



FOOTPRINT
ECOLOGY



Essex Disturbance Study 2021

Phil Saunders & Durwyn Liley

FOOTPRINT ECOLOGY, FOREST OFFICE, BERE ROAD,
WAREHAM, DORSET BH20 7PA
WWW.FOOTPRINT-ECOLOGY.CO.UK
01929 552444



FOOTPRINT
ECOLOGY

Footprint Contract Reference: 595

Date: 30th September 2022

Version: Final

Recommended Citation: Saunders, P. & Liley, D. (2022). Essex Disturbance Study 2021. Unpublished report by Footprint Ecology.

Summary

This report, commissioned by the RSPB, presents the results from bird disturbance fieldwork carried out by RSPB staff and volunteers at Colne Point, Old Hall Marshes, and Tollesbury Wick on the Essex Coast during the spring and summer 2021. All three localities support beach nesting waders (Ringed Plover and Oystercatcher), both comprising declining species of particular conservation concern.

Disturbance by people using the coast is a concern and the three localities are all publicly accessible. During 2021, RSPB staff and volunteers collected data on recreation use and disturbance at each locality (through standardised watches) and deployed camera traps to further record human activity and disturbance at each location.

Key findings from the Standard Watch surveys included:

Categories, levels, and distribution of human activities

- A total of 97 individual activity events were recorded from the three survey locations (from 40.25 hours of survey work in total across the three sites).
- These events comprised activities involving at least 174 people/watercraft.
- The number of observations varied considerably between survey locations.
- Large motorboats were the most commonly recorded activity type at Old Hall Marshes (30% of observations), followed by walkers and moderate to large sized sailing craft (17% each).
- Watercraft also comprised the dominant activity type amongst the small dataset collected from Tollesbury Wick.
- Terrestrial activities were dominant in the similarly small dataset collected from Colne Point, with 50% of the 6 observations made in total comprising dog walkers.

Bird Counts

- A total of 19 species, including five wader, three wildfowl, and two tern species, were recorded during the Standard Watches carried out at the three survey locations over the entire survey period.
- Ringed Plovers and Oystercatchers were recorded from all three survey locations.

Behavioural responses

- Of the 97 individual activity events recorded across the three survey locations over the entire survey period, 38 (39%) comprised potential disturbance events (i.e. birds were present within the recording area and the activity was close enough to potentially have an effect).
- Across all survey locations, the 38 potential disturbance events observed generated a total of 32 species-specific behavioural observations.

- 84% of potential disturbance events therefore generated a behavioural response, with 16% leading to either mobbing behaviour from the birds present or a major flight.

Responses to activity types

- A large proportion of potential disturbance events across all activity types triggered a response from the birds present, with the most frequently recorded activity (walking) resulting in a response on 80% of occasions.
- Although comprising a small dataset, there are indications that both canoeists, dog walkers, and small sailing boats lead to a disproportionate flight response from the birds present.

Variation between sites

- The single disturbance event noted at Tollesbury Wick resulted in a minor flight (i.e. birds being flushed and flying less than 50m), whilst 75% of the responses to the four disturbance events recorded at Colne Point resulted in a major or minor flight.
- The responses observed within the larger Old Hall Marshes dataset were more varied.

Response by species

- Ringed Plover were less liable to exhibit a behavioural response than Oystercatcher, with the former showing no response on approximately half of occasions.
- Fewer than 20% of behavioural responses from Ringed Plovers comprised an extreme behavioural response (i.e. flushing or mobbing).
- Oystercatcher showed a behavioural response to all relevant disturbance events, with approximately 60% of the responses comprising an extreme response.

Distances displaced and time lost

- The distance that the birds were displaced after a flush or mobbing event was estimated for 6 disturbance event observations, with the mean displacement distance across all three survey locations being 59m.
- The time taken for normal behaviour to resume for birds identified during 7 separate extreme behavioural responses ranged from 30 seconds to 5 minutes.

Key findings from the camera trap surveys included:

- A total of 1,042 activity events caught on camera across the three survey locations during their respective deployment periods. These were mostly at Colne Point with only 26 recorded from Tollesbury Wick and 6 from Old Hall Marshes.
- Walking was the most frequently recorded activity type recorded from the cameras overall, with approximately one walker/walking group observed per nine hours of observation.
- Tollesbury Wick was the only location where predator activity was recorded from the camera.

- Walkers were recorded across the camera trap survey period at Colne Point, whereas boat-based activities were predominantly recorded from late May and into June, and observations of kitesurfers were only made in April.
- In most weeks there were obvious weekend peaks in the number of observations made at Colne Point, with an extreme peak also noted on the Monday of the May Bank Holiday weekend.

It is recommended that both camera trapping and Standard Watch surveys continue at Old Hall Marshes and Colne Point in future years, with camera traps solely deployed at Tollesbury Wick due to the low level of recreational activity recorded there in 2021. The location of the camera trap at Colne Point may however warrant review. We also recommend that any future standard watches should be stratified with respect to timing to ensure a representative sample of different days (including weekends) and that the data collection should also be reviewed at key points across the survey period.

Contents

Summary	ii
Contents.....	v
Acknowledgements	vi
1. Introduction	7
Impacts of disturbance on beach-nesting waders	7
Report aims	8
2. Methods.....	11
Survey locations	11
Sampling approaches	11
Standard Watches.....	12
<i>Recording elements.....</i>	12
<i>Bird count.....</i>	12
<i>Diary.....</i>	16
<i>Bird response.....</i>	16
<i>Additional Information.....</i>	18
Camera trap monitoring.....	18
Timing and logistics (including coverage of tide states, etc.).....	18
3. Results.....	20
Standard Watches.....	20
<i>Categories, levels, and distribution of human activities</i>	20
<i>Bird Counts</i>	23
<i>Behavioural responses</i>	24
<i>Responses to activity types.....</i>	25
<i>Distances displaced and time lost.....</i>	30
Camera trap monitoring.....	32
<i>Activities recorded</i>	32
<i>Temporal variation in camera trap recordings.....</i>	35
4. Discussion.....	37
Recommendations.....	38
References	40
Appendix 1: Activity codes.....	42
Appendix 2: Response codes	43
Appendix 3: Camera trap fields of view	44



Acknowledgements

This report was commissioned by the RSPB, and we are grateful to Kieren Alexander for overseeing the work and to the RSPB volunteer surveyors (Chris Balchin, Kate Jackman, and John Pritchard) for carrying out the majority of the fieldwork alongside Kieren. Camera trap data were analysed and entered by Kieren and the same volunteer team, with bird disturbance data entered by Emma Bishop (Footprint Ecology). The work was funded by the LIFE Programme of the European Union as part of the project LIFE on the Edge: improving the condition and long-term resilience of key coastal SPAs in S, E and NW England (LIFE19 NAT/UK/000964)

Photo © [Mike Pennington](#) (cc-by-sa/2.0).

1. Introduction

1.1 This report, commissioned by the RSPB, presents the results from bird disturbance fieldwork carried out by RSPB staff and volunteers at three localities on the Essex Coast during spring and summer 2021 (see Map 1), namely:

- Colne Point;
- Old Hall Marshes; and,
- Tollesbury.

1.2 All three localities support beach nesting waders (Ringed Plover and Oystercatcher). Both species are of particular conservation concern and are declining. Disturbance by people using the coast is one of the issues of concern and the three localities are all publicly accessible. During 2021, RSPB staff and volunteers collected data on recreation use and disturbance at each locality and deployed camera traps to further record human activity and disturbance at each location. The data collected will inform our understanding of human-mediated disturbance upon breeding waders at the survey localities.

