also not significantly different between sessions when the ranger was present compared to when the ranger was absent (Wilcoxon $T=871$, $N=68$, $p=0.727$), and there were also no significant differences in the number of dogs off lead (Wilcoxon $T=938.5$, $N=68$, $p=0.793$). This would suggest that there was no effect on the presence of a ranger in terms of people putting their dog on a lead or walking their dog elsewhere if they wanted it to be off-lead. It is important to note here that the rangers were not specifically asking people to put dogs on leads or giving out such a message.
- 3.4 In Figure 2 we summarise the data for dogs off lead and diary events within 200m of the birds, showing the data by site and comparing when rangers are present (green boxes) to when they are absent (grey boxes). There are no individual sites where a particular difference is apparent when the rangers were present.

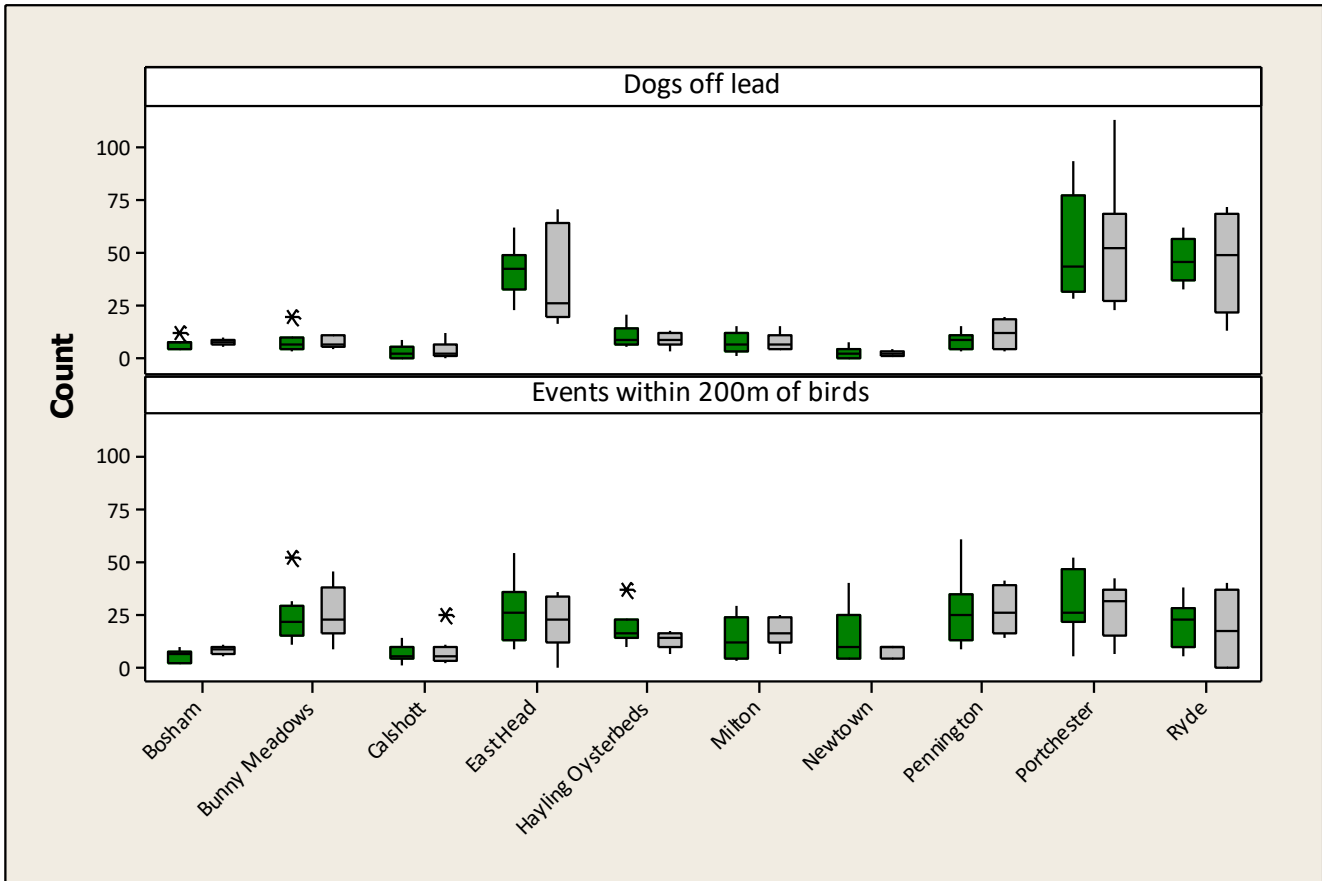


Figure 2: Box plot showing numbers of dogs off lead and diary events within 200m of birds within the recording area, comparing when ranger is present (green) to when absent (grey), by site. Horizontal lines represent the median (i.e. the mid-point, half the data falls below this line and half above), the boxes show the 25th and 75th percentiles, the vertical lines show the upper and lower limits of the data with outlying points shown as asterisks.

Interaction with rangers

- 3.5 For each diary entry, a note was made as to whether the event occurred within 100m of the ranger, whether the ranger spoke to the person/group (i.e. clearly stopped and had a conversation rather than saying hello in passing) and whether there was a notable change in behaviour, for example a change of direction or putting a dog on a lead directly after talking to the ranger. It is important to note that these data are estimates only as it was sometimes difficult to record. For example, after talking to a ranger it might be hoped that people are more aware of issues relating to bird disturbance and as such modify their behaviour in certain situations, for example when approaching a roosting flock of birds. Such behaviour change might not necessarily occur directly after the interaction with the ranger, and could even be on a different date. Furthermore, the rangers were not directly asking people to modify their behaviour (for example they did not specifically request that dogs were put on leads).
- 3.6 There was a total of 3,712 diary entries logged during fieldwork. A total of 1,780 entries were made during the paired visits used in the analysis and were during the visit when a ranger was present. Interactions with a ranger from this total of 1,780 are summarised in Table 4-Table 6. A little under half (41%) of diary events were seen to pass within 100m of a ranger, with Bunny Meadows, Portchester and Pennington seeming to work particularly well in the proportion of people that passed close to the ranger. Around a fifth (20%) of groups were seen to speak to a ranger with Newton and Hayling Oysterbeds the two sites with the highest percentages. Ryde was notable in that only 2% of the groups logged in the diary were seen to speak to the ranger. Few (1%) people clearly changed their behaviour directly after speaking to a ranger and it was at Pennington where the highest number (5 groups, 3%) were thought to have changed their behaviour.
- 3.7 There were no significant correlations between the number of groups that passed within 100m of a ranger and the total diary entries⁵ (with a ranger present) at the site, nor between the number of groups that spoke to a ranger and the total diary entries, nor between the number of groups that changed their behaviour and the total diary entries (Pearson correlation, $n=10$, $p>0.05$ in all cases). There was however a very strong correlation between the number of groups that passed within 100m of a ranger and the number of groups that spoke to a ranger (Pearson correlation coefficient =0.952, $n=10$, $p<0.001$); a plot of these data is shown in Figure 3. It might be expected that a ranger can only speak to a proportion of people passing and that, at very busy sites, that proportion might be expected to be less. The plot suggests that even at

⁵ Total diary entries describes all the observations of people, events etc. that were logged in the diaries. It is therefore a measure of how busy each location was.

Solent Bird Disturbance Monitoring

Portchester, where the number of people passing within 100m was particularly high, the proportion of groups engaged was broadly in line with other sites.

Table 4: Number (%) of diary events at each site where event was within 100m of a ranger.

Location	Did not pass within 100m of ranger	Passed within 100m of ranger	Total
Bosham	41 (57)	31 (43)	72 (100)
Bunny Meadows	55 (27)	148 (73)	203 (100)
Calshot	40 (61)	26 (39)	66 (100)
East Head	202 (71)	81 (29)	283 (100)
Hayling Oysterbeds	90 (58)	65 (42)	155 (100)
Milton	77 (72)	30 (28)	107 (100)
Newtown	43 (58)	31 (42)	74 (100)
Pennington	71 (37)	119 (63)	190 (100)
Portchester	104 (35)	192 (65)	296 (100)
Ryde	324 (97)	10 (3)	334 (100)
Total	1047 (59)	733 (41)	1780 (100)

Table 5: Number (%) of diary events at each site where the person/group was seen to speak to a ranger (speaking in terms of stopping and having a conversation).

Location	Did not speak to ranger	Spoke to a ranger	Total
Bosham	56 (78)	16 (22)	72 (100)
Bunny Meadows	152 (75)	51 (25)	203 (100)
Calshot	47 (71)	19 (29)	66 (100)
East Head	238 (84)	45 (16)	283 (100)
Hayling Oysterbeds	109 (70)	46 (30)	155 (100)
Milton	85 (79)	22 (21)	107 (100)
Newtown	51 (69)	23 (31)	74 (100)
Pennington	141 (74)	49 (26)	190 (100)
Portchester	213 (72)	83 (28)	296 (100)
Ryde	326 (98)	8 (2)	334 (100)
Total	1418 (80)	362 (20)	1780 (100)

Table 6: Number (%) of diary events at each location where there was a definite change in behaviour as a result of speaking to a ranger. Note that the changed behaviour totals are minimum values as this was very difficult to record.

Location	Did not change behaviour	Changed behaviour	Total
Bosham	72 (100)	0 (0)	72 (100)
Bunny Meadows	201 (99)	2 (1)	203 (100)
Calshot	66 (100)	0 (0)	66 (100)
East Head	282 (100)	1 (0)	283 (100)
Hayling Oysterbeds	151 (97)	4 (3)	155 (100)
Milton	106 (99)	1 (1)	107 (100)
Newtown	74 (100)	0 (0)	74 (100)
Pennington	185 (97)	5 (3)	190 (100)
Portchester	295 (100)	1 (0)	296 (100)
Ryde	334 (100)	0 (0)	334 (100)
Total	1766 (99)	14 (1)	1780 (100)

