

Non-Breeding Bird Survey of the South Tyneside, Sunderland and County Durham Coast 2019/2020

Work undertaken by Whittingham Ecology and Associates

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Executive Summary

- This report outlines the background, methodology and results from surveys of key bird species conducted along the Northumbria and Durham coasts, as well as inland stretches of the rivers Tyne and Wear, between October 2019 and March 2020.
- Surveys aimed to record the numbers and distribution of wading birds, with a particular focus on four species notified under the SPA/SSSI designations: turnstone, purple sandpiper, sanderling and knot. A number of other species were included in the survey work namely: redshank, cormorant, shelduck, teal and shoveler. In addition, any sizeable wader flocks/roosts (e.g. above 30 individuals) were also noted
- Surveys also recorded levels of human activity, and the degree to which these activities constituted potential and actual sources of disturbance for wading birds.
- Results are presented in tables and maps to show the populations and distribution of key bird species, and the distribution and extent of human activities and disturbance events.
- We were able to estimate a snapshot of the maximum number of individuals from two key species across our coastal study area that overlapped with the Northumbria Coast SPA (Tyne to Crimdon). When the Northumbria Coast SPA was designated the numbers of turnstones and purple sandpipers were 1739 and 787 respectively. We found that the maximum number from any one survey across the winter of 2019/20 was 229 turnstones and 32 purple sandpipers (our coastal survey areas covered 25% of the SPA and so we were able to multiply our counts to estimate densities across the entire Northumbria Coast SPA).
- Our work and that of previous surveys all suggested that purple sandpiper numbers declined more in the Northumbria Coast SPA as a whole since 2000 [this study (-84%); BTO 2018 (-69%), Ecology Consulting (-91%) and Arcus (-55%)] than across the UK as a whole (average decline in from 1999/2000 to 2018/19 was 36% for purple sandpipers). Although counts from Arcus (2015) suggested an increase in turnstone numbers since the designation of the Northumbria Coast SPA this was out of line with the other three studies of Turnstone numbers. Across the Northumbria Coast SPA as a whole since 2000 the four studies showed: this study (-48%); BTO 2018 (-64%); Ecology Consulting (-60%); and Arcus (+126%). These compared with an average decline across the UK as a whole from 1999/2000 to 2018/19 of 35%.
- Suggestions for future work are also briefly discussed including the role of offshore refuges as a potential driver of steeper declines of turnstones and purple sandpipers in the north-east of England than across the wider UK.

Introduction

Background to this contract

Sunderland City Council, South Tyneside Council and Durham County Council requested wintering bird activity and disturbance surveys along the south Tyne and Wear and County Durham sections of the Northumbria Coast Special Protection Area (SPA) in 2019-2020. Whittingham Ecology was awarded the contract and the work undertaken is outlined in this report.

The surveys and resulting analysis produced by this report will inform monitoring programmes and measures to conserve birds of conservation concern, and emerging and future plans and projects within and across Local Authority areas.

The project brief was to carry out bird surveys of the coast focusing primarily on species associated with the Northumbria Coast SPA and Ramsar Site, and Durham Coast Site of Special Scientific Interest (SSSI).

Previous surveys along this area of the coastline have been undertaken in five previous winters: in 2011-12 (Cadwallender Consultancy 2012); in 2012-13 (Cadwallender Consultancy 2013); in 2014-15 (Arcus 2015); 2015-2016 River Wear (BSG 2016a); 2015-2016 Sunderland and South Tyneside (BSG 2016b); 2015-2016 (Ecology Consulting 2016); 2017-2018 (Cadwallender Consultancy 2018). The information used in these previous studies was used to compare with our findings. The survey has been undertaken using an approach that will allow comparisons to be made with earlier surveys that overlap with the same area.

Site description

As detailed in BSG (2016) the survey area (the Site) comprises a wide range of habitats including tidal beaches, rocky foreshore, coastal cliffs, amenity grassland, municipal areas, piers, industrial areas (including docks) and farmland.

Significant areas of the Site are subject to statutory designation in recognition of the populations of wintering and summer breeding bird species they support. This includes elements of the Northumbria Coast SPA and RAMSAR site. Species cited within the Durham Coast Site of Special Scientific Interest (SSSI) were also considered to provide a wider context for wading bird activity.

Key aims of report

To provide a comprehensive written report that includes details of methodologies used to collect bird and disturbance data, a clear presentation of the results, analysis of the results, followed by conclusions and recommendations. In particular reference to, and comparison with, results from preceding studies and regional and national bird populations and trends are included. The report also includes an assessment of impacts on the priority bird species.

Methods

Survey area

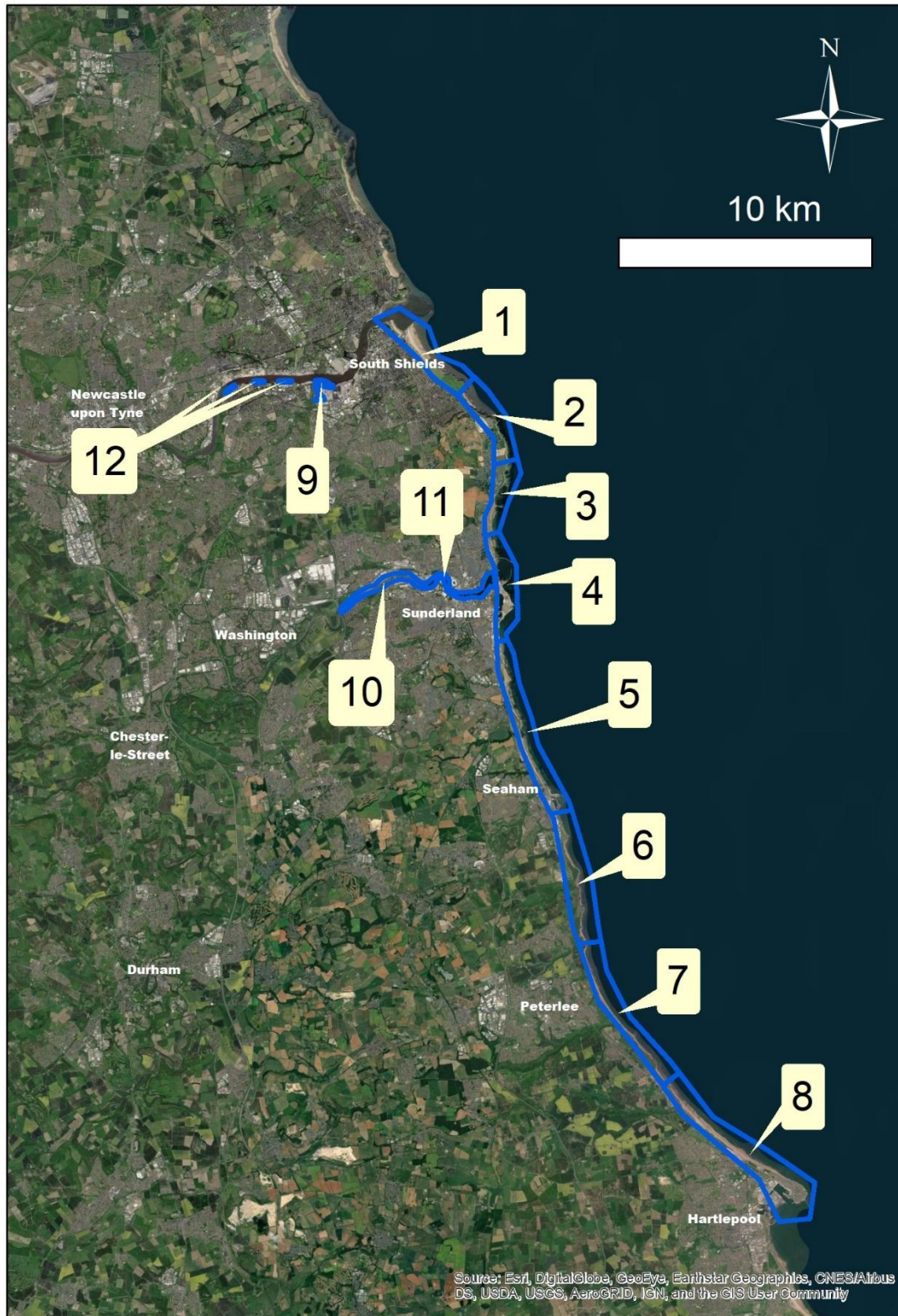
Diurnal survey areas

Eleven survey areas (named 1-11 in Table 1 and Figure 1) were surveyed on two days each month from October 2019 to March 2020. For each of survey area 1-11, one surveyor was used on any one day, thus 11 surveyors simultaneously covered all parts of the study area on any given day. Survey area 12 was included in the package of work at a later stage and was surveyed on different days to the other survey areas given constraints on access to the land used to survey for this area. We have included the results of survey area 12 in this report for completeness, but the different timing of the surveys here should be taken into consideration when interpreting the results of surveys. A map showing the location of the 12 survey areas is presented in Figure 1 below.

Table 1. Twelve survey areas used for diurnal surveys between October 2019 and March 2020 (inclusive). Note we have used the same survey areas as set out in the original tender document to aid with comparisons from previous surveys. Survey area 12 was added to the project later and was counted on different days than the other eleven areas.