Impacts of disturbance on beach-nesting waders

1.3 Ringed Plover and Oystercatcher nest on open beach habitats and settle on territories in the early part of the spring. Nesting tends to start around April and extends into the summer. As such, the key period for birds is also when recreational use is likely to peak. Eggs are laid in open scrapes on the beach, often just above the tideline, and once the chicks hatch they are mobile and will often feed on the water's edge or around the strandline.

1.4 The habitat is therefore also often a focus for people and used for a range of recreation activities such as dog walking, beach activities, wildlife watching, etc. Coastal waters also provide a particular draw for water-based activities such as boating, paddleboarding, kayaks and watersports and these may also bring people into proximity to nesting birds.

1.5 Disturbance of beach nesting waders by people can have a range of impacts, for example:

- Otherwise suitable habitat is avoided due to the presence of people (Liley and Sutherland, 2007);

- Direct loss of nests or chicks can occur, e.g. through accidental trampling or predation of chicks by dogs (Liley and Sutherland, 2007; Pienkowski, 1984);
 - Disturbance of foraging adults results in less food being provided to chicks and reduction in parental care (Verhulst et al., 2001);
 - Reduced foraging time for chicks (Weston and Elgar, 2005).
- 1.6 Disturbance is not the only threat to these species. Ground-nesting birds are vulnerable to predation (Macdonald and Bolton, 2008) and coastal squeeze and habitat change potentially restrict the extent and scale of open, dynamic beach habitats, exacerbating impacts from both disturbance and predation.
- 1.7 As such beach-nesting waders are increasingly recognised as a conservation priority and in many areas their continued presence is reliant on conservation action such as cordons and access management. Ringed Plover is a Red-listed Bird of Conservation Concern (Eaton et al., 2015) reflecting the marked decline in the non-breeding population, but the numbers breeding have also declined and the species' breeding population is Near Threatened in a GB context (Stanbury et al. 2017). Oystercatcher are Amber-listed on the Birds of Conservation Concern (Eaton et al., 2015) and this is due to its vulnerable status on the European red-list and also the international importance of the UK for the species (the UK holds 30-40% of the European population in both the breeding and non-breeding season).
- 1.8 The Essex Coast is of particular importance for beach nesting waders, for example it contains the only Special Protection Areas (SPAs) where breeding Ringed Plover are a qualifying feature¹.

Report aims

- 1.9 This report has been triggered by growing concerns around recreation impacts on beach-nesting waders on the Essex coast, potentially exacerbated by the Covid pandemic resulting in increased levels of recreation use and potentially different types of use. The work has been commissioned by the RSPB with the aim of understanding the extent of current recreational use around three locations with breeding waders on the Essex coast.

¹ The three SPAs classified for Ringed Plover are: Blackwater Estuary, the Colne Estuary and Foulness

- 1.10 The primary aim is therefore to provide a baseline of human recreation activity levels, and their effects in terms of disturbance upon breeding waders, at three previously identified survey locations (Map 1). Furthermore, the data collected will allow us to identify those recreation activities occurring most frequently, as well as any which have a higher level of impact (in terms of behavioural response) upon the birds present. Comparison between the three localities will also allow any site-specific issues related to recreational disturbance to be identified.
- 1.11 A survey protocol was recommended by Footprint Ecology and RSPB staff and volunteers subsequently collected data during the 2021 breeding season.

2. Methods

Survey locations

- 2.1 Individual survey points were identified at each of the three survey locations (Colne Point, Old Hall Marshes, and Tollesbury Wick) shown in Map 1. The exact locations of the survey points were selected by local RSPB staff/volunteers, taking into account the distribution of breeding waders/terns at the locality and associated public access points/routes.
- 2.2 Finer spatial scale maps of the survey points, in addition to the nearby locations at which camera traps were deployed, and any associated seasonal visitor management infrastructure deployed by the RSPB, are depicted in Maps 2 to 4.

Sampling approaches

- 2.3 The survey methodology comprised two different approaches:
- **Standard Watches**, involving continued observation within a 500m arc over a fixed time period (1 hour and 45 minutes), recording the birds present, human activity, and any interactions between people and birds, and;
 - **Camera trap monitoring**, involving deployment of stationary, fixed viewpoint, time lapse cameras at preselected locations in proximity to the standard watch survey points, to provide information on site access across the study period (including in the absence of surveyors on the ground).
- 2.4 Standard watches provided detailed data relating to the responses of birds, and prolonged observation across a fixed (but relatively small) recording area. Camera traps comprised a complimentary technique allowing access within the study area to be monitored across the 24hr period but did not necessarily provide detailed data on how birds responded.

Standard Watches

Recording elements

- 2.5 Each count involved the following elements:
- Two counts of birds, one count 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, and;
 - Any additional information.
- 2.6 These different elements are described in more detail below, but in summary the bird counts provided a detailed level of use within the core area, the diary recorded the level of human activity, the response data detailed any behavioural response to disturbance shown by the birds present, and the additional information provided context and background.

Bird count

- 2.7 At the start of each survey visit, a count of the birds present was conducted. While the focus of the study was on the breeding waders, the count extended to a range of other species, including waders, terns, wildfowl, grebes, divers, and herons/egrets. The count only recorded the birds present within a pre-defined recording area that extended to a maximum of 500m from the watch point. This area was carefully mapped for each location, using aerial photographs (see Maps 2 to 4). The proportion of breeding birds present was also noted.
- 2.8 All mapped areas had a clear line of sight, with their entire extent (within 500m) visible to the recorder from the fixed watch point. Each fixed watch point was selected to be at a point where any disturbance caused by the presence of the surveyor could be minimised/avoided, although the exact size of the recording area on the ground varied at each location due to differences in topography, hydrology, tide effects, etc.

Map 2: Location of Colne Point survey point, associated 500m recording area, and camera trap, and seasonal visitor management infrastructure in relation to the survey point



Map 3: Location of (a) Old Hall Marshes survey point, associated 500m recording area, and camera traps, and (b) seasonal visitor management infrastructure in relation to the survey point



Map 4: Location of (a) Tollesbury Wick survey point, associated 500m recording area, and camera trap, and (b) seasonal management infrastructure in relation to the survey point



Diary

- 2.9 All recreation events (and events which could disturb birds, such as aircraft, birds of prey, etc) which occurred during the following 1 hour and 45 minutes were recorded in a diary format. This diary involved all observed events that could affect birds within the recording area, including those that occurred outside (but still in the vicinity of) the recording area. This was due to the fact that activities above the Mean High Water Mark (MHW), and events outside the recording area, could still disturb birds. Regardless of whether birds were present or not, all events were recorded in the diary, allowing comparisons of the levels of human activity in different areas.
- 2.10 Each activity type was categorised using pre-determined activity codes (see Appendix 1). Each diary entry was assigned a unique identifier, indicating a single unique event, with details recorded including activity (categorised to standard codes), group size, zone (intertidal, on water, or above MHW), length of time present in area, and notes relating to behaviour.