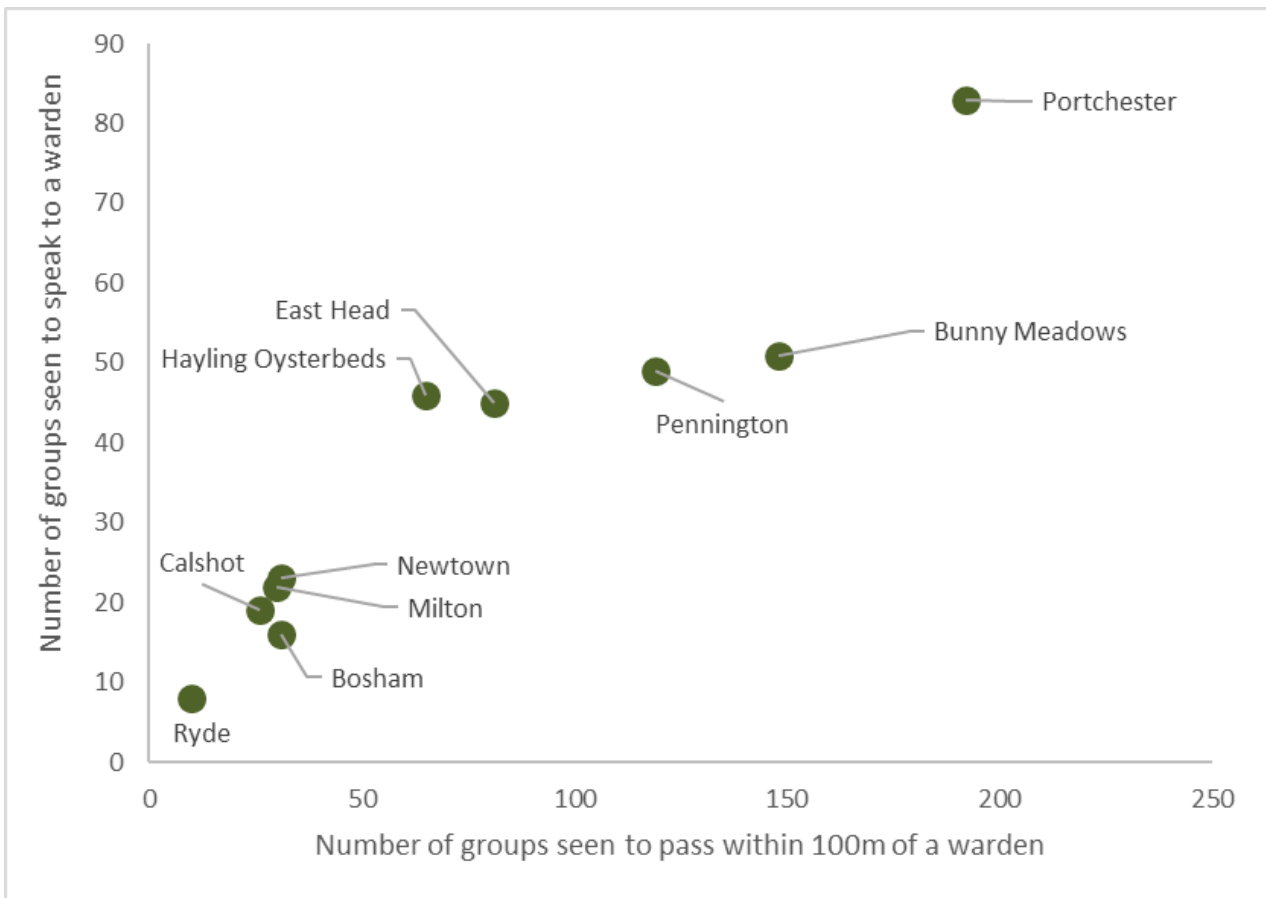


Figure 3: Scatterplot showing the number of groups seen to pass within 100m of a ranger and the number of groups seen to speak to the ranger. Data from valid pairs when ranger present only.

Numbers of birds present

- 3.8 A total of 19 species of wader and 16 wildfowl were recorded. In addition, there were counts for 7 species of gulls/terns, and 10 'other' species including grebes, herons, egrets, cormorant, coot etc.
- 3.9 Bird count data are summarised by location in Figure 4, and full details by site and species are provided in Appendix 4. It can be seen that by far the highest counts were from Hayling Oysterbeds, which is an important roost site on the Solent. The lowest counts were from Ryde, with relatively low numbers of birds also at Milton, Calshot and Bunny Meadows. It can be seen that waders (green colours) dominated the counts at Hayling Oysterbeds, with Dunlin in particular accounting for a large proportion of the birds counted. Bosham and to some extent Newtown and Pennington were the sites with the most wildfowl, with Brent Goose the main species at Bosham. Gulls/terns (grey colours) and other species (grebes, herons, egrets etc.) made up a relatively small proportion of the numbers of birds counted, but gulls did account for the majority of birds counted at Ryde.

Solent Bird Disturbance Monitoring

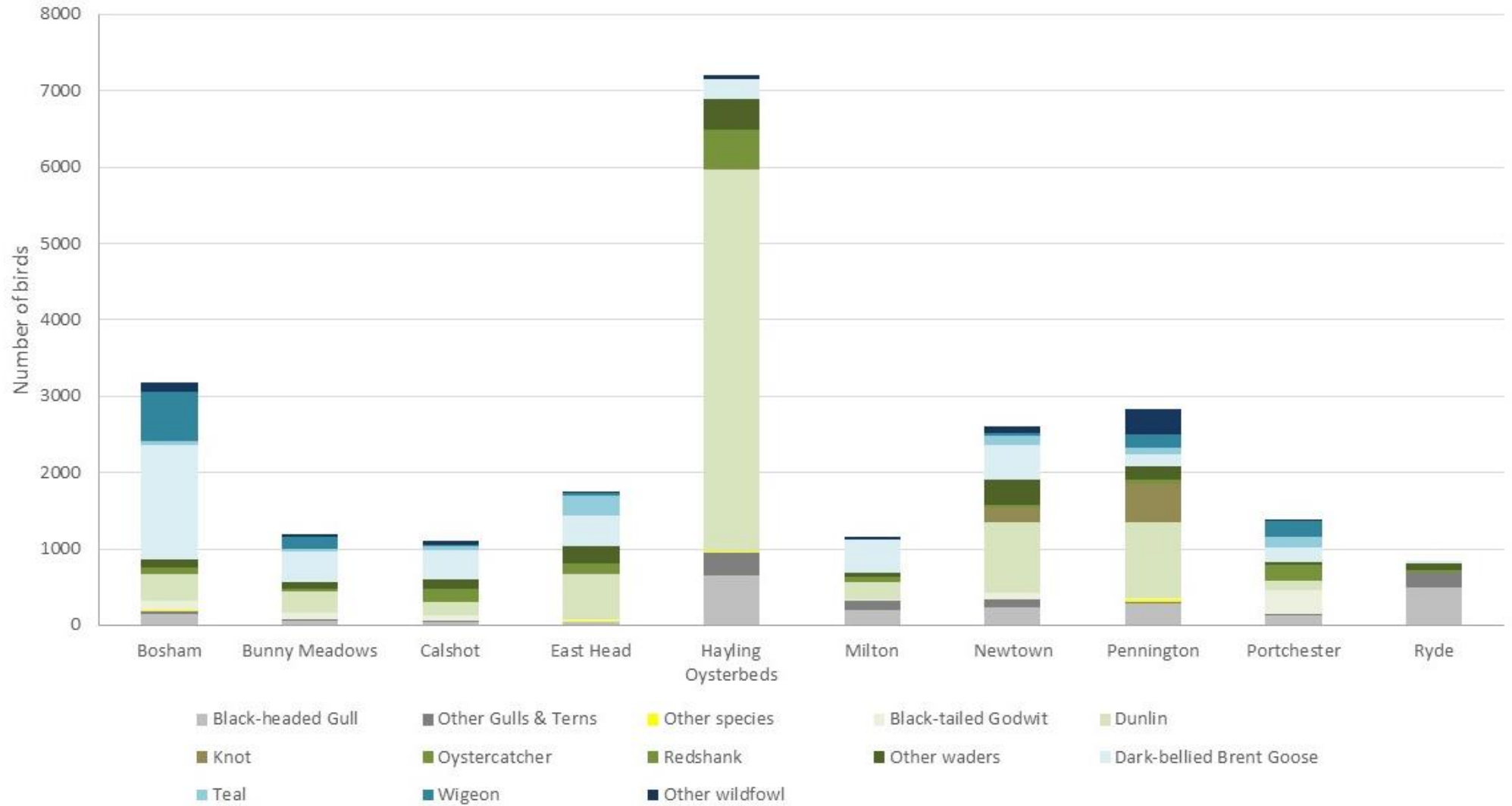


Figure 4: Maximum counts of birds at each location. Data from all counts (with and without ranger present). For individual species the graph shows maxima, for groups of species the maximum value for each species at each site are summed. Counts are from the set recording area only.

- 3.10 Looking across all sites and paired counts there were no significant differences in the number of birds present when a ranger was present compared to when a ranger was absent (Wilcoxon T values, n=68 in all cases; Gulls/terns T=940.5, p=0.803; other species T=308, p=0.114; waders T=1033, p=0.646; for wildfowl T=722, p=0.109).
- 3.11 Data are summarised by site, for waders and wildfowl (the main species relevant to the SPA designations) in Figure 5. Hayling Oysterbeds is particularly notable in that there were some marked differences in the number of waders on two occasions, both of which involved differences of thousands of birds. On the third paired visit to the site the maximum count was 3,424 birds when the ranger was present compared to 547 without the ranger. Similarly, on the sixth paired visit there was a maximum count of 5,375 birds with the ranger present compared to 500 without the ranger. For all other pairs of visits the numbers were similar.

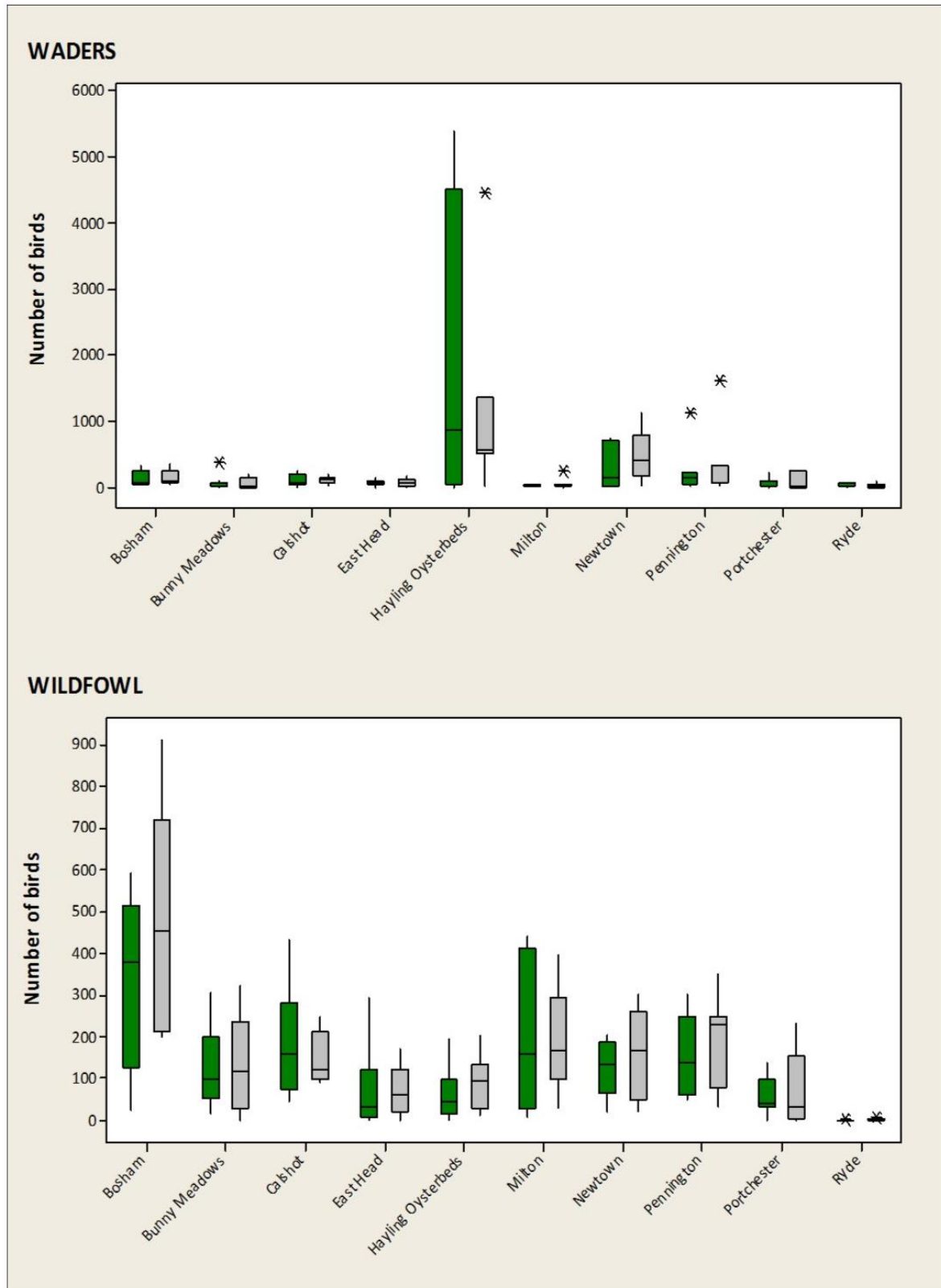


Figure 5: Boxplot showing the numbers of wildfowl and waders by site, with and without a ranger present. Green bars indicate counts when the ranger was present. Counts are maximum counts at the end of the count. Horizontal lines represent the median (i.e. the mid-point, half the data falls below this line and half above), the boxes show the 25th and 75th percentiles, the vertical lines show the upper and lower limits of the data with outlying points shown as asterisks.