Sector name from tender document	Survey area number and name for our project
Survey Area 1: Mouth of River Tyne (south side) and Tyne South Pier to Marsden Rock	Survey Area 1: South Shields to Marsden
Survey Area 2: Marsden Rock to Souter Point	Survey Area 2: Marsden to Whitburn
Survey Area 3: Souter Point to Parson's Rock	Survey Area 3: Whitburn to Sunderland
Survey Area 4: Parson's Rock to Hendon	Survey Area 4: Sunderland Docks
Survey Area 5: Hendon to Seaham	Survey Area 5: Hendon to Seaham
Sections 3, 4 and 5 from Durham Coastal map	Survey Area 6: Seaham to Easington Colliery
Sections 6, 7 and 8 from Durham Coastal map	Survey Area 7: Easington Colliery to Crimdon
Section 9 from Durham Coastal map and Survey Area 11	Survey Area 8: Crimdon to Hartlepool
River Tyne-River Don confluence	Survey Area 9: Tyne Docks
Sectors 1 and 2 - shown in Figs 2 and 3 in BSG report for River Wear (Sunderland and South Tyneside 2015-2016 Non-breeding bird survey report)	Survey Area 10: River Wear West
Sector 3 - shown in Fig 4 in BSG report for River Wear (Sunderland and South Tyneside 2015-2016 Non-breeding bird survey report) and remainder of area from eastward end of sector 3 to coast not including areas covered by the Sunderland Docks (area 4 in our survey).	Survey Area 11: River Wear East
New area not surveyed in previous reports. Refers to a stretch of the River Tyne incorporating three separate survey areas (see Figure 1).	Survey Area 12: River Tyne

Figure 1. Map showing the location of the 12 sectors surveyed as part of this project. Note: survey area 12 was divided into three non-contiguous sections of the south bank of the River Tyne.



Survey team

The vast majority of surveyors have been birdwatchers for more than 10 years and all are experienced birdwatchers in the northeast. Most of them have studied ecology/zoology to at least masters level or are well qualified to carry out this work through long-term engagement in bird-related work.

Survey dates

Survey dates were designed to cover both weekends (when disturbance from people was predicted to be higher) and weekdays. The dates chosen were constrained by tide times because each survey needed to fall 3 hours either side of high or low tide. During the winter only a subset of days were available because sometimes those time periods overlapped with hours of darkness. Therefore, the dates selected was a practical attempt to cover both weekends and weekdays across the winter when all 11 surveyors could simultaneously visit on the same day. Six surveys took place at the weekend and six were planned for weekdays (see Table 2a). Unfortunately due to travel restrictions imposed by the COVID-19 outbreak the final survey on 20th March 2020 was unable to go ahead.

Sector 12 was surveyed from November through to March (see Table 2b). Unfortunately, due to travel restrictions imposed by the COVID-19 outbreak, the final high tide survey in March 2020 was unable to go ahead.

Table 2a. Survey dates for survey areas 1-11. Two surveys per month (one at low tide and the other at high tide) were carried out on the dates shown below. The final survey was scheduled for 20th March 2020 (shown in red) but was unable to go ahead due to restrictions on access imposed by the UK Government due to COVID19. Thus only 11 of the 12 planned surveys were completed.

	Low and High Tide Survey Dates											
	2019						2020					
	October		November		December		January		February		March	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Sunday			17/11/19		1/12/19							
Monday											2/03/20	
Tuesday							21/01/20					
Wednesday												
Thursday							30/01/20			20/02/20		
Friday		25/10/19										20/03/20
Saturday	19/10/19			23/11/19		7/12/19			29/02/20			

Table 2b. Survey dates and times for survey area 12 from November to March. Note the March high tide visit was cancelled due to restrictions on access due to COVID-19.

Survey Type	Date	Tide Time
High Tide	22.11.2019	11:47
Low Tide	26.11.2019	09:10
Low Tide	03.12.2019	16:08
High Tide	10.12.2019	17:22
High Tide	09.01.2020	14:20
Low Tide	28.01.2020	11:30
High Tide	19.02.2020	12:37
Low Tide	28.02.2020	12:15
Low Tide	11.03.2020	10:42

Bird counts (low and high tide counts)

Counts were made using the ‘look-see’ methodology outlined in Bibby et al. (2000) whereby an observer familiar with the species surveyed the whole of a predefined area (provided to surveyors as survey areas 1-12 – each surveyor being responsible for one area). The areas to be surveyed were shorelines, including rocky shores, sand and man-made areas (e.g. piers/jetties), as well as areas next to the coast (e.g. grass fields on top of the cliffs) - some areas contained inland areas that were outlined in the maps for each sector. Observations were made from a distance (to avoid flushing birds) and no physical access to rocky shores or jetties was required.

Each observer was provided with a map of their survey area (both satellite and ordnance survey) along with health and safety instructions bespoke to their survey area. Each of the twelve survey areas were surveyed for six hours, covering the period three hours before and after high-/low-tide. Visits focused on high or low tide were made on separate days (therefore a total of 12 hours observation were made to each survey area in each month from October to March) (see Tables 2a and 2b for details).

Surveyors covered each survey area following WeBS (Wetland Bird Survey) methodology (as appropriate to the site). Weather conditions were recorded at hourly intervals in all survey areas. Bird locations were plotted on large-scale maps, and behaviour (e.g. feeding/roosting) noted, allowing changes in distribution and behaviour to be recorded over the course of the tidal cycle. Surveys were carried out across the diurnal period, on weekdays and at weekends so that a representative data sample was collected (see Tables 2a and 2b). Surveys covered a range of tides (neap/spring) to ensure variation in coverage of roosting and feeding locations across different tidal states, and to account for changes in bird abundance and site use.

A separate form was used to collect data on birds and on disturbance. Each surveyor spent 20 minutes carrying out counts from points with a good vantage over the area to collect data on birds and/or disturbance. Surveyors then moved on to other good vantage points to collect data but ad-hoc records of birds and disturbance were also recorded when travelling (i.e. walking) between areas. Breaks between recording were encouraged so that surveyors did not undertake more than two consecutive counts (i.e. no more than 40 minutes of continuous recording to avoid count fatigue and loss of concentration).

Each area was systematically surveyed to avoid double-counting and ensure complete coverage. Every effort was made to avoid double-counting of birds re-locating within a site. Observations were carried out from a number of viewpoints to observe all areas. A counting strategy for each area was developed (by individual surveyors) and routes and vantage points established (avoiding any health and safety risks) to ensure complete coverage, whilst avoiding significant disturbance to birds.

On each visit the number and activity of each of the key species (see below) in each survey area was recorded. Birds flying over a site were not recorded. Maps were marked with an identification number that was then cross referenced to the recording form. For example, if the first birds recorded were 2 turnstones then a '1' was written on the map where the birds were located and then the recording sheet was filled in using the number '1' in the map reference column and then filling in the other details. Surveyors also marked on the maps any areas of the shoreline which were not visible to them when undertaking the surveys. Full details of any roost sites were also recorded. This included the number of each species using the roost, together with the location of the roost and a summary of the roosting habitat. For each visit to a survey area, the following was also recorded: date; start and finish times; time of high-/low-tide; hourly weather conditions (wind speed and direction, cloud cover, precipitation, temperature); the route used for the count and any vantage point locations. The survey forms used for both low and high tide are presented in Appendix 1a and 1b.

Nocturnal surveys

Nocturnal surveys were conducted at five sites along the coast between October 2019 and March 2020. Sites were chosen with local knowledge of the surveyors, which would be most suitable or likely to be attractive to roosting waders during darkness. These were:

- Steetley Pier. North of Hartlepool, and beach under pier (NZ 505 356). Within survey area 8.
- Hartlepool Marina. Artificial islands and beach within marina (NZ 519 328). Just outside the southern boundary of survey area 8.
- Whitburn Fields. Horse paddock, agricultural field and cliff-top grassland close to Whitburn (NZ 412 629). On the boundary of survey areas 2 & 3.
- Seaham Business Park. Car park and grassland close to Spectrum Business Park, south of Seaham (NZ 436 478). Within survey area 6.
- Blackhall Rocks Fields. Cliff-top grassland and agricultural fields, Station Road, Blackhall Rocks (NZ 470 390). Within survey area 7.

Sites were visited during darkness hours twice per month (once at high tide, once at low tide) between October 2019 and February 2020, with a repeat visit during March 2020 to one of the sites. Surveys lasted 3 hours and began 1.5 hours before the high/low tide, and were conducted entirely during darkness hours. Species were recorded by sight if possible, or by sound whereby a minimum number of individuals present was recorded. The surveyors covering these areas worked as a pair. At least one was an experienced bird surveyor (in all cases this was Richard Francksen) with the second person present for Health and Safety reasons (working at night).

Species included in the surveys

Key species present in the non-breeding season, as advised by Sunderland City Council and partners, were supplied to us prior to the onset of the work. These species included the following: Northumbria Coast SPA qualifying species present in the non-breeding season (**turnstone and purple sandpiper**); and Durham Coast SSSI notified bird species associated with the winter (**purple sandpiper, sanderling, turnstone and knot**). In addition, the following species were noted: **redshank, cormorant, shelduck, teal and shoveler**. Any sizeable wader flocks/roosts (e.g. above 30 individuals) were also noted.

Table 3. Key bird species recorded during surveys and their conservation status and relevant area designations.