Bird response

- 2.11 Events in the diary were categorised as a 'potential disturbance event' if:
- They coincided with birds being present within the count area; and/or,
 - They occurred within 200m of birds within the recording area; and/or,
 - There was a behavioural response recorded for birds within the recording area (i.e. seen to become alert, change position, or were flushed).
- 2.12 For each potential disturbance event, the response of the birds was recorded, even if no behavioural response was logged – i.e. if the birds were not visibly disturbed.
- 2.13 The disturbance data recorded the number of birds within 200m of the potential source of disturbance, with each group of birds of a given species being recorded as an observation. There could therefore be multiple observations for the same potential disturbance event, for example someone walking across the intertidal zone might pass various groups of birds of different species.
- 2.14 For each observation, bird behaviour was categorised simply as (1) feeding or (2) roosting/preening/loafing. The response of the birds was categorised,

using simple categories ('Alert', 'walk/swim', 'short flight (<50m)', 'Major Flight (>50m)', or 'No Response') and the number of birds falling into each response category recorded (see Appendix 2). Each observation might therefore involve a range of responses, for example some birds in a flock might remain *in situ* whilst a part of the flock undertakes a major flight. To simplify the data presentation, we also used single response codes, assigning each observation a single code representing the strongest response observed (e.g. if any of the birds in a group undertook a major flight, major flight would be the single response code assigned to the observation).

- 2.15 For each activity/event where disturbance occurred the maximum distance from the birds to the event was estimated, 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). If the birds were in a tight flock, or only a single individual was involved, then this distance was relatively easy to measure.
- 2.16 If the birds were scattered over a wide area, and all were disturbed, then the distance will be the approximate range (i.e. 20m – 50m). In all cases distances were estimated to the nearest 5m. In order to ensure consistency in recording distances volunteer/RSPB surveyors were provided with:
- Aerial photographs, with distance bands plotted, at each location. When blown up and printed on good quality paper, with distance bands overlaid, such images show creeks, buoys, marker posts, and landmarks clearly.
- 2.17 Furthermore, the use of the following additional equipment/techniques were also recommended, following RSPB-led field training of the volunteer surveyor team:
- Laser rangefinders to determine the distance to key landmarks/features and the birds, and;
 - Triangulation or pacing out of some of the distances at the end of the survey – helpful where distances are hard to estimate during the survey period (for example due to the angles between the observer, source of disturbance, and the birds).

Additional Information

- 2.18 Additional information provided context and background and included tide times, tide coverage, and weather. A free text box allowed any anecdotal information, such as particular events or activities taking place that might make the birds jumpy to also be recorded.

Camera trap monitoring

- 2.19 In order to maximise the recording of recreational activities/access at the three survey locations automated, time lapse, camera traps were deployed. Single cameras were installed at both Colne Point and Tollesbury Wick, with two cameras (providing an approximate 360-degree field of view) installed at Old Hall Marshes.
- 2.20 The Colne Point camera was installed outside of the 500m recording area, at approximately 3m height above a creekside footpath, due east of the survey point (see Map 2 and Appendix 3). Both Old Hall and Tollesbury Wick cameras were installed at ground level, on the beach in proximity to breeding localities, in front of the survey point/within the relevant 500m recording area (see Maps 3 and 4 and Appendix 3).
- 2.21 The cameras at Colne Point were deployed between 1st April and early July (although data was only provided until 29th June (i.e. 90 days)), at Old Hall between 31st March and 3rd August (126 days), and at Tollesbury Wick between 31st March and 29th July (121 days).
- 2.22 Each camera was set to record an image once every 10 minutes across each 24-hour period, with the camera batteries changed, and memory files downloaded, on a frequent basis across the study period by RSPB staff/volunteers. At the end of the study period the images recorded were analysed by RSPB staff/volunteers, with all human/disturbance-inducing (i.e. predator presence) activities categorised and transcribed onto a digital logbook. The date and time of recording for each observed activity event were also noted in the log.

Timing and logistics (including coverage of tide states, etc.)

- 2.23 Survey effort varied considerably between the three study locations:
- Three survey visits were carried out at Colne Point between 13th April and 11th May 2021:

- Twelve survey visits were carried out at Old Hall Marshes between 9th April and 29th July 2021, and;
- Eight survey visits were carried out at Tollesbury Wick between 7th April and 29th July 2021.

2.24 Only three of the survey visits across all sites (2 at Old Hall Marshes and one at Tollesbury Wick) were carried out at weekends, with the rest undertaken between Monday and Friday.

2.25 Volunteer surveyors were instructed to spread the survey effort over different days and times of day to ensure a range of conditions and circumstances were covered, including:

- A range of weather conditions;
- Any particular events that were known to be taking place, and;
- A range of tide states.

3. Results

Standard Watches

Categories, levels, and distribution of human activities

- 3.1 A total of 97 individual activity events within 12 categories were recorded in total from the three survey locations across the survey period (see Table 1). These events comprised activities involving at least 174 people/craft². The number of observations made varied considerably between survey locations, with 87 at Old Hall Marshes, 6 at Colne Point, and 4 at Tollesbury Wick. Only 4 incidences of dog walking were recorded from the Standard Watches (three at Colne Point and one at Old Hall Marshes) involving a total of 6 dogs on the lead and 4 dogs off the lead.
- 3.2 Large motorboats were the most commonly recorded activity type at Old Hall Marshes (30% of observations), followed by walkers and moderate to large sized sailing craft (17% each). Watercraft dominated the remainder of activities recorded there, with dog walkers (for example) only comprising a single observation. Watercraft also comprised the dominant activity type amongst the small dataset collected from Tollesbury Wick, with single observations of large motorboats, RIBs, and beached watercraft comprising 75% of the activities observed. Terrestrial activities were however dominant in the similarly small dataset collected from Colne Point, with 50% of the 6 observations made in total comprising dog walkers and 34% comprising walkers.

² Note that aircraft and larger watercraft were automatically assigned a group size of 1 for the purposes of the analysis.

Table 1: Total number (%) of activities recorded from Standard Watches at each survey location across their respective survey periods, arranged in order of prevalence across the combined sites. The most frequently recorded activity at each survey location is highlighted dark grey, and the second most frequent is highlighted light grey. Note that row/column percentages have been rounded up to the nearest whole number. n is the total number of survey visits carried out at each locality.

Activity	Colne Point (n=3)	Old Hall Marshes (n=12)	Tollesbury Wick (n=8)	Total (n=23)
Large motorboat with inboard engine > 10m	0 (0%)	26 (30%)	1 (25%)	27 (28%)
Walking	2 (34%)	14 (17%)	1 (25%)	17 (18%)
Moderate – large sailing boat, not running motor	0 (0%)	14 (17%)	0 (0%)	14 (15%)
Rib or similar fast small boat	0 (0%)	13 (15%)	1 (25%)	14 (15%)
Small sailing boat (e.g. Laser / dinghy)	0 (0%)	10 (12%)	0 (0%)	10 (11%)
Dog walking	3 (50%)	1 (2%)	0 (0%)	4 (5%)
Canoe on water	0 (0%)	3 (4%)	0 (0%)	3 (4%)
Beaching of watercraft on shoreline	0 (0%)	1 (2%)	1 (25%)	2 (3%)
Birdwatching	1 (17%)	1 (2%)	0 (0%)	2 (3%)
Airborne	0 (0%)	2 (3%)	0 (0%)	2 (3%)
Person working on boat	0 (0%)	1 (2%)	0 (0%)	1 (2%)
Other	0 (0%)	1 (2%)	0 (0%)	1 (2%)
Total	6 (100%)	87 (100%)	4 (100%)	97 (100%)

3.3 Table 2 provides the rate of observation for Standard Watch activities adjusted for survey effort (i.e. the number of visits) at each survey location. The data indicate that the levels of activity recorded at all three survey locations was extremely low, with the majority of activity types recorded less than once per survey visit.