Numbers of birds in relation to the number of people

- 3.12 If disturbance is affecting the distribution of birds it is to be expected that there would be fewer birds present within the recording area when there are more people present, i.e. a negative correlation between the number of birds and the number of people. Were the rangers to make a difference then it would be potentially expected that the correlations would be weaker or less obvious, as the rangers might be reducing the impact of the people on the birds, for example through a change in visitor behaviour.
- 3.13 Correlation coefficients are shown in Table 7 and an example plot (for wildfowl) is shown in Figure 6. There were significant negative correlations in all cases for wildfowl, the correlations were slightly weaker (but still highly significant) when rangers were absent. For waders, the correlations were not significant apart from using the number of diary events when rangers were absent. As such no clear or consistent pattern is evident.

Table 7: Rank Spearman correlation coefficients for selected bird and visitor variables, with and without rangers present

Ranger	Bird variable	Visitor Variable	rho	p
Present	Total wildfowl at end of count	Number of diary events	-0.467849	<0.001
Present	Total wildfowl at end of count	Total number of dogs	-0.38788	<0.001
Absent	Total wildfowl at end of count	Number of diary events	-0.328293	0.006
Absent	Total wildfowl at end of count	Total number of dogs	-0.303812	0.011
Present	Total waders at end of count	Number of diary events	-0.18578	0.126
Present	Total waders at end of count	Total number of dogs	-0.107633	0.379
Absent	Total waders at end of count	Number of diary events	-0.305538	0.012
Absent	Total waders at end of count	Total number of dogs	-0.180904	0.127

Solent Bird Disturbance Monitoring

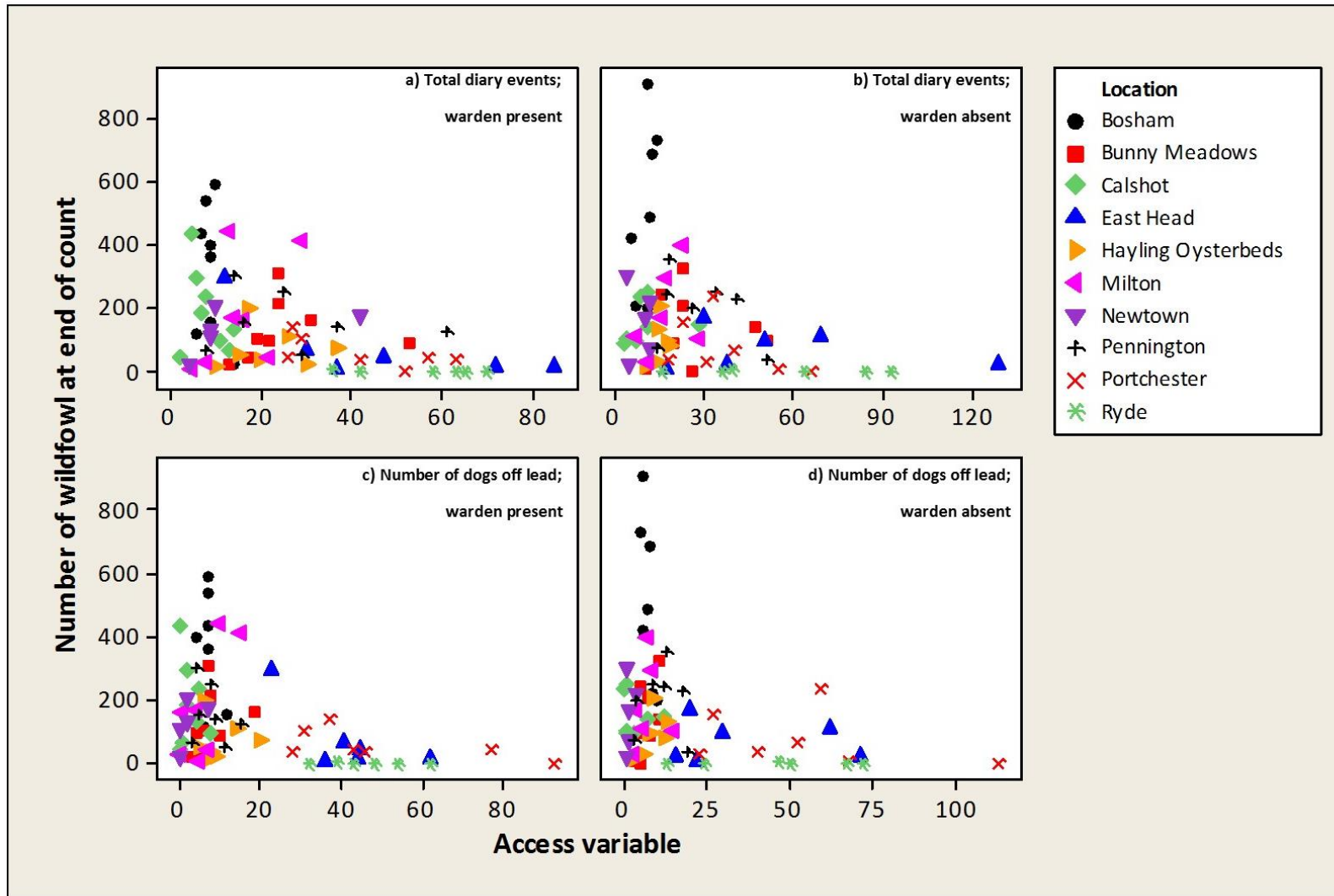


Figure 6: Numbers of wildfowl (at the end of the count) and visitor totals (total diary events (top graphs) and number of dogs off lead (lower graphs); with and without ranger present.

Behavioural responses of the birds

The number of observations involving disturbance

- 3.14 During each survey visit the diary element essentially recorded all human activities and potential disturbance events that might affect birds within the focal recording area. This diary was maintained even when no birds were present within the recording area (for example some prior disturbance or changes in the tide might have pushed birds out of the recording area). Some of the diary events could also result in different disturbance events, involving multiple species-specific observations: a single person might disturb different birds in different parts of the survey area and different species may respond differently (e.g. some might take flight, while others show no response). The data therefore consist of a number of unique diary entries, some of which could result in multiple potential disturbance events, each of which we treat as a unique observation. We use the term potential disturbance event throughout this report to highlight those diary entries that resulted in people/activities occurring within 200m of birds within the study area. Each of these potential disturbance events could be associated with multiple observations.
- 3.15 Across all sites there were 3,712 diary entries. Of these 2,559 (69%) occurred when birds were present in the focal area and either caused disturbance or were within 200m of the birds. There were therefore 2,559 different potential disturbance events. These potential disturbance events generated a total of 7,993 species specific observations (all species) and 7,447 observations (wildfowl and waders only). Considering these 7,447 observations (Table 8), 6,701 (90%) resulted in no visible change in behaviour or any kind of response from the birds, 10% of observations resulted in a behavioural response from a given species, with 279 observations (4%) involving birds undertaking a major flight.
- 3.16 There were significant (but small) differences in the proportion of observations resulting in a particular response when comparing when the ranger was present to when the ranger was absent (Table 8) ($\chi^2_4=21.050$, $p<0.0001$). The main difference was in the relative proportion of birds that were categorised as alert.

Table 8: Number (%) of species specific observations (wildfowl and waders only) and disturbance responses with and without a ranger present. Responses are based on single response codes only.

Response	With Ranger Present	Without Ranger Present	Total
No Response	3384 (91)	3317 (89)	6701 (90)
Alert	33 (1)	72 (2)	105 (1)
Walk/Swim	132 (4)	139 (4)	271 (4)
Minor Flight	41 (1)	50 (1)	91 (1)
Major Flight	121 (3)	158 (4)	279 (4)
Total	3711 (100)	3736 (100)	7447 (100)

3.17 In Figure 7, we show the responses of birds at each location, comparing when a ranger was present to when the ranger was absent (using only the paired visit data). The most marked differences in terms of the presence of a ranger reducing the behavioural responses to disturbance appear to be at Milton and Newtown and slight differences at Bunny Meadows, Hayling Oysterbeds and Pennington.

Solent Bird Disturbance Monitoring



Figure 7: Responses of birds at each location, using single response codes only, comparing when ranger present to when ranger absent. Data from paired observations only and for waders and wildfowl only. Numbers in brackets reflect the sample size.

Rates at which birds are flushed

- 3.18 The busiest sites (Ryde and East Head, see Figure 1) are not necessarily the sites with the most observations of people and birds together. In Figure 8, we show the rate at which birds were flushed at each location in relation to three different measures of access/disturbance. The plots just use data relating to waders and wildfowl and the number of flights is the number of major and minor flights combined. In a) we show the total number of diary events per hour, i.e. a measure of how busy each site is in terms of access; in b) we use the number of dogs off lead per hour, another measure of overall busyness and potentially particularly relevant to the birds; in c) we use potential disturbance events per hour, i.e. the number of events that occurred when birds were present and that were within 200m of birds in the recording area.
- 3.19 None of the three plots show a significant correlation (Pearson correlation coefficients; $n = 10$, $p > 0.05$ in all cases), however the sample size (number of sites) is small. The plots are useful in highlighting differences between sites. It can be seen that Newton has comparatively high numbers of flushing events and is one of the least busy sites. Ryde also stands out in the three plots, as a location it has high levels of access and relatively high rates of birds being flushed. The plots also show that Portchester is the site with the highest numbers of dogs off lead per hour and also the highest number of potential disturbance events, while access levels (events per hour, based on paired visit data) were highest at Ryde.