Common name	Scientific name	Relevant designations	BoCC status*
Turnstone	<i>Arenaria interpres</i>	Northumbria Coast SPA (non-breeding), Durham Coast SSSI (winter)	Amber
Purple sandpiper	<i>Calidris maritima</i>	Northumbria Coast SPA (non-breeding), Durham Coast SSSI (winter)	Amber
Sanderling	<i>Calidris alba</i>	Durham Coast SSSI (winter)	Amber
Knot	<i>Calidris canutus</i>	Durham Coast SSSI (winter), Teesmouth & Cleveland Coast SPA (non-breeding)	Amber
Redshank	<i>Tringa totanus</i>	Teesmouth & Cleveland Coast SPA (passage)	Amber
Cormorant	<i>Phalacrocorax carbo</i>		Green
Shelduck	<i>Tadorna tadorna</i>		Amber
Teal	<i>Anas crecca</i>		Amber
Shoveler	<i>Spatula clypeata</i>		Amber

*Birds of Conservation Concern (Eaton *et al.* 2015)

Disturbance Surveys

Methods used to log 'actual' and 'potential' disturbance were based on the methods described by Ravenscroft *et al.* (2007) and other subsequent surveys (e.g. Arcus 2015). Actual disturbance includes any disturbance event, natural or human related, that caused an observed reaction from waders present within the survey area. Potential disturbance refers to any event that could disturb

birds but where the event did not cause actual disturbance at the time (e.g. if birds were not obviously within the vicinity of the event).

Another consideration was the potential displacement of roosting/feeding birds as a result of potential disturbance activities. This refers to repeated events in an area which may be causing displacement of birds (e.g. a continual presence of people on a beach may be preventing birds from feeding in that area without causing any directly observable disturbance). A basic assessment of this was made by recording all disturbance events occurring around potential wader habitat within the survey areas, whether birds were nearby, or not. Comparisons were made between busier and quiet times at the same locations within survey areas (i.e. at weekends and during weekdays). The location of each disturbance event was marked as accurately as possible onto a large-scale map using a unique identification number which cross-referenced to a disturbance log sheet which was based on the recording form used by Arcus in their 2014-15 report (see Appendix 1c). The log sheet detailed the time and type of disturbance and, where applicable, reaction, number and species of bird present and their behaviour at the time of the event (i.e. feeding or roosting). The reaction of any birds in the vicinity of the disturbance event was recorded as follows:

- N: No response;
- A: Alert (bird raises head and resumes activity);
- B: Alert (bird moves by foot from disturbance and then resumes activity);
- C: High Alertness (bird stops feeding/roosting and shows agitation);
- D1: Short-flight (<50 m);
- D2: Long-flight (>50 m); and
- D3: Birds leave the survey area.

Results

Bird count totals per month

Since survey areas 1 - 11 were surveyed simultaneously, we are able to combine all bird sightings across these survey areas, for high and low tide separately, to estimate the total number of individuals of each species present across the survey area. This is summarised in Table 4 below. The peak for each tide is also shown. Survey area 12 and nocturnal surveys were conducted separately from these 11 areas, and so are not included in Table 4. Results for these surveys are given in the survey area specific sections below.

Table 4. Total and max counts of species across diurnal survey areas 1-11 at high and low tide, October 2019 - March 2020.

Species	High Tide						Low Tide						
	Oct	Nov	Dec	Jan	Feb	Max	Oct	Nov	Dec	Jan	Feb	Mar	Max
Cormorant	103	64	94	75	76	103	96	58	57	107	77	112	112
Curlew	33	63	64	33	34	64	20	149	84	75	106	103	149
Dunlin	0	62	66	90	130	130	0	0	0	36	0	4	36
Golden Plover	8	0	0	118	29	118	240	0	106	74	0	0	240
Knot	12	4	1	0	0	12	18	0	0	0	0	0	18
Lapwing	159	78	199	1	0	199	70	6	219	100	0	1	219
Oystercatcher	456	517	363	492	547	547	163	398	304	385	606	405	606
Purple Sandpiper	31	9	16	23	28	31	24	21	45	25	10	28	45
Redshank	619	486	758	590	422	758	359	520	246	260	208	415	520
Ringed Plover	71	2	86	82	10	86	40	46	36	39	21	20	46
Sanderling	43	82	59	5	34	82	68	118	166	50	62	51	166
Shelduck	0	16	11	10	6	16	1	9	0	11	20	26	20
Teal	8	32	60	76	52	76	0	48	38	82	35	43	82
Turnstone	244	275	214	206	261	275	212	253	214	188	244	205	253

Species accounts - notified species

The following section outlines the results for the four SPA/SSSI notified species (turnstone, purple sandpiper, sanderling and knot) in each of the 12 diurnal survey areas and the 5 nocturnal survey areas.

Turnstone (*Arenaria interpres*)

The UK trend for turnstones from BTO WeBS data (Frost *et al.* 2020) shows a long-term decline from a peak in 1987/88 (Figure 2).

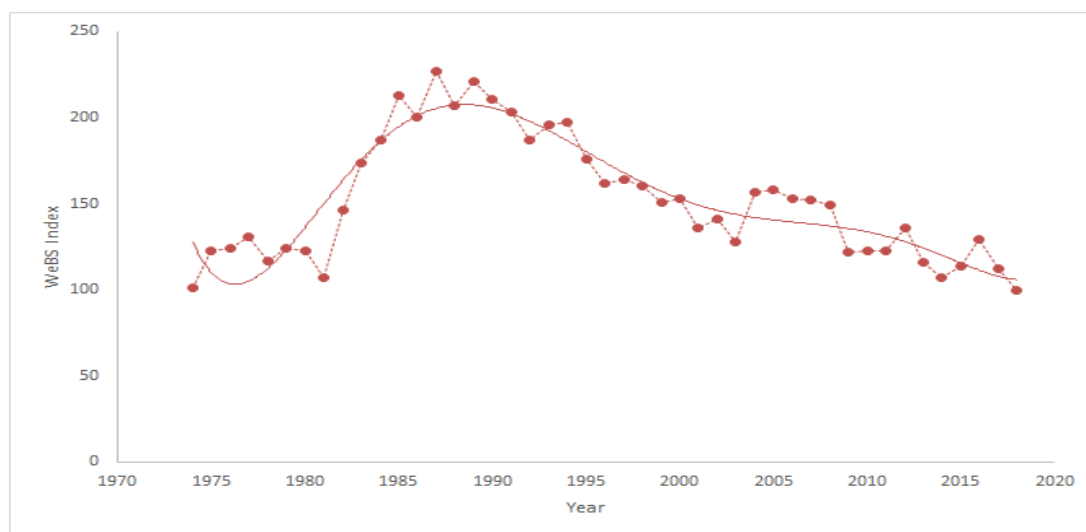


Figure 2. WeBS index for turnstone in the UK

During diurnal surveys, turnstones were observed at high and low tide in all survey areas (1-12) during at least one survey, including coastal and inland/estuarine areas. The highest total number counted during a high tide survey (Table 5) was in survey area 5 (Hendon to Seaham - 83 birds), whereas the highest total count at low tide (Table 6) was in survey area 9 (Tyne Docks - 56 birds). Nocturnal surveys recorded turnstones at Whitburn fields and Blackhall rocks fields at high tide, and at Hartlepool Marina and Blackhall rocks fields at low tide.

The heatmap of turnstone counts (Figure 3) over both tides shows that sightings of turnstone were made all along the coast. It also reveals hotspots of sightings made around Whitburn (survey areas 2 & 3) and around Hendon (survey area 5) and to a lesser extent around the Tyne Docks (survey area 9), Sunderland Docks (survey area 4) and Hartlepool (survey area 8).

Table 5. Total turnstone count (and max count) by month at each survey area during **high tide** surveys

	Survey area	October	November	December	January	February	Max count
Diurnal	1	41	11	8	29	25	41
	2	10	59	44	1	4	59
	3	31	59	19	40	63	63
	4	67	28	54	12	27	67
	5	37	63	22	55	83	83
	6	0	5	0	0	0	5
	7	4	4	9	2	12	12
	8	45	20	41	42	28	45
	9	3	3	14	25	19	25
	10	6	18	2	0	0	18
	11	0	5	1	0	0	5
	12	0	4	5	1	12	12
Nocturnal	Steeley Pier	0	N/A				0
	Hartlepool Marina	N/A	0	N/A			0
	Whitburn Fields	N/A		6	N/A		6
	Seaham Business Park	N/A			0	N/A	0
	Blackhall Rocks Fields	N/A				5	5

Table 6. Total turnstone count (and max count) by month at each survey area during **low tide** surveys

	Survey area	October	November	December	January	February	March	Max count
Diurnal	1	19	29	23	26	18	29	29
	2	28	9	29	22	15	15	29
	3	6	28	28	29	51	51	51
	4	18	18	11	4	15	23	23
	5	31	53	49	47	51	35	53
	6	12	3	0	0	0	0	12
	7	26	6	14	4	13	18	26
	8	47	44	34	26	34	30	47
	9	13	56	21	14	39	0	56
	10	12	0	1	0	0	0	12
	11	0	7	4	16	8	4	16
	12	0	0	0	2	7	0	7
Nocturnal	Steeley Pier	0	N/A				0	
	Hartlepool Marina	N/A	4	N/A			4	
	Whitburn Fields	N/A		0	N/A		0	
	Seaham Business Park	N/A			0	N/A		0
	Blackhall Rocks Fields	N/A				9	0	9