Table 2: Rate of observation of activities (total/n) recorded from Standard Watches at each survey location across their respective survey periods. N is the total number of survey visits carried out at each locality.

Activity	Colne Point (n=3)	Old Hall Marshes (n=12)	Tollesbury Wick (n=8)	Total (n=23)
Large motorboat with inboard engine > 10m	0	2.2	0.2	1.2
Walking	0.7	1.2	0.2	0.8
Moderate – large sailing boat, not running motor	0	1.2	0	0.7
Rib or similar fast small boat	0	1.1	0.2	0.7
Small sailing boat (e.g. Laser / dinghy)	0	0.9	0	0.5
Dog walking	1	0.1	0	0.2
Canoe on water	0	0.3	0	0.2
Beaching of watercraft on shoreline	0	0.1	0.2	0.1
Birdwatching	0.4	0.1	0	0.1
Airborne	0	0.2	0	0.1
Person working on boat	0	0.1	0	0.1
Other	0	0.1	0	0.1
Total	2	7.3	0.5	4.3

3.4 The majority (73%) of activity events across all three survey locations occurred on the water (see Figure 1), although this was due to the dominance of watercraft activities within the Old Hall Marshes dataset. All of the small number of activity events recorded at Colne Point occurred above the highwater mark, and the events at Tollesbury Wick were equally spread across the terrestrial, intertidal, and aquatic zones.

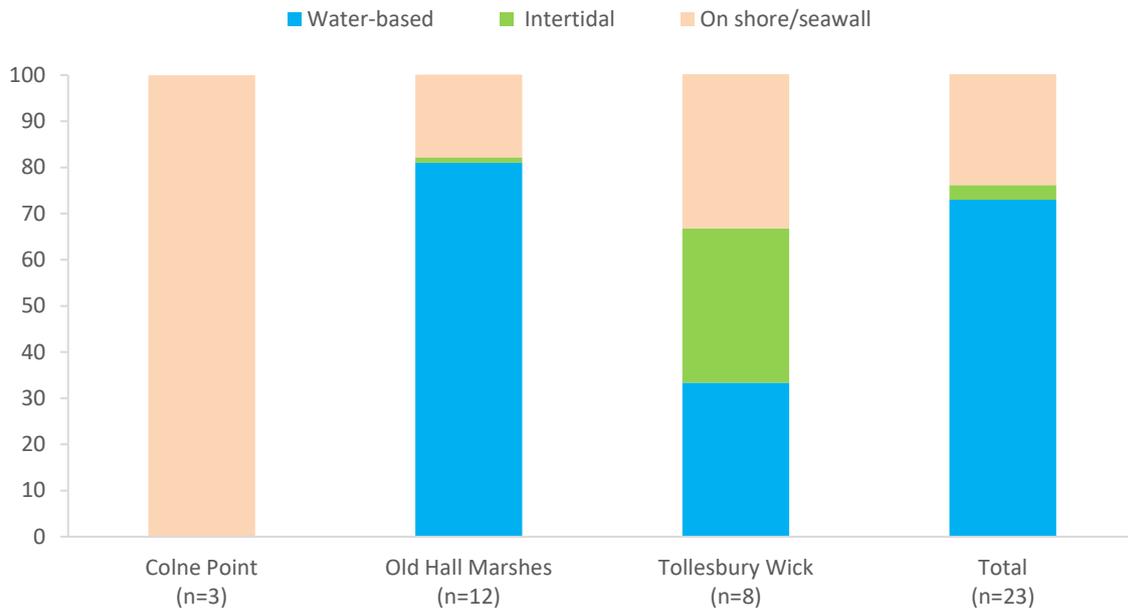


Figure 1: Distribution of observed activities across the coastal gradient, expressed as %. Note that single activity events could occur across multiple substrates. n is the number of survey visits at each locality.

Bird Counts

- 3.5 A total of 19 species, including five wader, three wildfowl, and two tern species, were recorded during the Standard Watches carried out at the three survey locations over the entire survey period (see Table 3). Small numbers of Ringed Plover and Oystercatcher were the only species recorded from Colne Point, and also the only wader species recorded from Tollesbury Wick. A greater variety of species overall were however recorded from the latter location, including a large count of dark-bellied Brent Geese and small numbers of seven other bird species.
- 3.6 The large maximum count of Ringed Plovers made from Tollesbury Wick comprised migrant birds on passage early in the season, rather than locally breeding individuals. Old Hall Marshes recorded the largest number of species (13) of all three survey locations, with small maximum counts of both Ringed Plover and Oystercatcher also made. The latter two species were the only ones depicted that were recorded from all three survey locations.

Table 3: Maximum counts of species (%) recorded from the survey locations during Standard Watches. The largest maximum species counts at each survey location are highlighted dark grey, and the second most frequent are highlighted light grey. Note that column percentages have been rounded up to the nearest whole number. n is the total number of survey visits carried out at each locality.

Species	Total no. locations recorded	Maximum single count		
		Colne Point (n=3)	Old Hall Marshes (n=12)	Tollesbury Wick (n=8)
Avocet	1	0 (0%)	1 (3%)	0 (0%)
Redshank	1	0 (0%)	4 (10%)	0 (0%)
Ringed Plover	3	6 (50%)	7 (16%)	40 (29%)
Oystercatcher	3	6 (50%)	11 (25%)	6 (5%)
Turnstone	1	0 (0%)	1 (3%)	0 (0%)
Dark-bellied Brent Goose	1	0 (0%)	0 (0%)	80 (58%)
Shelduck	2	0 (0%)	2 (5%)	2 (2%)
Mallard	1	0 (0%)	0 (0%)	3 (3%)
Great Crested Grebe	1	0 (0%)	2 (5%)	0 (0%)
Cormorant	1	0 (0%)	0 (0%)	1 (1%)
Little Egret	1	0 (0%)	2 (5%)	0 (0%)
Common Tern	2	0 (0%)	2 (5%)	1 (1%)
Little Tern	1	0 (0%)	0 (0%)	2 (2%)
Tern species	1	0 (0%)	0 (0%)	1 (1%)
Black-headed Gull	2	0 (0%)	8 (19%)	4 (3%)
Herring Gull	1	0 (0%)	2 (5%)	0 (0%)
Lesser Black-backed Gull	1	0 (0%)	1 (3%)	0 (0%)
Great Black-backed Gull	1	0 (0%)	1 (3%)	0 (0%)
Total		12 (100%)	12 (100%)	44 (100%)

Behavioural responses

- 3.7 Of the 97 individual activity events recorded across the three survey locations over the entire survey period, 38 (39%) comprised potential disturbance events. A potential disturbance event occurred when birds were present within the focal area during a standard watch, and an activity was carried out within 200m of them (or when an activity was carried out >200m distant but had an obvious disturbance effect).
- 3.8 Across all survey locations, the 38 potential disturbance events observed generated a total of 32 species-specific behavioural observations. Of these, 5

(16%) resulted in no visible change to the birds' behaviour or any direct response. 84% of potential disturbance events therefore generated a behavioural response, with 16% leading to either mobbing behaviour from the birds present or a major flight.