Solent Bird Disturbance Monitoring

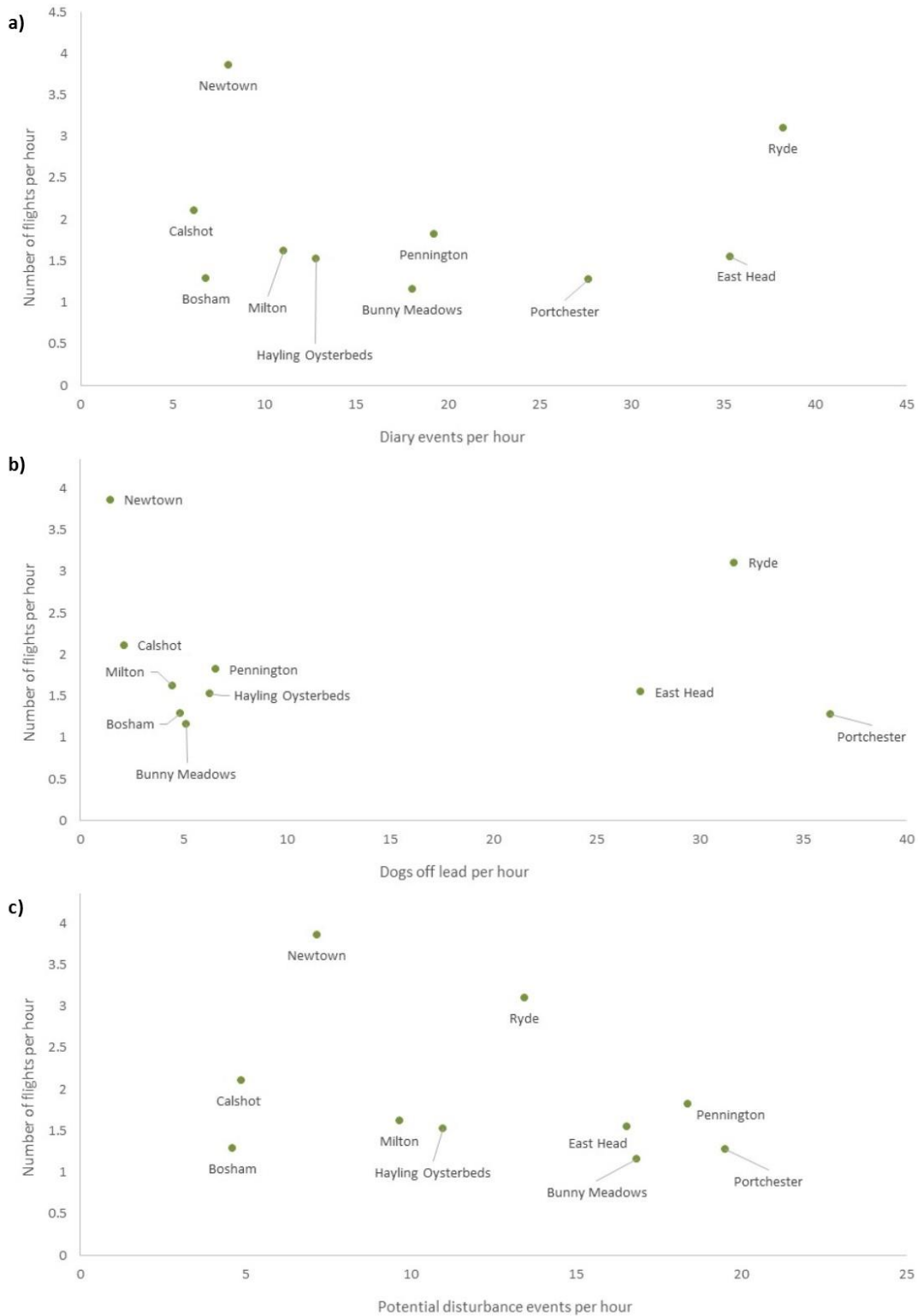


Figure 8: Number of times birds were flushed (major and minor flights combined) and levels of disturbance at each site. Data are for wildfowl and waders only, from paired visit data. a) uses all diary entries, b) the total number of dogs of leads and c) the total number of potential disturbance events.

Behavioural responses and the number of birds involved

3.20 Figure 7 essentially compares the proportions of observations involving a particular response. Another key consideration is the actual number of birds involved. In Figure 9 we show the number of birds recorded as showing a behavioural response. The plot indicates that fewer birds responded to disturbance (for example being flushed) when a ranger was present at Bosham, Bunny Meadows, Hayling Oysterbeds, Milton, Newtown, Pennington and Portchester (seven out of the ten locations). Comparing the proportion of birds (waders and wildfowl combined) showing a behavioural response to the proportion not showing a response, with and without a ranger present, there were significant effects (Chi-square test of independence, $p < 0.001$) of the presence of a warden (i.e. fewer birds flushed when ranger present) at seven sites and no effect or a negative effect at three sites (Calshot, East Head and Hayling Oysterbeds).

Solent Bird Disturbance Monitoring

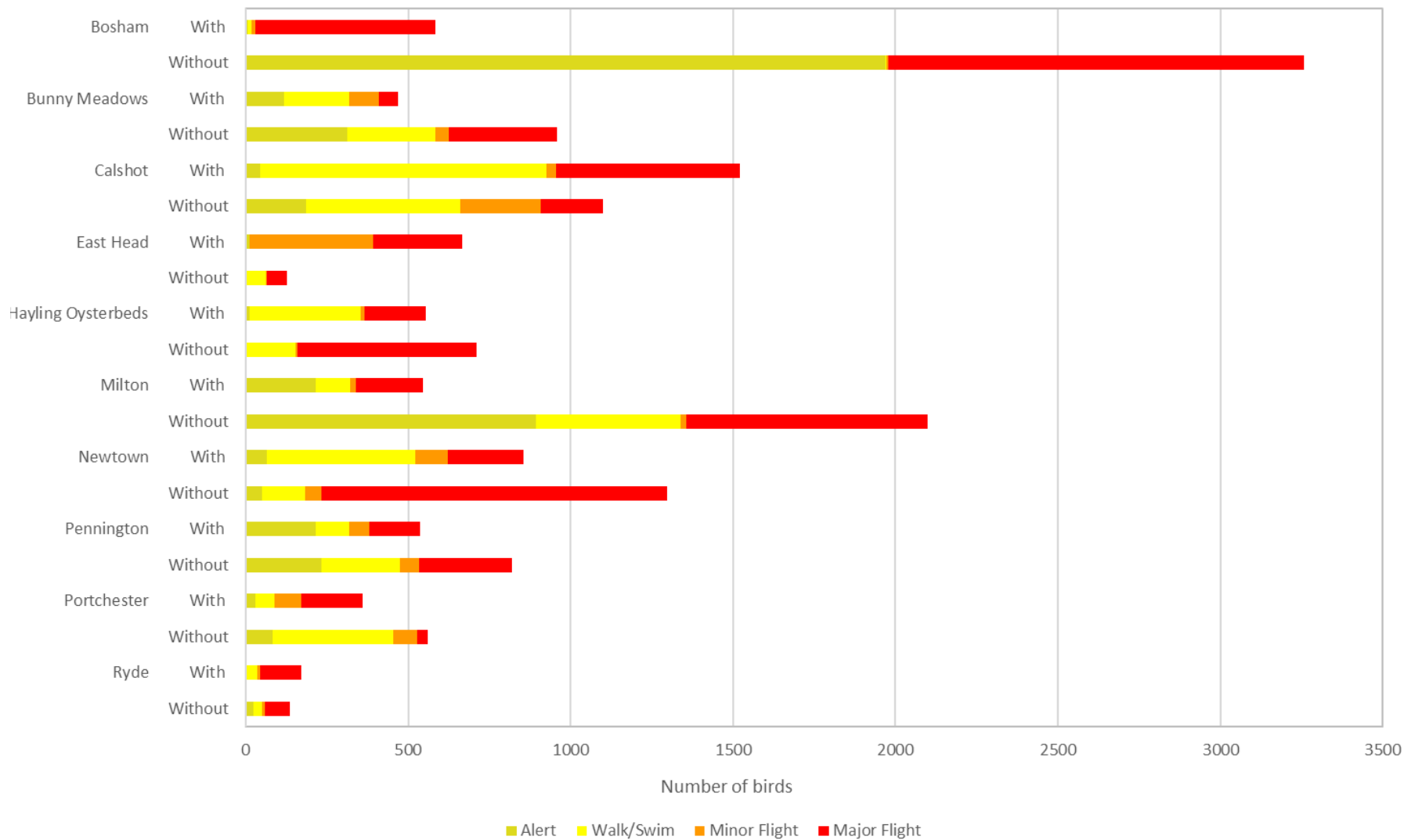


Figure 9: Numbers of birds showing a behavioural response by location, with or without a ranger. Data from paired observations only and for waders and wildfowl only

Behavioural responses and activity

3.21 Figure 10 shows a similar plot to Figure 7, this time showing responses by activity (only those activities with at least 25 observations) rather than location. Activities where the proportion of events resulting in a behavioural response was higher when rangers were not present were: dog walking, walking, jogging, and 'other' (i.e. activities that did not fit with our standard categories). These are potentially some of the activities that would be most easily intercepted by the rangers.

Solent Bird Disturbance Monitoring

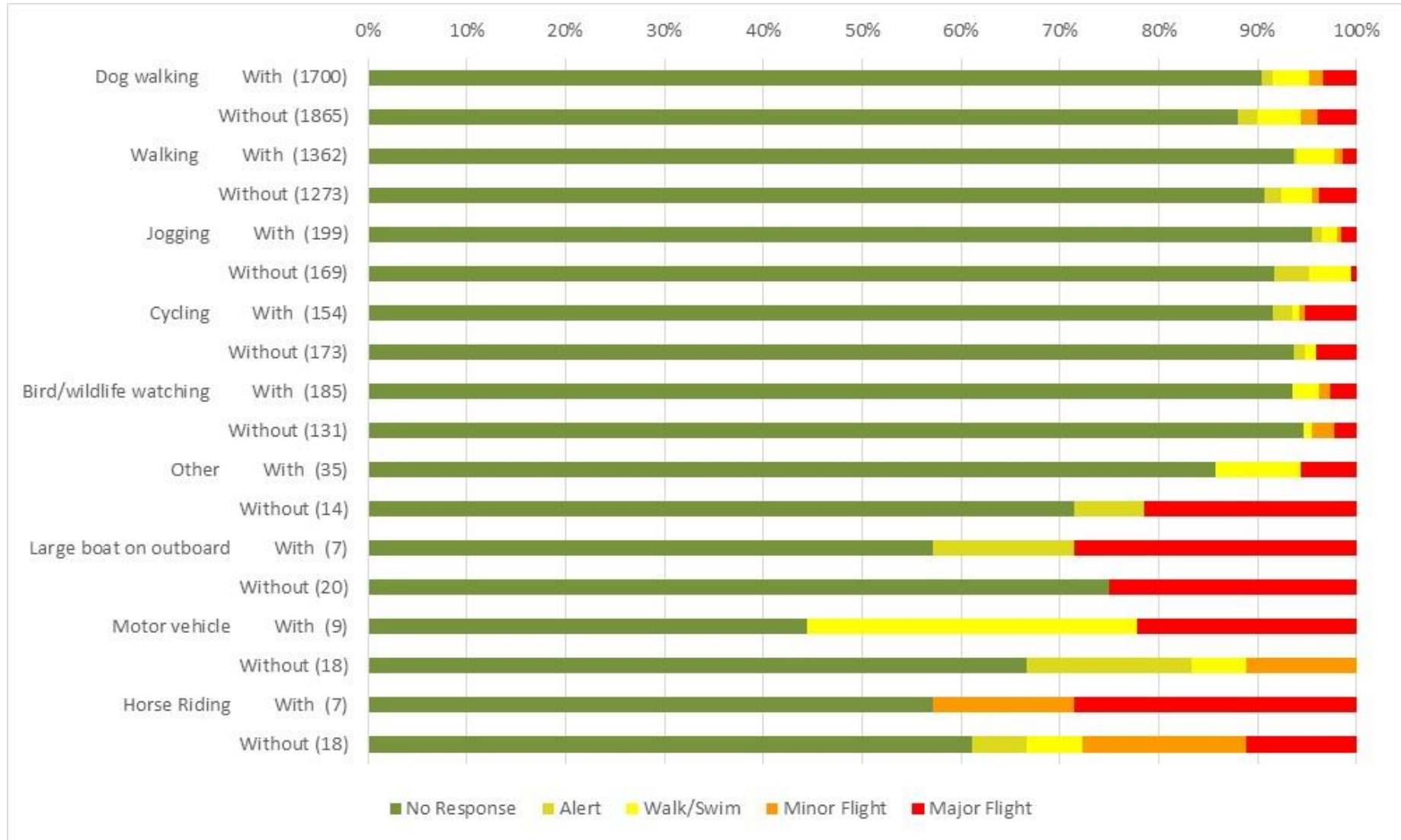


Figure 10: Responses of birds by activity, using single response codes only, comparing when ranger present to when ranger absent. Waders and wildfowl only. Activity categories shown are those with at least 25 species specific observations. Numbers in brackets are the total number of observations.