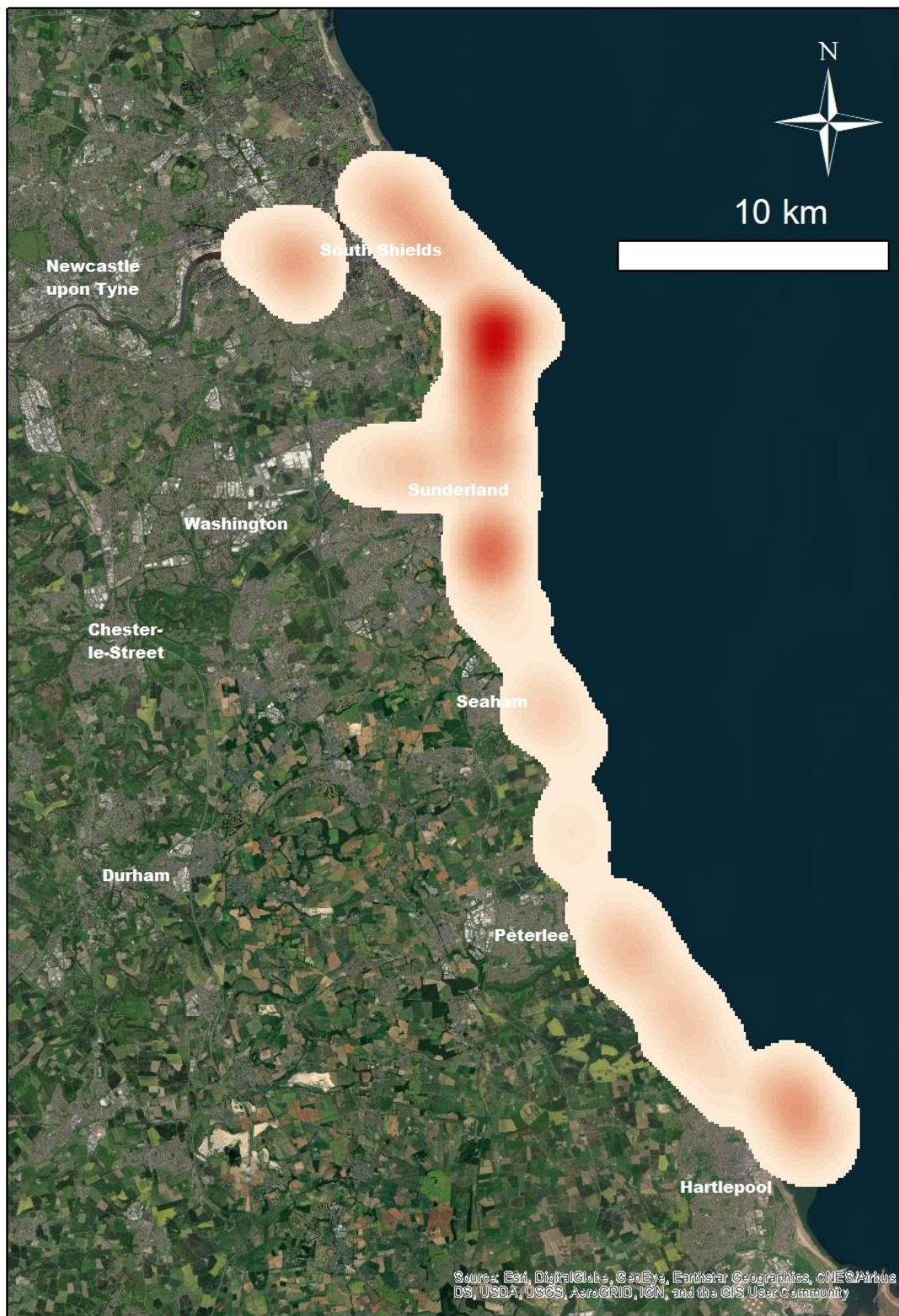


Figure 3. Kernel Density heat map of turnstone sightings throughout the survey area between October 2019 and March 2020. Darker colours indicate higher maximum counts over the survey period.

Purple sandpiper (*Calidris maritima*)

The UK trend for purple sandpiper from BTO WeBS data (Frost *et al.* 2020) shows a long-term decline from a peak in 1987 - 1989 (Figure 4).

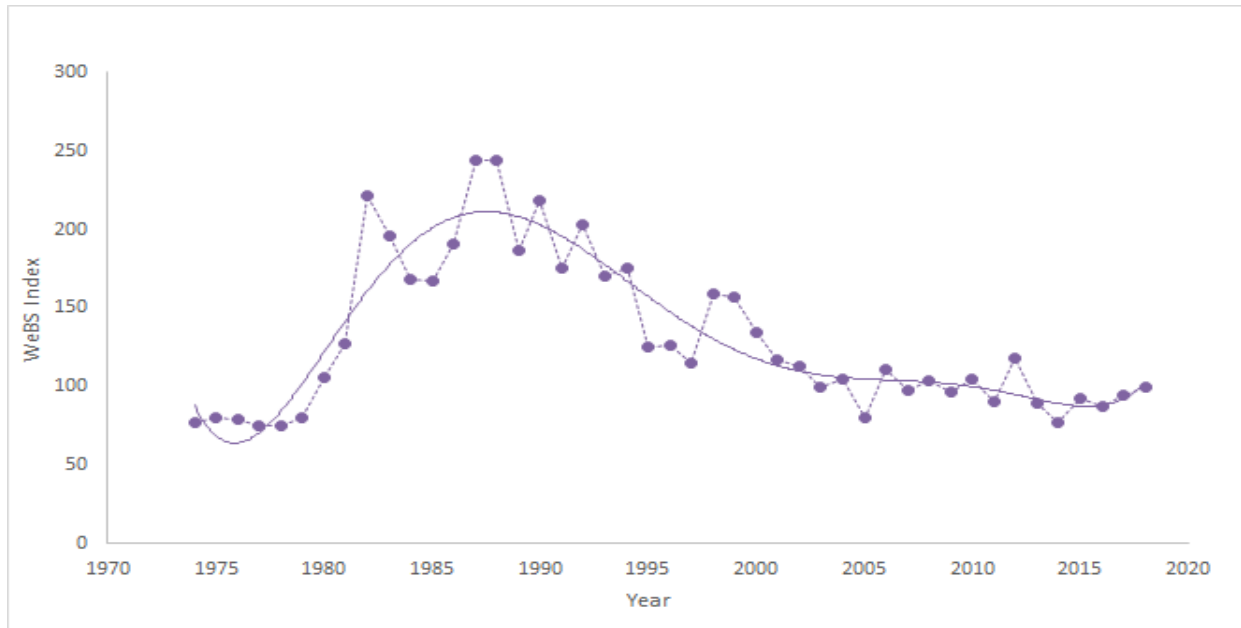


Figure 4. WeBS index for purple sandpiper in the UK

Purple sandpipers were recorded at both high and low tide in survey areas 1 – 5 (South Shields to Seaham) and at survey area 8 (Crimdon to Hartlepool). There was just one record of two individuals at high tide in survey area 6 (Seaham to Easington Colliery), and no purple sandpipers were recorded at survey area 7 (Easington Colliery to Crimdon) nor at any of the inland areas on the rivers Tyne or Wear (survey areas 9 – 12). No purple sandpiper were recorded during nocturnal surveys.

The heatmap of purple sandpiper counts (Figure 5) over both tides shows that sightings were concentrated in the northern coastal survey areas, and at Hartlepool, with hotspots of sightings made around Hendon (survey area 5), South Shields (survey area 1) and Hartlepool (survey area 8) in the far south of the survey area.

Table 7. Total purple sandpiper count (and max count) by month at each survey area during **high tide** surveys

	Survey area	October	November	December	January	February	Max count	
Diurnal	1	10	2	7	17	7	17	
	2	3	0	2	0	4	4	
	3	4	0	1	2	9	9	
	4	3	5	2	3	0	5	
	5	0	0	0	1	2	2	
	6	2	0	0	0	0	2	
	7	0	0	0	0	0	0	
	8	9	2	4	0	6	9	
	9	0	0	0	0	0	0	
	10	0	0	0	0	0	0	
	11	0	0	0	0	0	0	
	12	0	0	0	0	0	0	
Nocturnal	Steeley Pier	0	N/A					0
	Hartlepool Marina	N/A	0	N/A				0
	Whitburn Fields	N/A		0	N/A			0
	Seaham Business Park	N/A			0	N/A		0
	Blackhall Rocks Fields	N/A					0	0

Table 8. Total purple sandpiper count (and max count) by month at each survey area during **low tide** surveys

	Row Labels	October	November	December	January	February	March	Max count
Diurnal	1	7	4	8	10	7	7	10
	2	1	1	1	1	1	1	1
	3	0	2	3	2	0	4	4
	4	6	6	8	0	0	5	8
	5	0	0	12	6	0	9	12
	6	0	0	0	0	0	0	0
	7	0	0	0	0	0	0	0
	8	10	8	13	6	2	2	13
	9	0	0	0	0	0	0	0
	10	0	0	0	0	0	0	0
	11	0	0	0	0	0	0	0
	12	0	0	0	0	0	0	0
Nocturnal	Steeley Pier	0	N/A					0
	Hartlepool Marina	N/A	0	N/A				0
	Whitburn Fields	N/A		0	N/A			0
	Seaham Business Park	N/A			0	N/A		0
	Blackhall Rocks Fields	N/A					0	0



Figure 5. Kernel Density heat map of purple sandpiper sightings throughout the survey area between October 2019 and March 2020. Darker colours indicate higher maximum counts over the survey period.

Sanderling (*Calidris alba*)

The overwintering sanderling trend in the UK (Figure 6) is stable over the short-term, with a long-term increase since 1973/74 (Frost *et al.* 2020).