- 3.9 Using these figures, we can calculate that there were, on average, a single potential disturbance event/hour across all three survey locations over the entire survey period (see Table 4). These events caused, on average, a single species response 0.7 times/hour during the same period, with a flight response (short or major) occurring approximately once every three hours.

Table 4: Hourly rates of potential disturbance and singles species/flight responses at each of the survey locations across the entire survey period. The largest value in each column is highlighted dark grey, the second largest in light grey, and the lowest is boldly italicised.

Survey location	Potential disturbance events/hr of survey	Single species response/hr of survey	Flight response/hr of survey
Colne Point	1.2	0.6	0.6
Old Hall Marshes	1.3	1.0	0.3
Tollesbury Wick	0.3	0.1	0.1
Mean	1.0	0.7	0.3

Responses to activity types

- 3.10 The 32 species specific response observations are summarised by activity type in Figure 2, with activities organised in decreasing number of observations. Those activities with shorter green bars led to a higher proportion of disturbance responses, although the small sample size of many of the activities should nevertheless be noted.

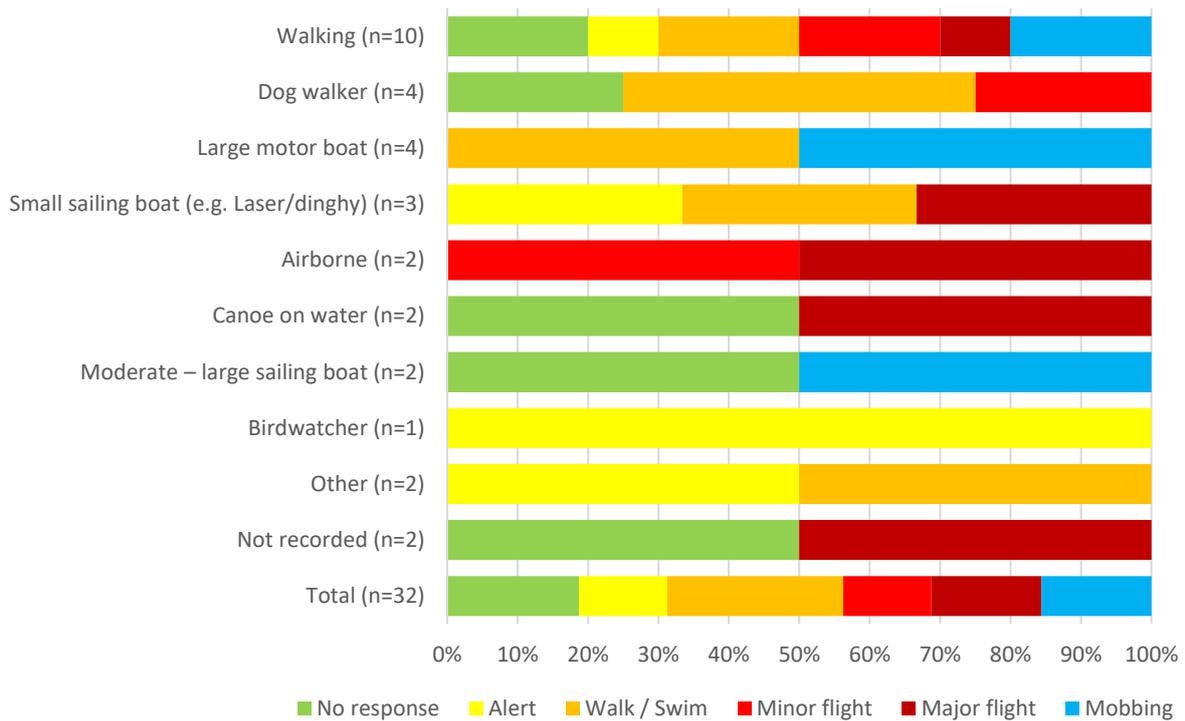


Figure 2: Responses of birds to differing activity types (all species across all locations), ordered by prevalence in dataset (with sample size per activity type identified in parentheses).

3.11 A large proportion of potential disturbance events across all activity types triggered a response from the birds present, with the most frequently recorded activity (walking) resulting in a response on 80% of occasions. The small dataset does not allow for a greater level of analyses across the other activity types. Nevertheless, it is evident that across all activity types, potential disturbance events led to an extreme response (birds taking flight or exhibiting energy demanding mobbing behaviour) in approximately 45% of cases.

3.12 It is however important to note that there are indications in the volunteer/RSPB collected dataset that those potential disturbance events resulting solely in no response from the birds present were not systematically recorded. This will therefore potentially artificially inflate the severity/frequency of responses to relevant activity types.

3.13 Table 5 provides a summary of observed flight events, including the total number of times that birds were flushed (i.e. combined short and major flights), stratified by activity type. The number of potential disturbance events indicates the frequency with which the activity was recorded. If all

activities were similar in the responses they caused, then both the percentages of times birds were flushed and the percentage of times a major flight was recorded would be expected to be broadly similar to the percentage of potential disturbance events.

3.14 Although comprising a small dataset, there are indications that both canoeists, dog walkers, and small sailing boats lead to a disproportionate flight response from the birds present. It should also be noted that the unrecorded activity identified in the dataset comprises a response by birds linked to either walking or dog walking activity (based upon the diary entry for that day).

Table 5: Summary of activity events resulting in potential disturbance events within recording arcs, the total number of birds flushed, and the frequency of any flush event (included combined totals for short and major flights). The largest and second largest % values per row are highlighted in dark and light grey, respectively (rows with equal percentages are not marked). Note that percentages have been rounded up to the nearest whole number).

Activity type	Total number (%) birds flushed	Number (%) of times major flight recorded	Total number (%) of times birds flushed	Total number (%) of potential disturbance events
Airborne	0 (0%)	0 (0%)	0 (0%)	N/A
Birdwatcher	0 (0%)	0 (0%)	0 (0%)	1 (3%)
Canoe on water	4 (9%)	0 (0%)	1 (12%)	2 (6%)
Dog walker	14 (30%)	2 (40%)	3 (34%)	4 (12%)
Large motorboat with inboard engine > 10m	0 (0%)	0 (0%)	0 (0%)	3 (9%)
Moderate – large sailing boat, not running motor	0 (0%)	0 (0%)	0 (0%)	2 (6%)
Other	0 (0%)	0 (0%)	0 (0%)	1 (3%)
Small sailing boat (e.g. Laser / dinghy)	7 (15%)	1 (20%)	1 (12%)	4 (12%)
Walking	6 (13%)	1 (20%)	3 (34%)	17 (50%)
Not recorded	17 (36%)	1 (20%)	1 (12%)	N/A
Total	48 (100%)	5 (100%)	9 (100%)	34 (100%)

Variation between sites

3.15 The number of potential disturbance events, and the resultant response of birds present, varied between survey location (see Figure 3). The single disturbance event noted at Tollesbury Wick resulted in a minor flight, whilst 75% of the responses to the four disturbance events recorded at Colne Point resulted in a major or minor flight. The responses observed within the larger Old Hall Marshes dataset were more varied, with an extreme response (birds being flushed or exhibiting mobbing behaviour) being recorded on >35% of occasions.