Distances at which birds respond

3.22 As expected, birds responded when the event was relatively close. For the observations (from valid pairs) where the single response code was no response, the median distance (for wildfowl and waders pooled) was 80m (n=6680), i.e. half of all observations where there was no response involved people within 80m of the birds. The median distance at which waders and wildfowl became alert was 40m (n=104) and the median distance for major flight was 42.5m (n=258). There were no clear differences between the distances when a ranger was present and when a ranger was absent (Figure 11), for example major flights for wildfowl and waders when a ranger was present were at a median of 40m (n=112) compared to 45m (n=146) when a ranger was absent (Mann-Whitney $W=19068$, $p=0.787$).

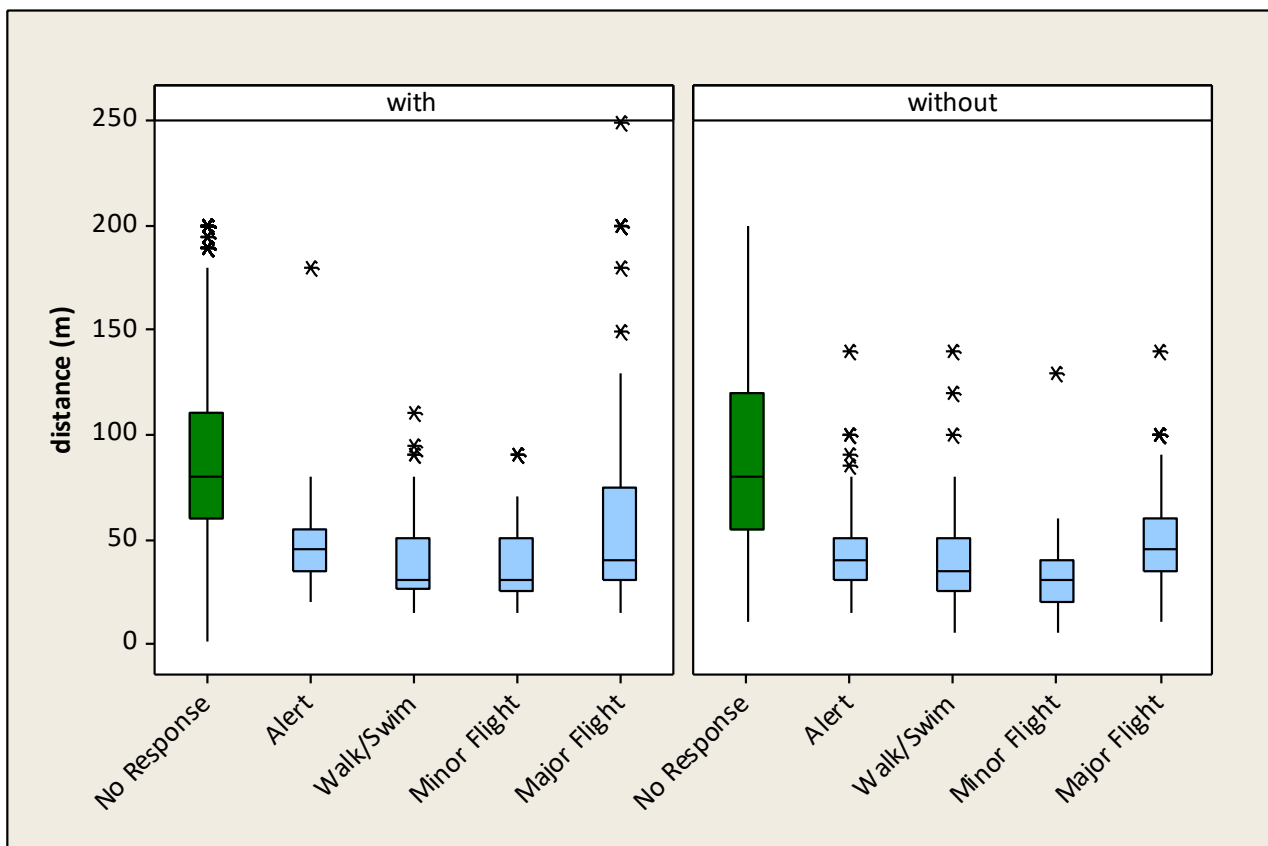


Figure 11: Boxplot showing distances for different behavioural responses, with and without a ranger present. Data from valid pairs only, pooled for waders and wildfowl across all sites. Horizontal lines represent the median (i.e. the mid-point, half the data falls below this line and half above), the boxes show the 25th and 75th percentiles, the vertical lines show the upper and lower limits of the data with outlying points shown as asterisks.

4. Discussion

4.1 The results presented here provide the initial findings of monitoring that is anticipated to run for a number of years, with this year providing a baseline for comparison in the future. The results from this year are therefore not intended to provide comprehensive findings or complete results. In this section of the report, we consider the results in context, in terms of the ranger work undertaken, weather etc. and we make recommendations for future monitoring.

Comparison with surveys in 2009/10

4.2 During the winter 2009/2010 similar survey work was undertaken at a range of locations across the Solent (Liley, Stillman & Fearnley 2010). That fieldwork was conducted during a very cold winter and there was no ranger presence. Fieldwork took place at 20 locations spread across the Solent shoreline – there was some overlap with the current survey with two specific locations (Newtown, Ryde) identical between the two. Selected metrics for the current survey and the 2009/10 survey are summarised in Table 9. The figures are expressed per hour of fieldwork, to facilitate comparison. Some caution is necessary as we are simply comparing data from two locations and survey effort was slightly different at each. At both sites, the data suggests access has risen over the 7 years, for example the number of diary events per hour at Newton is five times higher in the 2016/17 data. The number of flight events per hour has also increased over time.

Table 9: Simple comparison with 2009/10 data and 2016/17, using selected metrics for Ryde and Newtown survey points. For details of 2009/10 work see Liley, Stillman & Fearnley (2010).

	Ryde		Newtown	
	2009/2010	2016/17	2009/2010	2016/17
Diary events per hour	23.9	38.3	3.0	16.5
Total dogs per hour	25.6	35.3	1.0	1.9
Flight events per hour (all species)	2.3	3.5	0.6	3.7

Ranger levels and approach

4.3 In general, the findings from this first year show only a slight impact of the rangers' presence. Wardens/rangers are generally considered one of the best approaches to mitigation (see Ross *et al.* 2014 for review), and so the results presented here are perhaps surprising. However, the winter 2016-17 was only the second year that the rangers were deployed, and in 2015/16 the level of deployment was 2.6 full-time

equivalent. The Bird Aware logo, new website and leaflet became live in the early part of 2017 and prior to this, there was no clear brand or identity. The new branding will and engagement material help communicate the messages and issues.

- 4.4 The ranger team is also relatively small (three staff) and time on sites was therefore relatively limited and thinly spread. With the ranger team still in its infancy, it is likely that they will need some time to learn the best places to stand and best ways to engage with people. For some locations, such as the roost on the beach at Calshot, birds could be disturbed by people coming from either direction, and at such locations rangers need to learn how to maximise the effect of their time and presence on site.
- 4.5 The rangers approach when on sites was focussed around simply establishing contact, talking to visitors and showing people the birds, while communicating a general message that the area was important for birds and the birds are special. The approach has therefore been very soft and focussed on establishing a rapport with regular users and providing some visibility and promotion for the Bird Aware project.
- 4.6 Alongside the physical presence of the rangers on site, social media, the promotion of the bird aware website and other wider engagement will raise awareness and influence people. As such, the ranger presence is part of an overall package of measures which together will raise awareness of the issues and influence people's behaviour. It will take time for these other measures to become established.

The approach

- 4.7 A range of different approaches were considered in the monitoring strategy and through discussion with the steering group. We considered trying to establish monitoring before the rangers were present to allow comparison before and then over a few years after the ranger team was established. While this would have perhaps been ideal, it would have meant some locations not having rangers present, i.e. delaying the delivery of mitigation, and this was considered unacceptable.
- 4.8 The approach adopted here is based on paired comparisons, and the pairings were carefully targeted to ensure visits matched as closely as possible, with the exception of the ranger's presence.
- 4.9 Over time (i.e. in future years) there may be greater differences between the times when rangers are present and when they are absent, for example in the behaviour of people. It may also be that there is a general change such that even when the rangers are not present, people are more aware of issues and behave differently, as such there may be limited differences between when the rangers are present and when they are absent, however over time there may be changes in how birds use the sites, perhaps the numbers of birds changing or the behavioural responses.

- 4.10 Distances that birds flush are perhaps of less importance compared to overall numbers of people, activities undertaken, numbers of birds using the areas and response of the birds.

Recommendations for future monitoring

- 4.11 This report sets out results from the first year of monitoring of disturbance with rangers present. Other monitoring also includes counts of people and birds at a broad scale around the shore. Monitoring will continue in subsequent years, and here we consider how monitoring of effort and bird disturbance should take place in the future.
- 4.12 Given the findings here, repeat surveys in future years will be important to help focus ranger effort and ensure it is making a difference. In general, the monitoring approach works well, in terms of data collected. It does generate a large volume of information and requires careful collection.
- 4.13 For the monitored sites, it would potentially be ideal to have one or more clear aims that the rangers will achieve. This could be, for example, to prevent roosting waders along the beach at Calshot from being flushed. This targeting would mean switching from a general approach of roaming a stretch of coast and trying to engage with as many people as possible to targeting the ranger effort to very specific locations and issues. The clear aims could be communicated to visitors at each location too.
- 4.14 The aims could relate to bird numbers (increasing the number of birds using an area etc.), bird behaviour (preventing birds being flushed) or visitor behaviour (reducing the number of dogs off lead along a particular stretch of beach).
- 4.15 With the clear aims, it should be possible to then also target the monitoring to match the aim, facilitating the reporting, data presentation and interpretation. A problem with the monitoring results presented in this report is that there were many data collected and it is difficult to pull out the key metrics for each site. For example, at East Head the ranger effort was focussed at the base of the spit, relatively close to the car-park. The survey point was set well back along the sea wall and looked back over the area towards the spit. Most of the people passing on the seawall would not have met or passed the ranger and were not likely to. Our data showed occasionally large numbers of birds and relatively few observations of disturbance. Many of the birds were on the lagoon behind the seawall and separated from the seawall by a fence. Others were well out on the mudflats, still within the recording area, but away from the Head. These birds were at little risk of disturbance. The impact of disturbance at East Head is likely to relate to birds avoiding the area of saltmarsh and mudflats just by the Head (to the east), and few birds were recorded here. As such there was little disturbance to report. Monitoring results in the future that we might be particularly

interested in would therefore be the number of dogs off lead along the east side of the Head and the number of birds on the mudflats and the number of times these were flushed. If the rangers were focussed in such a way the monitoring would also be able to look for particular changes over time and report directly against the aims of the rangers.

- 4.16 Such an approach of having targets for very specific locations would not necessarily mean that the ranger effort was only focussed at specific locations and large areas of coast did not have ranger coverage. For example, rangers could still cover large areas of coast with a general engagement role, while also targeting specific locations with more time or a specific focus. Areas that were targeted could also shift over time. As behaviours change and disturbance reduces it could be that less effort is required at locations and other locations take priority. New development or other changes may also mean ranger effort needs to switch.

Recommendations for rangers' approach

- 4.17 Given the low levels of ranger effort in terms of person time (given the large areas involved) and limited time on site, the ranger team needs to maximise its reach. The following may make a difference:
- Branded vehicles, so that by parking in a prominent place in car-parks, the rangers can extend their prominence and the exposure to the Bird Aware project.
 - A-Boards or other temporary signage that can be put up on sites while the rangers are present – these could be located ahead of sensitive locations (roosts etc.) such that walkers know there are birds ahead. This could work well where there is a roost on an open stretch of beach and the ranger can only stand on one side.
 - Working closely with other organisations who manage sites (the National Trust for example at East Head and Newtown) to ensure that other site staff, signage and engagement reinforces messages.
 - Use time on site to identify specific locations for signage, interpretation, temporary fencing or changes to parking to help the ranger effort. For example, at Calshot it would be possible to have a temporary sign and short section of fence on the beach such that people walking west along the beach on the inside of the spit are directed up to the road at high tide. The ranger effort could then be focussed more around the car-park near the survey point.