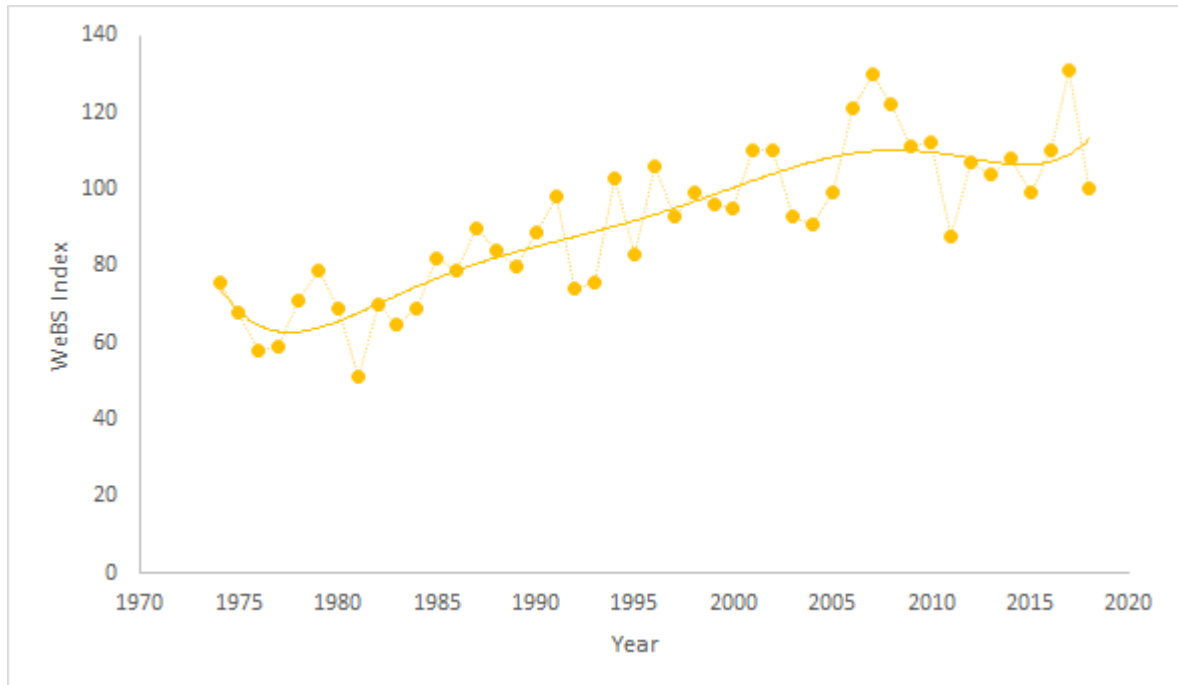


Figure 6. WeBS index for sanderling in the UK.

During high tide surveys, sanderling were recorded on all coastal survey areas (1 - 8) except area 5 (Hendon to Seaham). During low tide surveys, sanderling were recorded on all coastal survey areas except areas 5 & 6 (Hendon to Easington Colliery). No sanderling were recorded at the inland survey areas (9 - 12) nor during the nocturnal surveys at either high or low tide.

The heatmap of sanderling sightings shows the exclusively coastal distribution of sanderling, and that there was a hotspot of sightings in survey area 3 (Whitburn to Sunderland).

Table 9. Total sanderling count (and max count) by month at each survey area during **high tide** surveys

	Survey area	October	November	December	January	February	Max count	
Diurnal	1	3	1	16	5	14	16	
	2	0	0	0	0	1	1	
	3	31	71	41	0	10	71	
	4	0	5	0	0	0	5	
	5	0	0	0	0	0	0	
	6	0	0	0	0	3	3	
	7	0	0	2	0	0	2	
	8	9	5	0	0	6	9	
	9	0	0	0	0	0	0	
	10	0	0	0	0	0	0	
	11	0	0	0	0	0	0	
	12	0	0	0	0	0	0	
Nocturnal	Steeley Pier	0	N/A					0
	Hartlepool Marina	N/A	0	N/A				0
	Whitburn Fields	N/A		0	N/A			0
	Seaham Business Park	N/A			0	N/A		0
	Blackhall Rocks Fields	N/A					0	0

Table 10. Total sanderling count (and max count) by month at each survey area during **low tide** surveys

	Row Labels	October	November	December	January	February	March	Max count	
Diurnal	1	12	1	48	5	0	0	48	
	2	0	0	0	1	0	1	1	
	3	54	111	118	36	62	48	118	
	4	2	0	0	0	0	0	2	
	5	0	0	0	0	0	0	0	
	6	0	0	0	0	0	0	0	
	7	0	0	0	1	0	0	1	
	8	0	6	0	7	0	2	7	
	9	0	0	0	0	0	0	0	
	10	0	0	0	0	0	0	0	
	11	0	0	0	0	0	0	0	
	12	0	0	0	0	0	0	0	
Nocturnal	Steeley Pier	0	N/A						0
	Hartlepool Marina	N/A	0	N/A					0
	Whitburn Fields	N/A		0	N/A				0
	Seaham Business Park	N/A			0	N/A			0
	Blackhall Rocks Fields	N/A					0	0	0

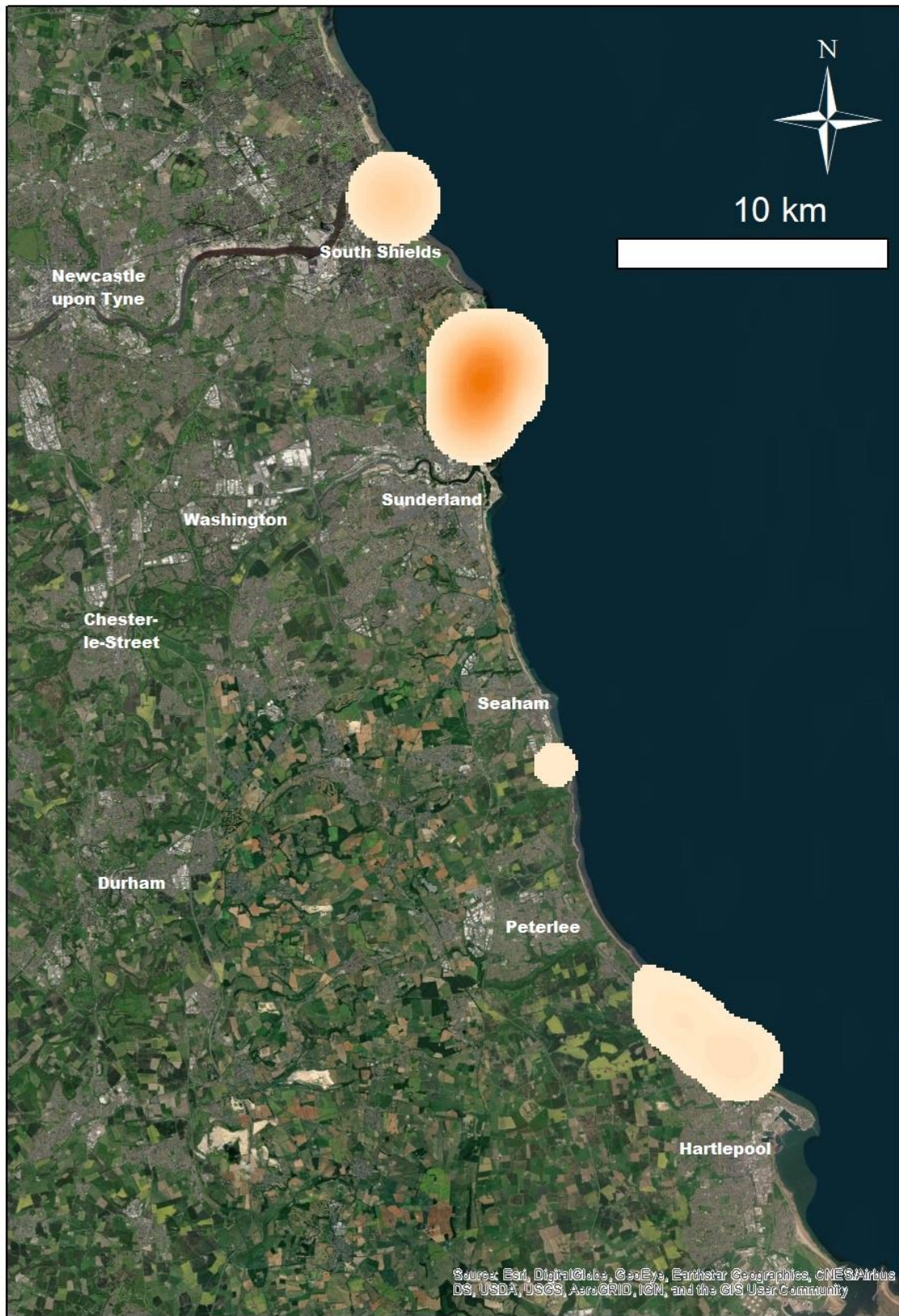


Figure 7. Kernel Density heat map of sanderling sightings throughout the survey area between October 2019 and March 2020. Darker colours indicate higher maximum counts over the survey period.

Knot (*Calidris canutus*)

Overwintering knot numbers in the UK (figure 8) have shown a steady decline since 1992/93 (Frost *et al.* 2020).