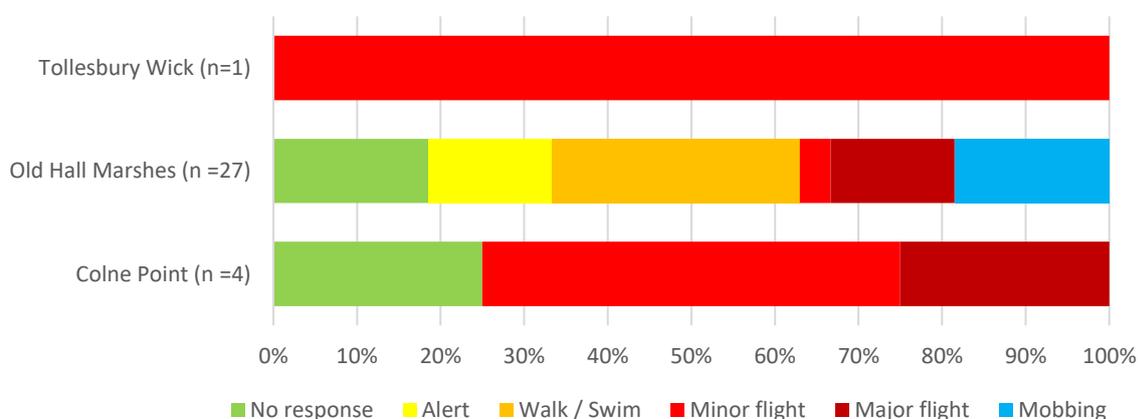


Figure 3: Responses of birds at each survey location (all species across all activity types). Sample sizes at each survey point are identified in parentheses.

3.16 The responses observed can be converted to the number of relevant events per hour of survey (see Table 6). The results suggest that a flight response (major or minor) occurs at Colne Point approximately once every 90 minutes, whilst a flight response (major or minor) occurs approximately once every four hours at Old Hall Marshes. Limited responses were observed at Tollesbury Wick.

Table 6: Responses of birds per hour of survey at each survey location (all species across all activity types).

Survey location	No response	Alert	Walk/ Swim	Mobbing	Short flight	Major flight
Colne Point	0.2	0	0	0	0.39	0.2
Old Hall Marshes	0.22	0.18	0.36	0.22	0.05	0.18
Tollesbury Wick	0	0	0	0	0.09	0

Response by species

3.17 Figure 4 summarises the proportional response by species across the three survey locations, with responses only observed/recorded from Ringed Plover and Oystercatcher. Ringed Plover were less liable to exhibit a behavioural response than Oystercatcher, with the former showing no response on approximately half of occasions. Of the responses observed for Ringed Plover, fewer than 20% comprised an extreme behavioural response (i.e. flushing or mobbing). Oystercatcher showed a behavioural response to all relevant disturbance events.



Figure 4: Response to disturbance events by individual species across all survey locations (sample sizes are provided in parentheses).

Distances displaced and time lost

3.18 The distance that the birds were displaced after a flush or mobbing event (i.e. moved away from their original position) was estimated for 6 disturbance event observations, with the mean displacement distance across all three survey locations being 59m (see Table 7). The single observed flush of Ringed Plover comprised the largest observed displacement (150m), with all other observed displacements being <100m. The very small sample size precludes any more detailed analyses.

Table 7: Distance that birds were displaced during an extreme behavioural response (flush or mobbing event), across all three survey locations stratified by activity type and species.

Activity	Species	Response type	Distance displaced (m)		
			Mean	Min	Max
Birdwatcher (=1)	Oystercatcher	Mobbing	20	n/a	n/a
Small sailing boat (e.g. Laser / dinghy) (n=1)	Ringed Plover	Major flight	150	n/a	n/a
Walking (n=4)	Oystercatcher	Mobbing/Short flight/Major flight	45	20	60
Total			59	20	150

3.19 Difficulties associated with the non-return of flushed birds, and in identifying those individual returning birds/flocks that did, means that establishing the amount of time lost to birds by a major flight is not straightforward. This is further compounded by the small dataset. Nevertheless, it was possible to record the amount of time taken for normal behaviour to resume for birds identified during 7 separate extreme behavioural responses (see Table 8). This ranged from 30 seconds to 5 minutes, although it is not possible to infer any further due to the small sample size.

Table 8: Time taken to resume previous behaviour following a flush or mobbing event, across all three survey locations stratified by activity type and species.

Activity	Species	Response type	Time taken to resume previous behaviour (secs)		
			Mean	Min	Max
Air-borne (n=1)	Oystercatcher	Mobbing	120	n/a	n/a
Large motorboat with inboard engine > 10m (n=1)	Oystercatcher	Mobbing	60	n/a	n/a
Moderate - large sailing boat, not running motor (n=1)	Oystercatcher	Mobbing	120	n/a	n/a
Small sailing boat (e.g. Laser / dinghy) (n=2)	Ringed Plover	Major flight	210	120	300
Walking (n=2)	Oystercatcher	Mobbing/Short flight	45	30	60
Total			125	30	300

Camera trap monitoring

Activities recorded

3.20 Camera traps recorded a total of 1,042 activity events across the three survey locations during their respective deployment periods, although only 26 of these were recorded from Tollesbury Wick and 6 from Old Hall Marshes. In order to account for survey effort (including period of deployment and number of cameras at each survey location) these total numbers have been converted to events per daylight hour to allow direct comparison of encounter rates (see Table 9).

Table 9: Total number of activity events and rate of observation per daylight hour of recording from camera traps at each of the three survey locations. The largest and second largest observation rates per column are highlighted in dark and light grey, respectively. Note that two cameras were deployed at Old Hall Marshes.

Activity	Colne Point (1,032hrs)	Old Hall Marshes (3,936hrs)	Tollesbury Wick (1,896hrs)	Total (6,864hrs)
Walking	692 (0.68)	2 (0.01)	5 (0.01)	699 (0.11)
Birdwatcher	127 (0.13)	0 (0)	0 (0)	127 (0.02)
Dog walker	113 (0.11)	0 (0)	2 (0.01)	115 (0.02)
Cycling	27 (0.03)	0 (0)	0 (0)	27 (0.01)
Canoe on water	24 (0.03)	0 (0)	1 (0.01)	25 (0.01)
Jogger	14 (0.02)	0 (0)	0 (0)	14 (0.01)
Small sailing boat (e.g. Laser / dinghy)	2 (0.01)	1 (0.01)	3 (0.01)	6 (0.01)
Beaching of craft on shoreline	1 (0.01)	3 (0.01)	0 (0)	4 (0.01)
Person working on boat	4 (0.01)	0 (0)	0 (0)	4 (0.01)
Rib or similar fast small boat	0 (0)	0 (0)	4 (0.01)	4 (0.01)
Kids playing	0 (0)	0 (0)	2 (0.01)	2 (0.01)
Kitesurfer on water	2 (0.01)	0 (0)	0 (0)	2 (0.01)
Moderate – large sailing boat, not running motor	2 (0.01)	0 (0)	0 (0)	2 (0.01)
Rowing boat	2 (0.01)	0 (0)	0 (0)	2 (0.01)
Other	0 (0)	0 (0)	2 (0.01)	2 (0.01)
Total	1,010 (0.98)	6 (0.01)	26 (0.02)	1,042 (0.16)