5. References

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Appendix 1: Summary of sites

In this appendix, we provide details for each site, including aerial photographs showing the recording area and vantage point location.

Bosham

Table 10

Grid Reference for vantage point	SU 80406 04572
Key habitats present	mudflat, saltmarsh, includes roost site west of Colner creek
Total dogs per hour from all visits (% off lead)	5.7 (15)
Dog walkers per hour from all visits	4.3
Walkers (without dogs) from all visits	1.1
Diary events per hour from all visits	6.9
Number of flights per hour (all species, all visits)	1.3
Top 5 bird species (max counts)	Dark-bellied Brent Goose (1500); Wigeon (640); Dunlin (350); Black-headed Gull (150); Black-tailed Godwit (120)
% of waders foraging	8
% of wildfowl foraging	61
Number species recorded (all species groups)	28
Number of visits with less than 25% rain	2
Number of visits with some rain	3
Notes on bird use	Top part of creek with diverse selection of waders including Black-tailed Godwits, Grey Plover, Greenshank, Dunlin and Redshank. Dark-bellied Brent Goose main species in terms of numbers and moving between intertidal habitats and fields. Other wildfowl included good numbers of Pintail, Teal and Wigeon.
Notes on access	One of the quietest sites in terms of visitor numbers. Predominantly dog walkers following shoreline.
Access infrastructure	Little infrastructure. Large pay and display car-park, toilets etc in village, but only roadside parking and residential directly by survey point.
Survey notes	Difficult to count birds in creeks and saltings when tide up; very few birds when tide right out.

Bunny Meadows

Grid Reference for vantage point	SU 48908 06765
Key habitats present	saltmarsh, mudflat, shingle beach
Total dogs per hour from all visits (% off lead)	6.5 (21)
Dog walkers per hour from all visits	5.3
Walkers (without dogs) from all visits	9.6
Diary events per hour from all visits	18.1
Number of flights per hour (all species, all visits)	1.5
Top 5 bird species (max counts)	Dark-bellied Brent Goose (410); Dunlin (280); Wigeon (156); Black-tailed Godwit (80); Grey Plover (45).
% of waders foraging	67
% of wildfowl foraging	46
Number species recorded (all species groups)	25
Number of visits with less than 25% rain	1
Number of visits with some rain	3
Notes on bird use	Relatively wide range of species, including mix of wildfowl and waders, but mostly in relatively low numbers. Brent Goose numbers reasonably high. Good mix of waders, with maximum counts of Grey Plover and Ringed Plover both in double figures. Bird use very tide dependent. At high tides and at low tides few birds present.
Notes on access	
Access infrastructure	
Survey notes	At high tide survey point not accessible from parking at end of Brook Avenue.

Bosham & Bunny Meadows Aerials

Bosham



100 0 100 200 300 400 m

3 Bunny Meadows



100 0 100 200 300 400 m

Calshot

Grid Reference for vantage point	SU 48429 01909
Key habitats present	saltmarsh, mudflat, shingle banks
Total dogs per hour from all visits (% off lead)	2.8 (23)
Dog walkers per hour from all visits	2.2
Walkers (without dogs) from all visits	2.4
Diary events per hour from all visits	6.2
Number of flights per hour (all species, all visits)	2.1
Top 5 bird species (max counts)	Dark-bellied Brent Goose (370); Dunlin (185); Oystercatcher (120); Ringed Plover (69); Black-tailed Godwit (65)
% of waders foraging	38
% of wildfowl foraging	50
Number species recorded (all species groups)	23
Number of visits with less than 25% rain	1
Number of visits with some rain	2
Notes on bird use	Brent Geese, Wigeon and Teal feed in bay and pushed in close on rising tide, then loafing on the water once tide up, often among the Spartina. Some Brent would feed on grass near car-park and were often flushed. Good wader roost on beach, north-west of the road, including Dunlin, Oystercatchers, Turnstone; roost mobile and often switching on to other side of road (away from recording area).
Notes on access	Relatively low levels of access. Some dog walkers heading out from small car-park, past survey point and inland. A few campervans and vehicles stopping briefly in car-park, often with people getting out and staying near car. Angling from here too.
Access infrastructure	Small car-park at start of path to survey point; large car-park and toilets on other side of road; parking charges apply across all.
Survey notes	Careful access required to not disturb birds at start. Rangers roamed widely, from survey point round to café.

Calshot Images

2 Calshot



Calshot, from small parking area near road, looking NW towards survey point



Calshot, view from survey point looking E towards road and car-parks



Calshot, looking NE from small parking area near road

East Head

Grid Reference for vantage point	SZ 76955 98571
Key habitats present	mudflats, saltmarsh, sand dune
Total dogs per hour from all visits (% off lead)	29.4 (13)
Dog walkers per hour from all visits	20
Walkers (without dogs) from all visits	12.2
Diary events per hour from all visits	34.2
Number of flights per hour (all species, all visits)	1.3
Top 5 bird species (max counts)	Dunlin (600); Dark-bellied Brent Goose (390); Teal (260); Golden Plover (86); Redshank (72)
% of waders foraging	28
% of wildfowl foraging	59
Number species recorded (all species groups)	29
Number of visits with less than 25% rain	1
Number of visits with some rain	3
Notes on bird use	As tide drops many waders leave pools behind seawall and fly out onto mud; sense that many birds avoiding areas with access. Golden Plovers roosting well out in Spartina.
Notes on access	Very busy site, particularly dog walkers walking along sandy spit and therefore along edge of recording area.
Access infrastructure	Very large car-park (charging on entry), toilets.
Survey notes	Difficult to survey and record accurately, particularly on weekends. Difficulties due to people moving along different paths/routes and birds spread out. Many walkers along head difficult to keep track of. People counts underestimates.

East Head Images

East Head



100 0 100 200 300 400 m



East Head, from survey point looking E



East Head, survey point . Taken from the S.



East Head, warden (front right) at base of spit



East Head, view south from survey point

Hayling Oysterbeds

Grid Reference for vantage point	SU 71509 03199
Key habitats present	mudflat, saltmarsh, lagoons
Total dogs per hour from all visits (% off lead)	7.1 (12)
Dog walkers per hour from all visits	5.6
Walkers (without dogs) from all visits	3.3
Diary events per hour from all visits	12.8
Number of flights per hour (all species, all visits)	1.6
Top 5 bird species (max counts)	Dunlin (5,000); Black-headed Gull (650); Mediterranean Gull (263); Oystercatcher (350); Grey Plover (271)
% of waders foraging	97
% of wildfowl foraging	29
Number species recorded (all species groups)	27
Number of visits with less than 25% rain	1
Number of visits with some rain	2
Notes on bird use	Counts dominated by roosting waders, in particularly Dunlin. Roost site use dependent on tide height, with birds pushed to inner banks on higher tides. Black-necked Grebes only recorded here - maximum count of 7.
Notes on access	Dog walking and walking the main access types. Birdwatchers more frequent here than any other site (and the third most common type of access). Other activities included jogging and fishing.
Access infrastructure	Small car-park with interpretation.
Survey notes	Location of survey point means some surveys were looking directly into sun.

Hayling Oysterbeds Images

Oysterbeds, Hayling



Oysterbeds, view of bay and mudflats to south of survey point



Oysterbeds, looking along path from car-park towards survey point

Milton

Grid Reference for vantage point	SZ 67766 99383
Key habitats present	shingle bank, roost site, mudflats
Total dogs per hour from all visits (% off lead)	7.5 (38)
Dog walkers per hour from all visits	6.9
Walkers (without dogs) from all visits	2.6
Diary events per hour from all visits	11.4
Number of flights per hour (all species, all visits)	1.6
Top 5 bird species (max counts)	Dark-bellied Brent-Goose (440); Dunlin (225); Black-headed Gull (190); Redshank (76); Common Gull (72)
% of waders foraging	25
% of wildfowl foraging	25
Number species recorded (all species groups)	26
Number of visits with less than 25% rain	3
Number of visits with some rain	5
Notes on bird use	Muddy creek with inlet just by survey point. Also small shingle spit with small lagoon (hard to see from survey point). Brent Geese and some waders spread across the mud when exposed. Small spit was once a roost.
Notes on access	Relatively quiet. People mostly walking along beach on other side of creek to the survey point. Access along pavement near survey point included people waiting for bus.
Access infrastructure	Pavement, bus stop.
Survey notes	Best watched from vehicle parked between small spit and bus stop, just by outlet. Ranger effort was focussed on far side of creek.

Milton Images

Milton



Milton, from survey point looking N



Milton, view of survey point from spit to S



Milton, view across spit towards survey point

Newtown

Grid Reference for vantage point	SZ 41796 91079
Key habitats present	mudflat, lagoon, saltmarsh
Total dogs per hour from all visits (% off lead)	1.9 (33)
Dog walkers per hour from all visits	1.6
Walkers (without dogs) from all visits	3.5
Diary events per hour from all visits	7.1
Number of flights per hour (all species, all visits)	3.7
Top 5 bird species (max counts)	Dunlin (924); Dark-bellied Brent Goose (450); Black-headed Gull (230); Knot (190); Dunlin (185); Golden Plover (160)
% of waders foraging	8
% of wildfowl foraging	23
Number species recorded (all species groups)	31
Number of visits with less than 25% rain	1
Number of visits with some rain	1
Notes on bird use	Diverse selection of water birds widespread at low tide, often including hundreds of Dark-bellied Brents (highest numbers first half of winter) and Dunlin. The most regular HT roosts are on nearby island to the NW (sporadically used by Dunlin, small numbers of other spp) and in/at edge of Spartina c300m NE of survey point (Curlew etc). Roosting Golden Plover often present (at any state of tide) NE of survey point, often obscured or difficult to see.
Notes on access	Walkers and dog-walkers (latter in minority here) the main activities; casual bird-watchers and photographers quite frequent. Sail and motor yachts often moored c500m N of survey point, arriving and departing via channel to N. Barge and associated boat sometimes using/mooring in channel NW of survey point. Kayaker on 2 visits and paddle boarders on one.
Access infrastructure	NT car-park and small car-park in village. Map with walks in NT car-park.
Survey notes	Careful access required not to disturb/influence distribution of birds.

Newtown Images

9 Newtown



100 0 100 200 300 400 m



Newton, view N from survey point



Newton, view NE from survey point

Pennington

Grid Reference for vantage point	SZ 32083 92189
Key habitats present	saltmarsh, mudflat, lagoon, shingle beach/chenier banks
Total dogs per hour from all visits (% off lead)	7 (12)
Dog walkers per hour from all visits	4.8
Walkers (without dogs) from all visits	7.2
Diary events per hour from all visits	16.5
Number of flights per hour (all species, all visits)	1.6
Top 5 bird species (max counts)	Dunlin (1,000); Knot (500); Black-headed Gull (290); Wigeon (164); Dark-bellied Brent Goose (155)
% of waders foraging	90
% of wildfowl foraging	47
Number species recorded (all species groups)	39
Number of visits with less than 25% rain	3
Number of visits with some rain	4
Notes on bird use	This site had by far the highest range of species (39 species recorded). Dunlin the species with the highest counts and no counts of over 1,000 for any species. Substantial roosts on spits 300-400m SSW of survey point.
Notes on access	Relatively busy, but the numbers of dog walkers relatively low compared to some other sites. This was the location with by far the most cyclists and bird watchers also made up a significant proportion of access.
Access infrastructure	A range of routes and walks possible. Seawall path from Keyhaven where large car-park. Well surfaced, signposted and with interpretation.
Survey notes	Roosts difficult to count accurately. People largely remaining on paths and banks and following linear routes with relatively little response from birds.