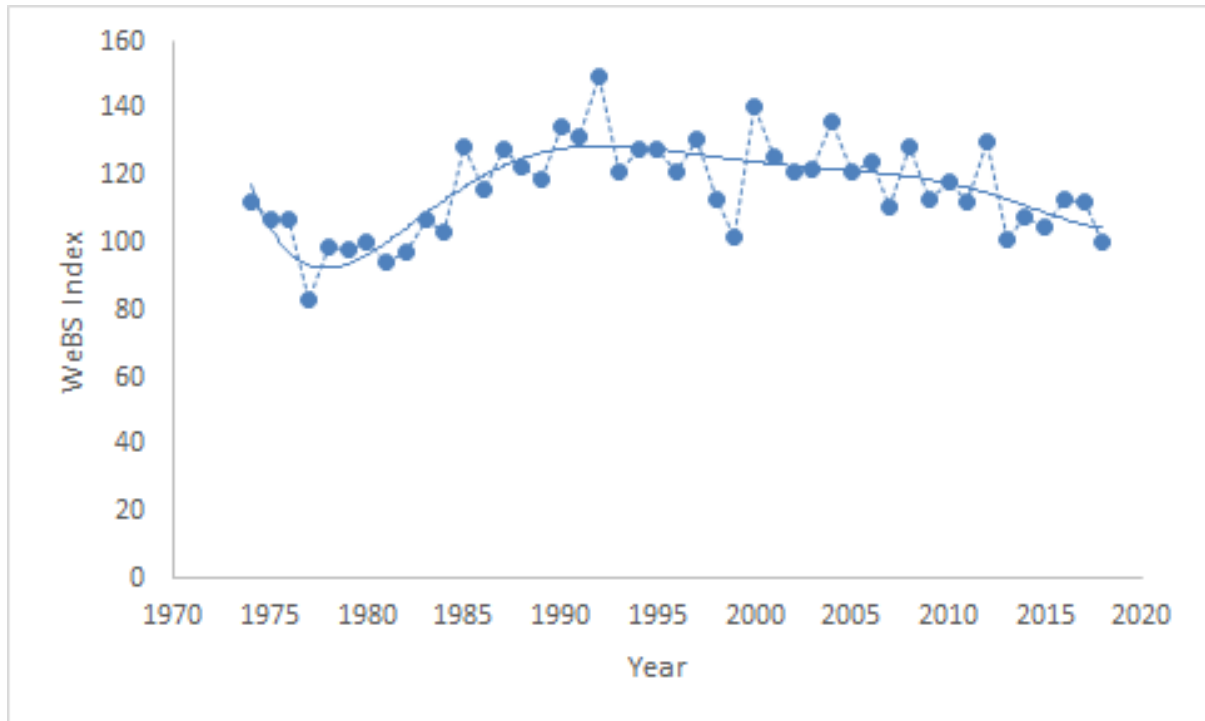


Figure 8. WeBS index for knot in the UK

Knot were only recorded in one survey area (8, Crimdon to Hartlepool) and all records were from October to December 2019, with none in 2020.

The heatmap of knot sightings shows the sole area of sightings around survey area 8 (Crimdon to Hartlepool).

Table 11. Total knot count (and max count) by month at each survey area during **high tide** surveys

	Survey area	October	November	December	January	February	Max count
Diurnal	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0
	7	0	0	0	0	0	0
	8	12	4	1	0	0	12
	9	0	0	0	0	0	0
	10	0	0	0	0	0	0
	11	0	0	0	0	0	0
	12	0	0	0	0	0	0
Nocturnal	Steetley Pier	0	N/A				0
	Hartlepool Marina	N/A	0	N/A			0
	Whitburn Fields	N/A		0	N/A		0
	Seaham Business Park	N/A			0	N/A	0
	Blackhall Rocks Fields	N/A				0	0

Table 12. Total knot count (and max count) by month at each survey area during **low tide** surveys

	Survey area	October	November	December	January	February	Max count
Diurnal	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	4	0	0	0	0	0	0
	5	0	0	0	0	0	0
	6	0	0	0	0	0	0
	7	0	0	0	0	0	0
	8	18	0	0	0	0	18
	9	0	0	0	0	0	0
	10	0	0	0	0	0	0
	11	0	0	0	0	0	0
	12	0	0	0	0	0	0
Nocturnal	Steetley Pier	0	N/A				0
	Hartlepool Marina	N/A	0	N/A			0
	Whitburn Fields	N/A		0	N/A		0
	Seaham Business Park	N/A			0	N/A	0
	Blackhall Rocks Fields	N/A				0	0



Figure 9. Kernel Density heat map of knot sightings along the Durham Coast between October 2019 and March 2020. Darker colours indicate higher maximum counts over the survey period.

Species accounts - other species

Redshank (*Tringa totanus*)

The UK WeBS trend for redshank (figure 10) shows a generally stable wintering population, with a peak count in 1993/94 (Frost *et al.* 2020).

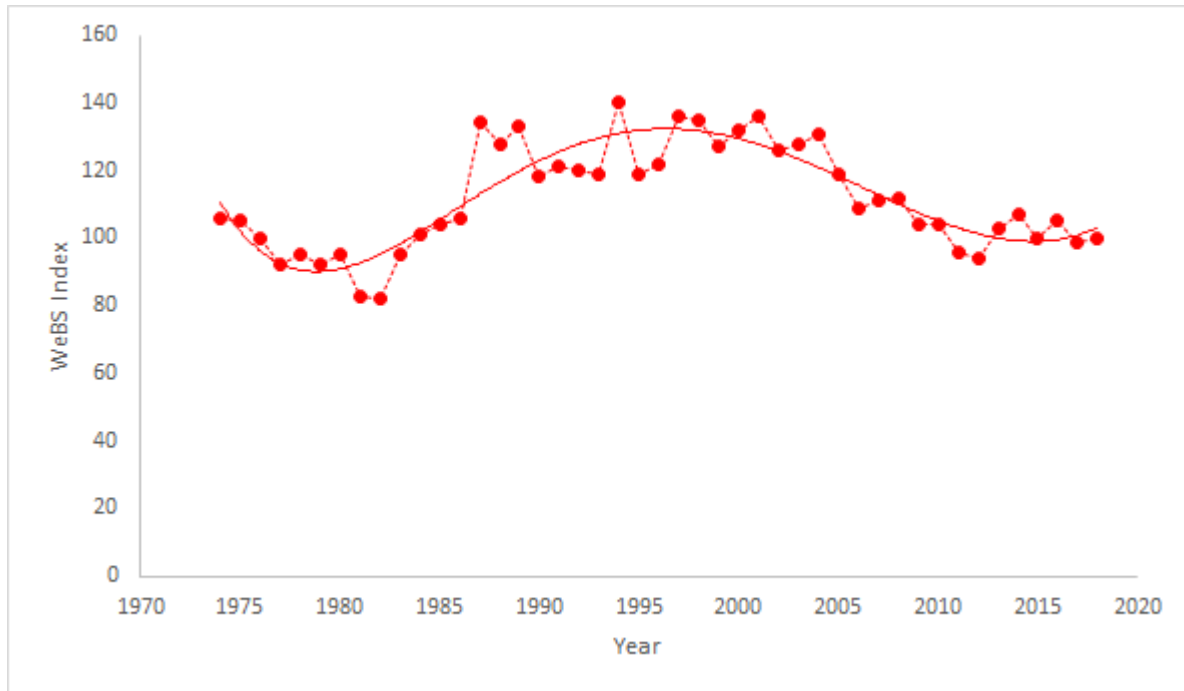


Figure 10. WeBS index for redshank in the UK

Redshank were observed in all 12 diurnal survey areas, as well as within three of the five nocturnal survey areas. The highest count for both high and low tides was in survey area 11 (River Wear East), with significant numbers (>200) also counted during high tide surveys in survey areas 10 (River Wear West) and 4 (Sunderland Docks).

Table 13. Total redshank count (and max count) by month at each survey area during **high tide** surveys

	Survey area	October	November	December	January	February	Max count
Diurnal	1	20	0	8	23	20	23
	2	27	0	27	0	15	27
	3	96	0	9	77	11	96
	4	71	81	125	232	175	232
	5	31	36	24	56	1	56
	6	3	0	1	0	0	3
	7	6	5	3	13	12	13
	8	50	31	12	8	21	50
	9	15	11	45	31	14	45
	10	67	79	227	51	89	227
	11	233	243	277	99	64	277
	12	0	21	3	12	12	21
Nocturnal	Steeley Pier	0	N/A				0
	Hartlepool Marina	N/A	26	N/A			26
	Whitburn Fields	N/A		1	N/A		1
	Seaham Business Park	N/A			0	N/A	0
	Blackhall Rocks Fields	N/A				3	3

Table 14. Total redshank count (and max count) by month at each survey area during **low tide** surveys

	Survey area	October	November	December	January	February	March	Max count
Diurnal	1	7	1	8	0	0	0	8
	2	3	2	18	17	6	10	18
	3	72	52	69	60	23	62	72
	4	8	91	8	23	28	87	91
	5	43	3	26	10	12	9	43
	6	9	1	5	0	0	0	9
	7	3	5	11	13	6	42	42
	8	23	40	22	25	20	13	40
	9	33	42	31	27	33	66	66
	10	69	83	19	52	44	64	83
	11	89	200	29	33	36	62	200
	12	0	7	7	5	6	1	7
Nocturnal	Steeley Pier	2	N/A				2	
	Hartlepool Marina	N/A	26	N/A			26	
	Whitburn Fields	N/A		1	N/A		1	
	Seaham Business Park	N/A			0	N/A	0	
	Blackhall Rocks Fields	N/A				2	2	2

Cormorant (*Phalacrocorax carbo*)

The UK WeBS trend for cormorant (figure 11) shows an increasing population since records began in 1986/87 (Frost *et al.* 2020).