- 3.21 It should be noted that an extremely small number of potential recreation activities were observed at Colne Point after dark, such as the observation of head torches of assumed walkers/dog walkers. The small number of observations (<5) have however still been included in Table 9.
- 3.22 Walking was the most frequently recorded activity type recorded from the cameras overall, with approximately one walkers/walking group observed per nine hours of observation. There was however much disparity between the survey locations, with single walkers/walking groups recorded each hour and a half of daylight recording at Colne Point, in comparison to once every 100 hours (i.e. less than once a week) at both Old Hall Marshes and Tollesbury Wick.
- 3.23 In addition to walkers, the Colne Point camera dataset largely comprised birdwatchers (at a rate of 1 observation every 7 to 8 hours) and dog walkers (at a rate of 1 observation every 8 to 9 hours). All other activity types at Colne Point were recorded at low levels (less than one observation for every 33 hours (i.e. 2.5 days) of daylight recording). The few camera observations made at Old Hall Marshes solely comprised small watercraft, beaching activity, and walking, and all at extremely low frequencies (less than once per week of daylight hours recording). Tollesbury Wick recorded a slightly larger range of activities, although still at a rate of less than once a week, including small watercraft, dog walkers, and children playing.
- 3.24 Furthermore, Tollesbury Wick was the only location where predator activity was recorded from the camera (not depicted in Table 9), comprising the most frequently observed activity type in that site's dataset (with seven records overall). This largely comprised nocturnal recordings of foxes, although diurnal observations were also made of corvids and large gulls.
- 3.25 A variety of example images collected by the camera traps at the three study locations are provided in Figure 5. It should be noted that the sample images provided by the RSPB did not completely tie in with the information entered in the digital logbooks by RSPB staff/volunteers (e.g. the presence of cyclists amongst the Tollesbury Wick photographs, an activity absent from the digitised dataset). It should therefore be recognised that a small number of activities recorded by the cameras may not have been recorded, and subsequently displayed in Table 9.

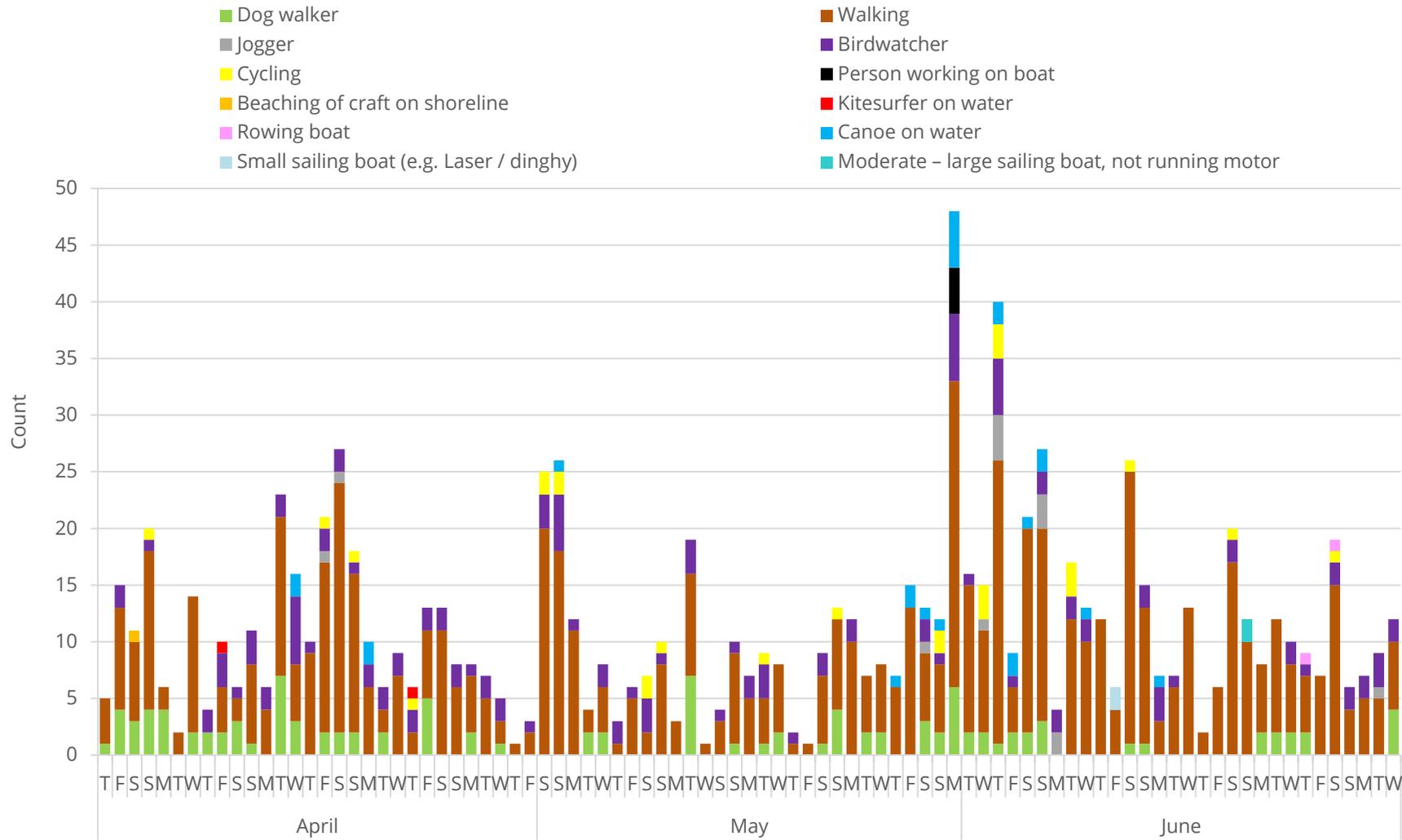


Figure 5: Representative examples of camera trap images and activities recorded from the three study locations: (a-f from Tollesbury Wick, g from Old Hall Marshes, and h from Colne Point): (a) Ringed Plover; (b) Oystercatcher; (c) child playing; (d) dog off the lead; (e) RIB; (f) fox; (g) beaching watercraft; and (h) walkers.

Temporal variation in camera trap recordings

- 3.26 Figure 6 depicts the temporal spread of camera trap recordings in the large Colne Point dataset. The prevalence of walkers in the dataset across the entire recording period is clear, alongside lower levels of bird watching and dog walking. Boat-based activities were predominantly recorded from late May and into June, whereas observations of kitesurfers were only made in April. In most weeks there are obvious peaks in the number of observations made at weekends, with an extreme peak also noted on the Monday of the May Bank Holiday weekend.

Essex Disturbance Study 2021



4. Discussion

- 4.1 RSPB data show that small numbers of breeding waders were present at all three study locations in 2021, although Ringed Plovers only managed to fledge young (from a single pair) at Old Hall Marshes. Five pairs of Oystercatchers managed to successfully fledge three chicks at the same locality, whereas a single pair failed at Tollesbury Wick (potentially due to fox predation). Breeding success was apparently mixed at Colne Point, and it is not clear how many young hatched or fledged.
- 4.2 The Ringed Plovers observed during the Standard Watch surveys were much less likely than Oystercatchers to exhibit an extreme response, almost certainly due to the differences in the predator avoidance behaviour of the two species (crypsis versus extreme advertising behaviour). Nevertheless, extreme behavioural responses (flushing or mobbing) were incited from the birds present on >40% of occasions when disturbance events occurred.
- 4.3 The recreation activity data collected by the RSPB and their volunteer team in 2021 is invaluable in providing context for the breeding success of wader species at the study locations. It also provides a baseline for our overall understanding of recreational disturbance levels, and its impact upon the birds present. The Standard Watch data has provided detailed information about the prevalence of particular activities and the severity of the response they incite in the birds present. Furthermore, the camera trap data has provided information on the frequencies of occurrence of recreational activity in the absence of surveyors and allowed us to identify potential seasonality and weekly temporal patterns in visitor access.
- 4.4 The Standard Watch surveys recorded relatively low levels of activity overall, with that recorded primarily observed at Old Hall Marshes (a locality with very few observations of recreational activity/disturbance within the camera trap dataset). Conversely, both Colne Point and Tollesbury Wick Standard Watch surveys recorded very little recreational activity, but the camera trap dataset from the first locality dwarfs that from the other two study sites. It is not clear whether the disparities seen between the Standard Watch and camera trap datasets are due to differing survey effort between sites/survey types, or due to the positioning of the Colne Point camera along a busy footpath some distance from the beach.