Pennington Images

Pennington



Pennington, view of outflow by survey point.



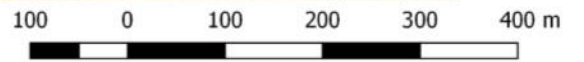
Pennington, warden talking to visitor

Portchester

Grid Reference for vantage point	SU 59638 05191
Key habitats present	mudflats
Total dogs per hour from all visits (% off lead)	39 (7)
Dog walkers per hour from all visits	22
Walkers (without dogs) from all visits	4.2
Diary events per hour from all visits	29.5
Number of flights per hour (all species, all visits)	1.3
Top 5 bird species (max counts)	Black-tailed Godwit (310); Dark-bellied Brent Goose (186); Teal (140); Redshank (131); Dunlin (130)
% of waders foraging	4
% of wildfowl foraging	25
Number species recorded (all species groups)	24
Number of visits with less than 25% rain	2
Number of visits with some rain	5
Notes on bird use	Muddy creek with outlet. Brent Goose, Wigeon and Teal coming to drink and bathe at low tide. Some wader use, including Black-tailed Godwit, Oystercatcher, Redshank, but birds mostly well outside recording area and sense that avoiding areas of high disturbance.
Notes on access	Very popular with dog walkers. Most access along grassy paths above beach, but some walkers and their dogs moving down onto beach where firm substrate at top.
Access infrastructure	Free parking and large area of open grass/playing fields.
Survey notes	Survey point by large pines, good view in to creek but difficult to keep whole area in view. Large numbers of people and dogs makes recording challenging. During survey work ranger was primarily at head of creek.

Portchester Images

4 Portchester



Portchester, from survey point looing NNW



Portchester, warden talking to various dog walkers



Portchester, looking W from survey point

Ryde

Grid Reference for vantage point	SZ 60430 92557
Key habitats present	sandflat
Total dogs per hour from all visits (% off lead)	35.3 (10)
Dog walkers per hour from all visits	26.6
Walkers (without dogs) from all visits	10
Diary events per hour from all visits	38.3
Number of flights per hour (all species, all visits)	3.5
Top 5 bird species (max counts)	Black-headed Gull (490); Sanderling (82); Common Gull (80); Herring Gull (75); Dark-bellied Brent Goose (22)
% of waders foraging	4
% of wildfowl foraging	100
Number species recorded (all species groups)	15
Number of visits with less than 25% rain	0
Number of visits with some rain	0
Notes on bird use	Limited variety. Oystercatcher and Sanderling very regular, up to 170 of latter (including birds outside count area) on one visit. Ringed Plover occasionally present 350-500m NW of survey point; Dunlin, Curlew and Greenshank occasional. Large numbers of Brents near pier to W (well beyond count area) on some early winter visits, but infrequent and in small numbers in count area. Up to 20 Sandwich Terns, usually associated with loafing gulls.
Notes on access	A busy site, dog-walkers particularly numerous. Vast majority of dogs-off-lead. Most walkers and dog-walkers stay on upper beach (often walking one way, then returning), but a minority venture well below MHWM and even to LT shore. These tend to include particularly active dog-walkers, e.g. throwing balls, free-range dogs. Other activities include horse-riders, joggers and, once each, drone-flyer, high-speed ATV rider and kite-surfer.
Access infrastructure	Parking extends along the Esplanade from c450m W of VP to c100m E of it. Charges apply from 10:00 to 18:00. Comprehensive signage regarding beach use, lifeguards etc; but nothing about birds/wildlife.
Survey notes	Feeding birds spread widely and in low numbers, difficult to simultaneously view all birds and people. Some disturbance (not major flights) may have been missed.

Ryde Images

10 Ryde



Ryde, survey point



Ryde, view ESE from survey point



Ryde, esplanade west of survey point



Ryde, shore west of survey point (at high tide)

Appendix 2: Summary of survey visits, dates etc.

In this appendix, we summarise all the visits, with details of weather and the presence/absence of a ranger. Grey shading indicates paired visits that were not valid pairs.

Date	Location	Start time	Wind Strength	Wind Direction	Rain duration during survey	Temp. (°C)	Tide	Ranger
21/11/16	Bosham	07:55	Moderate	E	None	12	falling	X
22/11/16	Bosham	08:05	Strong	SW	<25%	11	high	✓
06/12/16	Bosham	08:45	Light	N	None	8	low	✓
07/12/16	Bosham	10:00	Moderate	SW	None	11	low	X
10/12/16	Bosham	13:00	Light	S	None	11	low	X
11/12/16	Bosham	13:50	Light	W	None	9	low	✓
16/01/17	Bosham	07:55	Light	ESE	<50%	5	low	✓
17/01/17	Bosham	09:00	Light	NE	None	5	low	X
25/01/17	Bosham	13:30	Light	E	None	2	falling	✓
26/01/17	Bosham	14:25	Light	SE	None	2	low	X
15/02/17	Bosham	08:43	Light	SE	None	9	rising	X
16/02/17	Bosham	09:20	Light	W	None	8	rising	✓
18/02/17	Bosham	09:00	Light	SE	None	11	low	✓
19/02/17	Bosham	10:00	Light	NW	None	9	low	X
04/03/17	Bosham	09:00	Light	SW	None	11	low	X
05/03/17	Bosham	10:00	Strong	SW	<25%	11	low	✓
29/11/16	Bunny Meadows	14:25	Light	NW	None	8	falling	X
30/11/16	Bunny Meadows	14:15	Light	NW	None	7	falling	✓
01/12/16	Bunny Meadows	10:15	None		None	-1.5	rising	✓
02/12/16	Bunny Meadows	11:00	None		None	5	rising	X
10/12/16	Bunny Meadows	09:10	Light	S	<50%	11	falling	✓
11/12/16	Bunny Meadows	10:00	Light	W	None	9	falling	X
14/01/17	Bunny Meadows	09:30	Moderate	NW	None	3.5	rising	✓
15/01/17	Bunny Meadows	10:30	Moderate	NW	<50%	4.5	rising	X
25/01/17	Bunny Meadows	09:45	Light	E	None	2	falling	X
26/01/17	Bunny Meadows	10:45	Moderate	SSE	None	1	falling	✓
13/02/17	Bunny Meadows	13:35	Moderate	NE	None	11	high	✓
14/02/17	Bunny Meadows	14:30	Moderate	SE	None	9	high	X
27/02/17	Bunny Meadows	13:05	Strong	S	None	6	high	X

Solent Bird Disturbance Monitoring

Date	Location	Start time	Wind Strength	Wind Direction	Rain duration during survey	Temp. (°C)	Tide	Ranger
28/02/17	Bunny Meadows	14:00	Moderate	SW	<25%	7	high	✓
13/03/17	Bunny Meadows	12:00	Moderate	W	None	13.5	high	X
14/03/17	Bunny Meadows	12:30	Moderate	WNW	None	13	high	✓
28/11/16	Calshot	08:40	Moderate		None	7	rising	X
29/11/16	Calshot	09:20	Moderate		None	2	high	✓
05/12/16	Calshot	12:15	Light	SE	None	7	rising	✓
06/12/16	Calshot	13:15	Light	S	None	10	rising	X
15/12/16	Calshot	09:05	Light	S	None	10	rising	X
16/12/16	Calshot	10:00	Light	S	None	10	rising	✓
12/01/17	Calshot	08:10	Light	SW	<25%	11	rising	✓
13/01/17	Calshot	09:10	Moderate	NW	None	3	rising	X
16/01/17	Calshot	11:30	Light	E	<50%	6	rising	✓
17/01/17	Calshot	12:15	Light	ESE	None	6	rising	X
01/02/17	Calshot	12:10	Light	S	None	10	rising	✓
02/02/17	Calshot	12:45	Strong	S	None	10	rising	X
18/02/17	Calshot	14:00	Light	E	None	11	high	X
19/02/17	Calshot	15:00	Moderate	E	None	9	high	✓
04/03/17	Calshot	13:30	Strong	SW		11	rising	✓
05/03/17	Calshot	14:30	Moderate	SW	None	8	rising	X
28/11/16	East Head	12:00	Moderate		None	10	falling	✓
29/11/16	East Head	13:25	Light		None	5	falling	X
03/12/16	East Head	12:06	Moderate	NE	None	6	high	✓
04/12/16	East Head	12:58	Moderate	E	None	6	high	X
12/12/16	East Head	13:03	Moderate	S	<50%	11	falling	X
13/12/16	East Head	14:21	Moderate	SSW	<25%	11	falling	✓
17/12/16	East Head	11:10	Light	SW	None	10	rising	X
18/12/16	East Head	12:10	Light	NW	None	8.5	rising	X
12/01/17	East Head	12:35	Light	SW	<50%	6	falling	✓
13/01/17	East Head	13:40	Strong	NW	None	5	falling	X
13/02/17	East Head	10:30	Strong	NE	None	6	rising	✓
14/02/17	East Head	11:00	Light	SE	None	9	rising	X
01/03/17	East Head	15:50	Light	SW	None	9	falling	✓
02/03/17	East Head	15:05	Strong	SW	None	11	falling	X
29/11/16	Hayling Oysterbeds	11:30	Light		None	6	high	X
30/11/16	Hayling Oysterbeds	11:30	Light	NW	None	8	high	✓
01/12/16	Hayling Oysterbeds	13:20	None		None	5	high	✓
02/12/16	Hayling Oysterbeds	13:50	Light	N	None	6	high	X
15/12/16	Hayling Oysterbeds	13:05	Light	S	None	11	falling	X

Solent Bird Disturbance Monitoring

Date	Location	Start time	Wind Strength	Wind Direction	Rain duration during survey	Temp. (°C)	Tide	Ranger
16/12/16	Hayling Oysterbeds	14:05	Light	S	None	11	high	✓
04/01/17	Hayling Oysterbeds	11:30	Moderate	NW	None	7.5	rising	X
05/01/17	Hayling Oysterbeds	12:15	None		None	6	rising	✓
14/01/17	Hayling Oysterbeds	13:00	Moderate		None	7	high	✓
15/01/17	Hayling Oysterbeds	14:00	Moderate	NW	<50%	7.5	falling	X
11/02/17	Hayling Oysterbeds	13:52	Moderate	NE	<25%	2	falling	X
12/02/17	Hayling Oysterbeds	14:03	Moderate	NE	None	4	falling	✓
16/03/17	Hayling Oysterbeds	09:30	Light	SW	None	9	rising	X
17/03/17	Hayling Oysterbeds	10:30	Moderate	W	None	9	rising	✓
21/11/16	Milton	14:10	Moderate	SE	<25%	14	rising	X
22/11/16	Milton	14:25	Moderate	SW	None	12	rising	✓
03/12/16	Milton	08:14	Light	NE	None	4	rising	X
04/12/16	Milton	09:20	Light	E/ENE	None	6	rising	✓
08/12/16	Milton	11:40			<25%	12	low	✓
09/12/16	Milton	11:47	None		None	12	low	X
17/12/16	Milton	08:00	None		None	7.5	rising	X
18/12/16	Milton	09:00	Moderate		None	7	rising	X
04/01/17	Milton	08:50	Moderate	NW	None	5	rising	✓
05/01/17	Milton	09:15	Light	N	None	1.5	rising	X
27/02/17	Milton	10:05	Moderate	S	<50%	7	rising	✓
28/02/17	Milton	11:00	Moderate	SW	None	6	high	X
01/03/17	Milton	11:30	Light	SW	<25%	8	high	✓
02/03/17	Milton	12:00	Strong	SW	None	10	rising	X
11/03/17	Milton	08:30	Light	SE	None	9	high	✓
12/03/17	Milton	09:15	Light	W	<50%	9	rising	X
28/11/16	Newtown	11:15	Moderate	NE	None	6	high	X
29/11/16	Newtown	11:30	Moderate	NE	None	5	high	✓
08/12/16	Newtown	11:45	Moderate	SW	<25%	13	rising	X
09/12/16	Newtown	12:54	Moderate	SW	None	12	rising	X
07/01/17	Newtown	09:18	Light	W	None	10	low	X
08/01/17	Newtown	09:52	Light	W	None		falling	✓
21/01/17	Newtown	13:00	Light	ENE	None	4	rising	X
22/01/17	Newtown	14:13	Light	E	None	5	rising	✓
23/01/17	Newtown	10:35	Light	NW	None	2	falling	✓
24/01/17	Newtown	11:05	Light	Calm/variable 0-1	None	4	falling	X
06/03/17	Newtown	11:39	Moderate	WNW	None	8	rising	✓
07/03/17	Newtown	12:48	Light	W	None	9	rising	X