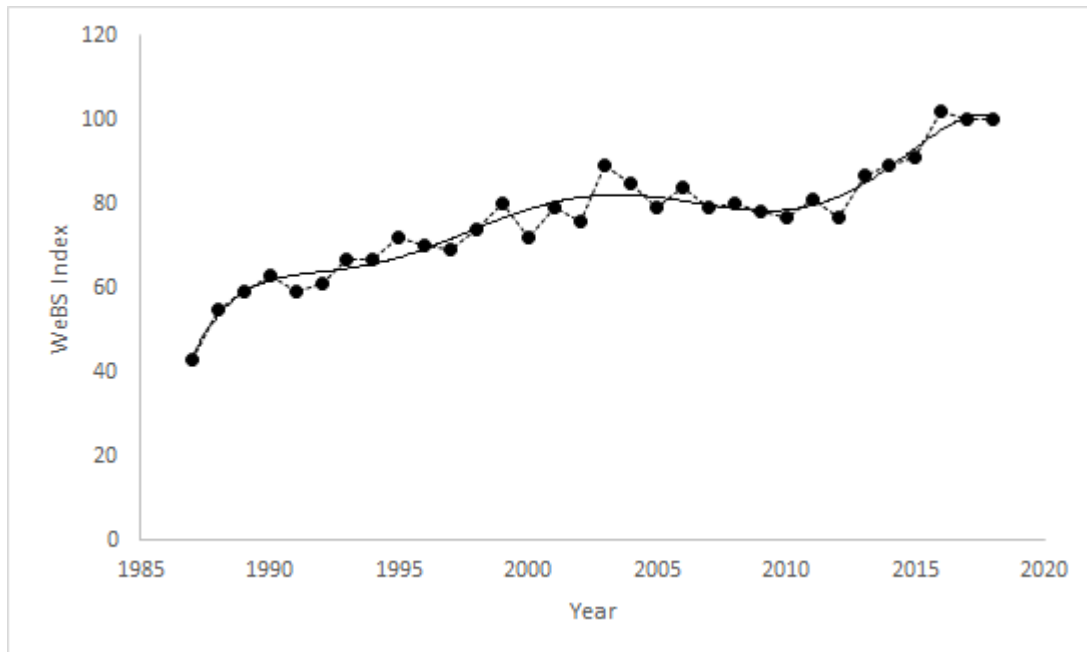


Figure 11. WeBS index for cormorant in the UK

Cormorants were recorded in all diurnal survey areas, except area 3 (Whitburn to Sunderland) during high tide. The peak high tide counts came from areas 4 (Sunderland Docks - 31 birds in February) and 11 (River Wear West - 32 birds in December), and during low tide from area 4 (58 birds in February). There were also regularly in excess of 20 birds roosting at the southern end of survey area 8 (Crimdon to Hartlepool).

Table 15. Total cormorant count (and max count) by month at each survey area during **high tide** surveys

	Survey area	October	November	December	January	February	Max count	
Diurnal	1	1	0	0	1	1	1	
	2	1	0	2	3	0	3	
	3	0	0	0	0	0	0	
	4	9	9	16	25	31	31	
	5	5	1	3	2	0	5	
	6	1	1	1	3	0	3	
	7	4	2	2	4	3	4	
	8	41	22	26	13	28	41	
	9	1	2	2	1	0	2	
	10	20	6	10	3	2	20	
	11	20	21	32	20	11	32	
	12	0	5	12	2	1	12	
Nocturnal	Steetley Pier	0	N/A					0
	Hartlepool Marina	N/A	0	N/A				0
	Whitburn Fields	N/A		0	N/A			0
	Seaham Business Park	N/A			0	N/A		0
	Blackhall Rocks Fields	N/A					0	0

Table 16. Total cormorant count (and max count) by month at each survey area during **low tide** surveys

	Survey area	October	November	December	January	February	March	Max count	
Diurnal	1	2	0	0	0	0	0	2	
	2	1	2	0	0	1	1	2	
	3	0	0	0	4	0	0	4	
	4	19	8	10	38	24	58	58	
	5	4	1	1	3	0	5	5	
	6	2	2	0	0	1	0	2	
	7	4	0	2	3	1	0	4	
	8	33	15	11	26	11	22	33	
	9	3	7	5	2	3	2	7	
	10	14	7	9	4	1	7	14	
	11	14	16	19	27	35	17	35	
	12	0	6	2	13	2	5	13	
Nocturnal	Steetley Pier	0	N/A						0
	Hartlepool Marina	N/A	2	N/A					2
	Whitburn Fields	N/A		0	N/A				0
	Seaham Business Park	N/A			0	N/A			0
	Blackhall Rocks Fields	N/A					0	0	0

Shelduck (*Tadorna tadorna*)

The UK WeBS trend for shelduck (figure 12) shows a declining population since a peak in 1996/97, which followed a population increase since 1965/66 (Frost *et al.* 2020).

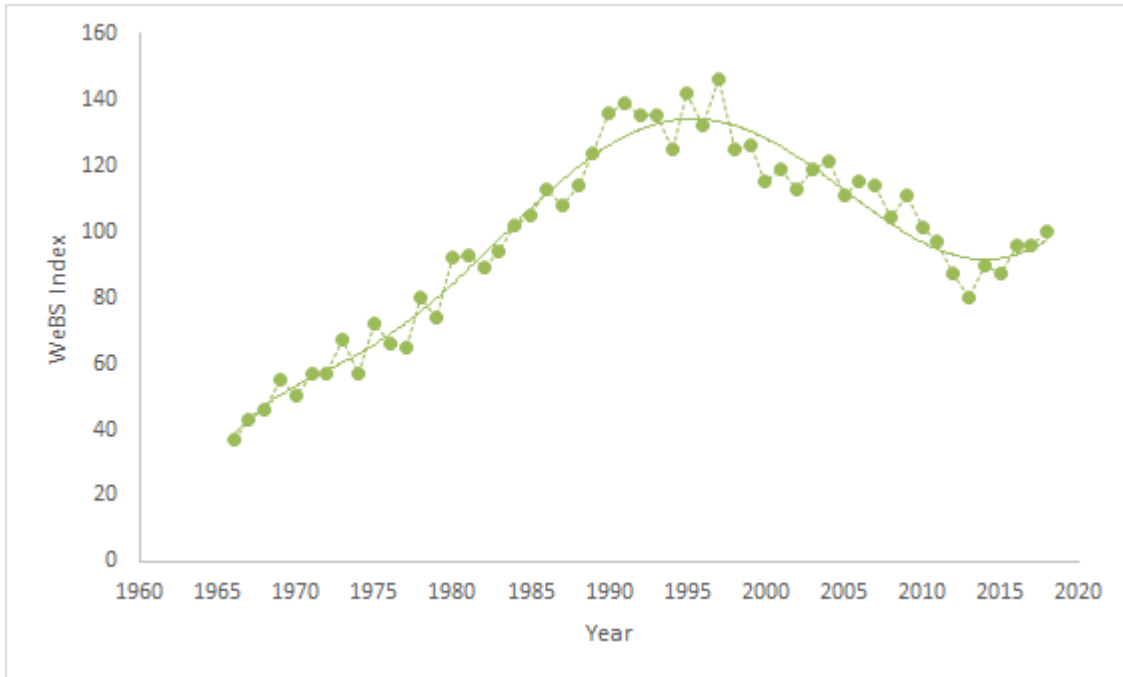


Figure 12. WeBS index for shelduck in the UK.

Shelduck were only recorded in four of the diurnal survey areas (7 - Easington Colliery to Crimdon, 9 - Tyne Docks, 10 - River Wear West and 12 - River Tyne), and three of these were inland river sites. The peak count from both tides was in survey area 10 (13 in November at high tide, and 18 at low tide in February and March).

Table 17. Total shelduck count (and max count) by month at each survey area during **high tide** surveys

	Survey area	October	November	December	January	February	Max count	
Diurnal	1	0	0	0	0	0	0	
	2	0	0	0	0	0	0	
	3	0	0	0	0	0	0	
	4	0	0	0	0	0	0	
	5	0	0	0	0	0	0	
	6	0	0	0	0	0	0	
	7	0	0	2	0	0	2	
	8	0	0	0	0	0	0	
	9	0	3	1	4	2	4	
	10	0	13	8	6	4	13	
	11	0	0	0	0	0	0	
	12	0	0	2	0	6	6	
Nocturnal	Steetley Pier	0	N/A					0
	Hartlepool Marina	N/A	0	N/A				0
	Whitburn Fields	N/A		0	N/A			0
	Seaham Business Park	N/A			0	N/A		0
	Blackhall Rocks Fields	N/A					0	0

Table 18. Total shelduck count (and max count) by month at each survey area during **low tide** surveys

	Survey area	October	November	December	January	February	March	Max count	
Diurnal	1	0	0	0	0	0	0	0	
	2	0	0	0	0	0	0	0	
	3	0	0	0	0	0	0	0	
	4	0	0	0	0	0	0	0	
	5	0	0	0	0	0	0	0	
	6	0	0	0	0	0	0	0	
	7	0	0	0	0	2	0	2	
	8	0	0	0	0	0	0	0	
	9	0	0	0	2	0	8	8	
	10	1	9	0	9	18	18	18	
	11	0	0	0	0	0	0	0	
	12	0	0	2	2	2	0	2	
Nocturnal	Steetley Pier	0	N/A						0
	Hartlepool Marina	N/A	0	N/A					0
	Whitburn Fields	N/A		0	N/A				0
	Seaham Business Park	N/A			0	N/A			0
	Blackhall Rocks Fields	N/A					0	0	0

Teal (*Anas crecca*)

The UK WeBS trend for teal (figure 13) shows an increasing population since 1967/68 (Frost *et al.* 2020).