- 4.5 The Standard Watch data indicates that watercraft comprise the dominant activity at both Old Hall Marshes and Tollesbury Wick, whereas terrestrial activities (predominantly walking) are prevalent at Colne Point. This is confirmed by the camera trap data, although it is not clear how much of the foot traffic recorded at Colne Point translates into access to wader breeding sites.
- 4.6 Very few of the interactions observed between the birds present and nearby recreational activity resulted in no response, although it is unclear from the data whether interactions resulting solely in such a response were systematically recorded. It is therefore difficult to accurately identify the relative proportion of response/no response engendered by specific activity types (with this difficulty further compounded by the low survey effort).
- 4.7 Nevertheless, the data suggests that although recreational activity is relatively infrequently recorded in proximity to key breeding areas, when it does occur it can lead to a high level of extreme behavioural responses. Although relatively poorly represented in both datasets, both dog walkers and canoeists appeared to flush a proportionately larger number of birds and/or more frequently.

Recommendations

- 4.8 The data collected by the RSPB and their volunteer team in 2021 provides a baseline for future monitoring. The use of camera traps is inexpensive and requires infrequent input from site staff; as such they can generate large amounts of data efficiently. The positioning of cameras is however key in order to make a defensible link between levels of site access and any impact upon breeding success.
- 4.9 The detailed information provided by the Standard Watch surveys allows for such a direct causal link to be made and assists in identifying key activity types and periods which can be subsequently targeted through outreach, information materials, etc to mitigate any impacts. Future Standard watch surveys would also build upon the existing baseline detailed in this report. However, in order to maximise the value of such a dataset the following prescriptions would be needed:
- A greater, more even, survey effort across the three study locations, including targeting of weekends in particular; and,
 - Accurate recording of 'no response' interactions to inform our understanding of the impacts of specific activity types.

- 4.10 While potentially making the standard watches more complex, they could be adapted to focus solely on breeding birds and to record where possible for each observation the breeding stage of the birds (i.e. whether chicks or eggs) and more detail on the impact – i.e. adult leaves nest, chicks running for cover, chicks lying down and stopping feeding, etc).
- 4.11 It is recommended that both camera trapping and Standard Watch surveys continue at Old Hall Marshes and Colne Point, with camera traps solely deployed at Tollesbury Wick due to the low level of recreational activity recorded there in 2021 via both survey types.

References

- Austin, G.E., Rehfisch, M.M., 2005. Shifting nonbreeding distributions of migratory fauna in relation to climatic change. *Global Change Biology* 11, 31–38.
<https://doi.org/doi:10.1111/j.1529-8817.2003.00876.x>
- Eaton, M., Aebischer, N.J., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D., Gregory, R., 2015. Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. *British Birds* 108, 708–746.
- Liley, D., Fearnley, H., 2012. Poole Harbour Disturbance Study. *Footprint Ecology / Natural England*.
- Liley, D., Sutherland, W.J., 2007. Predicting the population consequences of human disturbance for Ringed Plovers *Charadrius hiaticula*: a game theory approach. *Ibis* 149, 82–94. <https://doi.org/doi:10.1111/j.1474-919X.2007.00664.x>
- Macdonald, M.A., Bolton, M., 2008. Predation on wader nests in Europe. *Ibis* 150, 54–73.
<https://doi.org/10.1111/j.1474-919X.2008.00869.x>
- Maclean, I.M.D., Austin, G.E., Rehfisch, M.M., Blew, J., Crowe, O., Delany, S., Devos, K., Deceuninck, B., Günther, K., Laursen, K., Van Roomen, M., Wahl, J., 2008. Climate change causes rapid changes in the distribution and site abundance of birds in winter. *Global Change Biology* 14, 2489–2500. <https://doi.org/10.1111/j.1365-2486.2008.01666.x>
- Morrison, S., 2019. Wader and Seafowl Roost Survey of Poole Harbour, Dorset - Winter 2018/19. unpublished report for the Poole Harbour Commissioners.

- O'Neill, R., 2019. Monitor of Engagement with the Natural Environment – The national survey on people and the natural environment. Headline report 2019 (NECR No. 275). Natural England and the Office for National Statistics.
- Pienkowski, M.W., 1984. Behaviour of young Ringed Plovers *Charadrius hiaticula* and its relationship to growth and survival to reproductive age. *Ibis* 126, 133–155.
- Verhulst, S., Oosterbeek, K., Ens, B.J., 2001. Experimental evidence for effects of human disturbance on foraging and parental care in oystercatchers. *Biol. Conserv.* 101, 375–380.
- Weston, M.A., Elgar, M.A., 2005. Disturbance to brood-rearing Hooded Plover *Thinornis rubricollis*: responses and consequences. *Bird Conservation International* 15, 193–209. <https://doi.org/10.1017/S0959270905000158>

Appendix 1: Activity codes

Note that few of the activities listed were ultimately recorded during the study.

Activity type	Code	Activity type	Code
Airborne	AB	Paddleboard	Pb
Bait digger	BD	Person accessing boat or water	BW
Bait harvesting or similar from boat	BDD	Person working on boat	B
Birdwatching	BR	Photography	Ph
Canoe on water	Ca	Picnic	P
Cockle-raking	CR	Predator	PR
Cycling	C	Pump scoop dredging	PSD
Dog walking	DW	Resident activity in nearby garden	Rs
Fishing (from shore)	F	RIB or similar fast small boat	SMB
Horse riding	HR	Rollerskating/skateboarding	RSK
Jet ski on water	JS	Rowing boat	RB
Jogging (without dogs)	J	Sitting on beach/bench	Sit
Kids playing	KP	Swimming	Sw
Kitesurfer on water	KS	Train	Tr
Large motorboat with inboard engine > 10m	LMb	Unaccompanied dog off lead	DX
Litter picking	LP	Walking/rambling (without dogs)	W
Metal detecting	MD	Wildfowling	WF
Mobility scooter	Msc	Windsurfer on water	WS
Moderate to large sailing boat, not running motor	LS	Other	O
Motor vehicle	MV		

Appendix 2: Response codes

Response	Description	Code
No response	No change in behaviour/position	NR
Alert	Heads up/responsive, but no change in birds' position	A
Walk/Swim	Birds walked/swam a short distance prior to resuming previous behaviour	W
Short flight	Birds flew a short distance (<50m) and resumed previous behaviour in general area	f
Major flight	Birds took flight and flew >50m	F

Appendix 3: Camera trap fields of view



Figure A3.1: Colne Point camera trap field of view



Figure A3.2a: Old Hall Marshes camera trap field of view (camera 1)



Figure A3.2b: Old Hall Marshes camera trap field of view (camera 2)



Figure A3.3: Tollesbury Wick camera trap field of view