Solent Bird Disturbance Monitoring

Date	Location	Start time	Wind Strength	Wind Direction	Rain duration during survey	Temp. (°C)	Tide	Ranger
29/11/16	Pennington	07:45	Light	NW	None	3	rising	✓
30/11/16	Pennington	07:35	Light		None	-2	rising	X
06/12/16	Pennington	12:15	Light	S	None	10	rising	X
07/12/16	Pennington	13:20	Moderate	SSW	None	11	rising	X
12/12/16	Pennington	08:28	Moderate	SE	<50%	10	high	☒
13/12/16	Pennington	09:49	Moderate	SSW	<25%	11	high	X
07/01/17	Pennington	13:00	Light	NW	None	11	rising	✓
08/01/17	Pennington	14:00	Light	NW	None	11	rising	X
18/01/17	Pennington	12:10	Light	N	None	6.5	rising	✓
19/01/17	Pennington	13:00	Moderate	NE	None	7	rising	X
11/02/17	Pennington	09:33	Moderate	NE	<25%	2	high	✓
12/02/17	Pennington	09:59	Moderate	ENE	None	3	high	X
15/02/17	Pennington	13:29	Moderate	SW	<25%	9	high	X
16/02/17	Pennington	14:10	Moderate	W	None	10	high	✓
15/03/17	Pennington	12:10	Light	SW	None	15	high	X
16/03/17	Pennington	13:05	Light	SE	None	11	high	✓
21/11/16	Portchester	11:20	Moderate	E	<50%	13	rising	X
22/11/16	Portchester	11:45	Strong	SW	None	12	rising	✓
05/12/16	Portchester	08:00	Light	SE	None	6	low	✓
06/12/16	Portchester	09:20	Light	S	None	9	low	X
08/12/16	Portchester	08:43	Light		None	15	falling	✓
09/12/16	Portchester	09:17	None		None	12	falling	X
07/01/17	Portchester	09:00	Light	NW	None	10	falling	X
08/01/17	Portchester	10:00	Light	NW	<25%	9	falling	✓
18/01/17	Portchester	08:45	None		None	1	rising	✓
19/01/17	Portchester	09:45	Light	N	None	0	rising	X
01/02/17	Portchester	08:10	Light	S	<50%	10	rising	✓
02/02/17	Portchester	09:15	Moderate	S	<50%	9	rising	X
11/03/17	Portchester	11:51	Light	SE	None	10	high	✓
12/03/17	Portchester	12:22	Light	NW	<25%	12	high	X
28/11/16	Ryde	14:27	Moderate	NE-ENE	None	7	falling	X
29/11/16	Ryde	14:32	Moderate	NE	None	5	falling	✓
08/12/16	Ryde	08:18	Moderate	SW	None	14	falling	X
09/12/16	Ryde	09:32	Light	SW	None	13	falling	✓
07/01/17	Ryde	12:54	Light	W	None	10	rising	✓

Solent Bird Disturbance Monitoring

Date	Location	Start time	Wind Strength	Wind Direction	Rain duration during survey	Temp. (°C)	Tide	Ranger
08/01/17	Ryde	13:23	Light	W/ calm	None	10	rising	X
21/01/17	Ryde	09:19	Light	ENE	None	3	falling	✓
22/01/17	Ryde	10:23	Light	E	None	4	falling	X
23/01/17	Ryde	13:38	Light	NW	None	5	low	X
24/01/17	Ryde	14:23	Light	Calm/variable 0-1	None	5	rising	✓
06/03/17	Ryde	08:10	Light	NW	None	7	falling	✓
07/03/17	Ryde	09:15	Light	W	None	6	falling	X

Appendix 3: Summary of diary data by activity and location

The table overleaf summarises all diary data (all visits), giving total number (%) of events for each site. Grey shading indicates values above 0, with pale grey shading indicating percentages below 10 and darker grey shading indicating percentages of 10 and above.

Activity broad group	Activity	Bosham	Bunny Meadows	Calshot	East Head	Hayling Oysterbeds	Milton	Newtown	Pennington	Portchester	Ryde	Total
Airborne	Airborne	4 (3)	1 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	9 (0)
Raptor	Raptor	1 (1)	2 (0)	7 (5)	1 (0)	1 (0)	0 (0)	2 (2)	4 (1)	3 (1)	0 (0)	21 (1)
Terrestrial	Bait digging	0 (0)	1 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	3 (0)
	Bait harvesting from boat	0 (0)	0 (0)	4 (3)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0)
	Bird/wildlife watching	1 (1)	19 (5)	3 (2)	11 (2)	38 (15)	1 (0)	7 (6)	30 (8)	4 (1)	0 (0)	114 (3)
	Cycling	1 (1)	10 (2)	2 (1)	17 (2)	17 (7)	5 (2)	2 (2)	42 (11)	27 (5)	0 (0)	123 (3)
	Dog walking	100 (63)	124 (30)	51 (36)	407 (59)	113 (43)	159 (60)	27 (22)	111 (29)	446 (74)	462 (69)	2000 (54)
	Fishing	0 (0)	0 (0)	4 (3)	0 (0)	2 (1)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	7 (0)
	Horse Riding	0 (0)	1 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	1 (0)	0 (0)	6 (1)	9 (0)
	Jogging	6 (4)	31 (7)	0 (0)	8 (1)	9 (3)	19 (7)	0 (0)	24 (6)	29 (5)	15 (2)	141 (4)
	Kids playing	0 (0)	0 (0)	3 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (0)
	Metal detecting	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)
	Motor vehicle	0 (0)	0 (0)	6 (4)	0 (0)	0 (0)	6 (2)	0 (0)	0 (0)	0 (0)	5 (1)	17 (0)
	Other	20 (13)	0 (0)	1 (1)	2 (0)	1 (0)	12 (5)	4 (3)	0 (0)	2 (0)	2 (0)	44 (1)
	Person accessing boat	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	2 (0)
	Sitting/picnic	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)
	Walking	26 (16)	223 (53)	56 (39)	248 (36)	68 (26)	60 (23)	61 (49)	167 (44)	86 (14)	174 (26)	1169 (31)
	Working on boat (boat stationary)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	1 (0)
	Sitting/picnic	0 (0)	0 (0)	2 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0)
Water	Canoe on water	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	1 (0)
	Canoeing	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	2 (2)	0 (0)	0 (0)	0 (0)	3 (0)
	Large boat on outboard	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	2 (1)	11 (9)	0 (0)	0 (0)	0 (0)	14 (0)
	Moderate-large sailing boat	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (4)	0 (0)	0 (0)	0 (0)	5 (0)
	Paddleboarding	0 (0)	2 (0)	1 (1)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	4 (0)
	Rib/small motor boat	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	2 (2)	0 (0)	0 (0)	0 (0)	3 (0)
	Rowing boat	0 (0)	4 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (0)
	Small sailing boat	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)
	Windsurfing	0 (0)	0 (0)	0 (0)	0 (0)	5 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0)
Total		159 (100)	419 (100)	143 (100)	695 (100)	260 (100)	264 (100)	124 (100)	383 (100)	599 (100)	666 (100)	3712 (100)

Appendix 4: Bird Count data

The table overleaf gives the maximum count for each species across all visits to each site.

Solent Disturbance Fieldwork Method Statement

Species Group	Species	Bosham	Bunny Meadows	Calshot	East Head	Hayling Oysterbeds	Milton	Newtown	Pennington	Portchester	Ryde	Total
Gulls /Terns	Black-headed Gull	150	55	38	38	650	190	230	290	124	490	2255
	Common Gull	36	8	4		21	72	1	2	13	80	237
	Great Black-backed Gull		1	2	2	1	3		2		3	14
	Herring Gull	3	7	8	6	5	28	4	5	2	75	143
	Lesser Black-backed Gull										2	2
	Mediterranean Gull		3	1	1	263	26	95	4	4	14	411
	Sandwich Tern				2						20	22
Other	Black-necked Grebe					7						7
	Coot								19			19
	Cormorant	11		2	1			1	2			17
	Great-crested Grebe		3	1	1	4	1	1	4	3		18
	Grey Heron	1	1	1		2	1		2			8
	Little Egret	2	3		1	2	6	3	2	1	1	21
	Little Grebe	2	3		1	5	1	8	8	1		29
	Moorhen				3							3
	Razorbill						1					1
	Spoonbill								1			1
Waders	Bar-tailed Godwit	1			1			2	11			15
	Black-tailed Godwit	120	80	65	21		3	82	7	310		688
	Common Snipe								2			2
	Curlew	51	8	20	18	23	4	52	6	8	5	195
	Dunlin	350	280	185	600	5000	225	924	1000	130	1	8695
	Golden Plover				86			160				246
	Greenshank	2	4				1	1		1		9

Solent Disturbance Fieldwork Method Statement

Species Group	Species	Bosham	Bunny Meadows	Calshot	East Head	Hayling Oysterbeds	Milton	Newtown	Pennington	Portchester	Ryde	Total
	Grey Plover	19	45	10	34	271	12	28	75	5		499
	Knot				14	30		190	500			734
	Lapwing	8			34			70	36	10		158
	Oystercatcher	35	2	120	45	350	10	24	60	71	32	749
	Redshank	40	23	51	72	146	76	12	5	131		556
	Ringed Plover		21	69	40	70	5	19	18		11	253
	Ruff								1			1
	Sanderling										82	82
	Snipe				7							7
	Spotted Redshank	5							1			6
	Turnstone	23	12	28	11	43	18	8	21	16	1	181
	Whimbrel									1		1
Wildfowl	Barnacle Goose	1										1
	Canada Goose	5	3						200			208
	Dark-bellied Brent Goose	1500	410	370	390	260	440	450	155	186	22	4183
	Eider								2			2
	Gadwall	2				4	1	1	4			12
	Goldeneye					6		3		2		11
	Mallard		6	8	6	3	10	11	28			72
	Mute Swan	69					2	3	3			77
	Pale-bellied Brent Goose	1		1						1		3
	Pintail	42		6		3		2	57			110
	Red-breasted Merganser				12	14	8	13	3	10		60
	Shelduck	12	13	30	4	5	3	55	12	5		139

Solent Disturbance Fieldwork Method Statement

Species Group	Species	Bosham	Bunny Meadows	Calshot	East Head	Hayling Oysterbeds	Milton	Newtown	Pennington	Portchester	Ryde	Total
	Shoveler		9			7			12			28
	Teal	49	28	60	260	2	3	124	94	140		760
	Tufted Duck								14			14
	Wigeon	640	156	24	45			28	164	210		1267