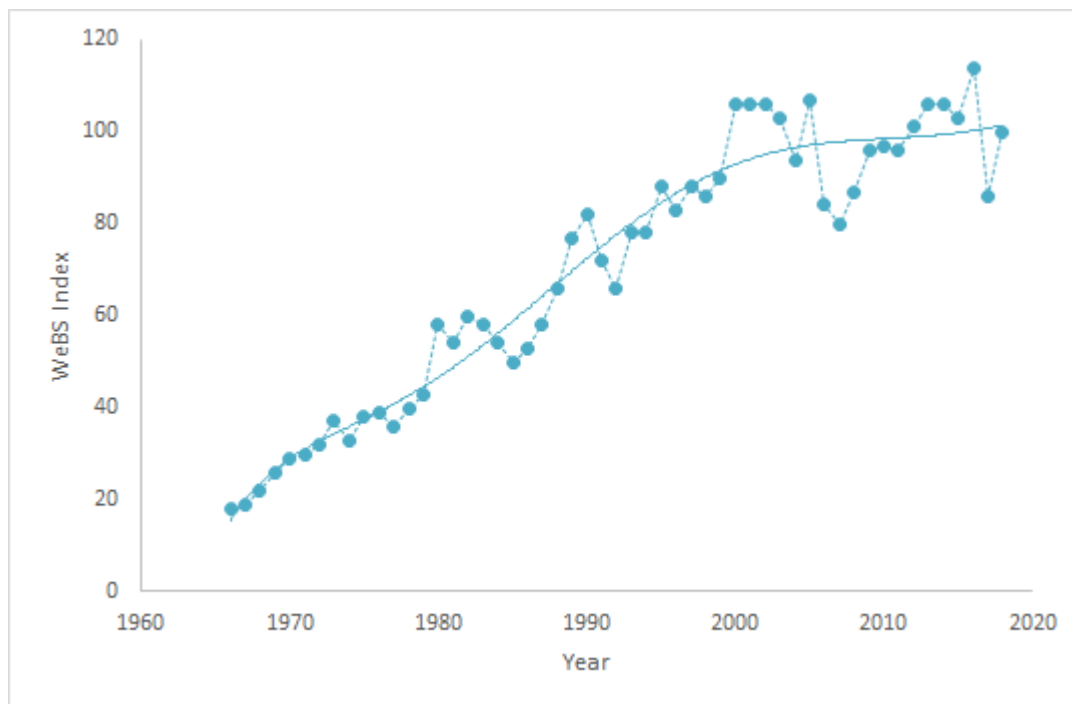


Figure 13. WeBS index for teal in the UK.

Teal were very rarely recorded at any of the coastal sites, with the vast majority of records coming from the three most inland survey areas (9 - Tyne Docks, 10 - River Wear West and 12 - River Tyne). The peak count for both tides came from survey area 9 in January, with 61 birds counted at high tide and 52 at low tide.

Table 19. Total teal count (and max count) by month at each survey area during **high tide** surveys

	Survey area	October	November	December	January	February	Max count		
Diurnal	1	0	0	0	0	0	0		
	2	0	0	0	0	0	0		
	3	0	0	0	0	0	0		
	4	0	0	0	0	0	0		
	5	0	0	0	0	0	0		
	6	0	0	0	0	0	0		
	7	0	0	0	0	1	1		
	8	1	0	0	0	0	1		
	9	7	31	38	61	35	61		
	10	0	1	22	15	16	22		
	11	0	0	0	0	0	0		
	12	0	1	17	9	12	17		
Nocturnal	Steetley Pier	0	N/A					0	
	Hartlepool Marina	N/A	0	N/A				0	
	Whitburn Fields	N/A		0	N/A			0	
	Seaham Business Park	N/A			0	N/A			0
	Blackhall Rocks Fields	N/A					0	0	

Table 20. Total teal count (and max count) by month at each survey area during **low tide** surveys

	Survey area	October	November	December	January	February	March	Max count	
Diurnal	1	0	0	0	0	0	0	0	
	2	0	0	0	0	0	0	0	
	3	0	0	0	0	0	0	0	
	4	0	0	0	0	0	0	0	
	5	0	0	0	0	0	0	0	
	6	0	0	0	0	0	0	0	
	7	0	0	0	4	0	0	4	
	8	0	0	0	0	0	0	0	
	9	0	22	33	52	0	4	52	
	10	0	26	5	26	35	39	39	
	11	0	0	0	0	0	0	0	
	12	0	1	5	14	12	0	14	
Nocturnal	Steetley Pier	0	N/A					0	
	Hartlepool Marina	N/A	0	N/A				0	
	Whitburn Fields	N/A		0	N/A			0	
	Seaham Business Park	N/A			0	N/A			0
	Blackhall Rocks Fields	N/A					0	0	

Shoveler (*Anas clypeata*)

The UK WeBS trend for shoveler (figure 14) also shows an increasing population since 1967/68 (Frost *et al.* 2020).

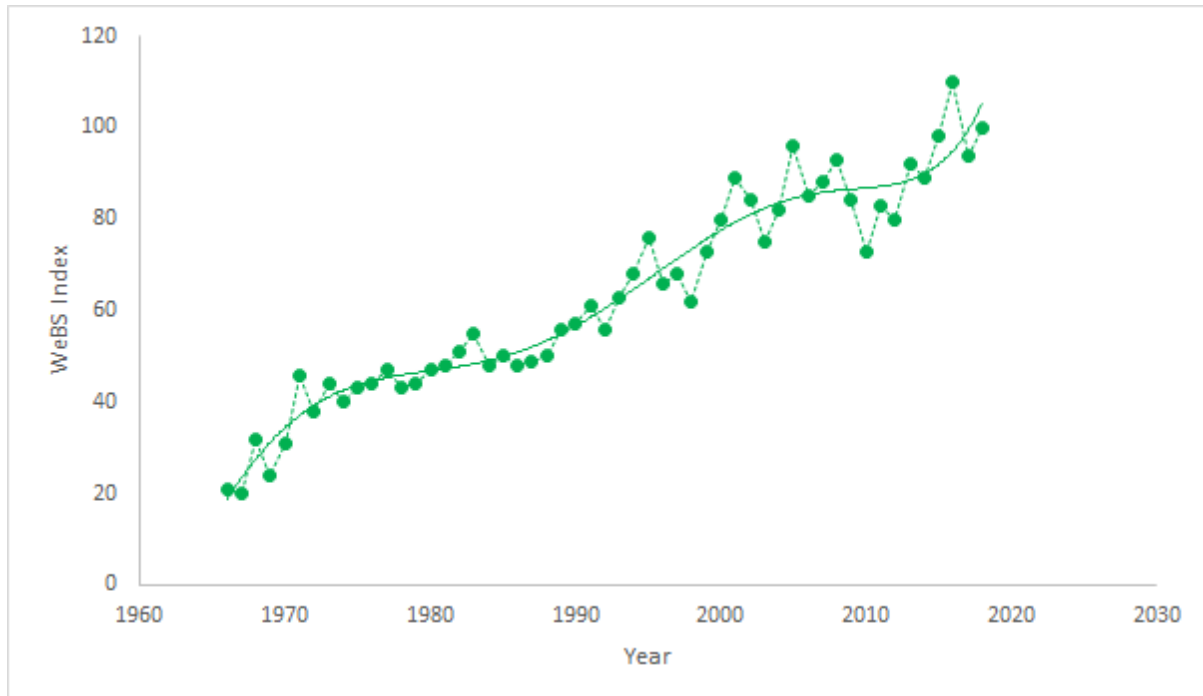


Figure 14. WeBS index for shoveler in the UK.

No shoveler were recorded during surveys, diurnal or nocturnal, between October 2019 and March 2020.

Notable records of other wader species

As well as the target species, records of which are outlined above, a number of other wader species were recorded throughout the survey period. Total counts of these in each survey area are provided in the appendix, and a brief overview is provided below.

- Curlew (*Numenius arquata*). Recorded in all diurnal survey areas except area 4 (Sunderland Docks). Not recorded during any nocturnal surveys. Highest total counts during low tide were in area 3 (Whitburn to Sunderland - 84 birds in March) and area 2 (Marsden to Whitburn - 53 birds in November) with much fewer in all other areas. Highest total counts during high tide were in area 2 (Marsden to Whitburn - 55 birds in November) and 10 (River Wear West - 52 birds in December), with much fewer birds counted in other survey areas.
- Dunlin (*Calidris alpina*). Only recorded in survey areas 1 (South Shield to Marsden), 4 (Sunderland Docks), 5 (Hendon to Seaham) and 11 (River Wear East). Highest counts both came from area 1, with a peak low tide count of 36 birds, and a peak high tide count of 90 birds in January.
- Golden plover (*Pluvialis apricaria*). Only recorded in survey areas 2 (Marsden to Whitburn), 3 (Whitburn to Sunderland) and 5 (Hendon to Seaham), plus during nocturnal surveys at Steetley Pier in October. Highest counts both came from area 3, with a peak low tide count of 240 birds in October, and a peak high tide count of 118 birds in January.
- Lapwing (*Vanellus vanellus*). Recorded during diurnal surveys in survey areas 3 (Whitburn to Sunderland), 5 (Hendon to Seaham), 7 (Easington Colliery to Crimdon), 8 (Crimdon to Hartlepool) and 12 (River Tyne). Also recorded during nocturnal surveys at Hartlepool Marina in November, and Blackhall Rocks fields in February. Highest counts both came from area 7 with a peak low tide count of 120 birds in December, and a peak high tide count of 120 birds in October.
- Oystercatcher (*Haematopus ostralegus*). Widely recorded, with records from all coastal diurnal survey areas, but no records from areas 9 (Tyne Docks), 10 (River Wear West) or 12 (River Tyne). There were also records from nocturnal surveys at Steetley Pier in October and Hartlepool Marina in November. Peak counts both came from survey area 4 (Sunderland Docks) during February, with a peak low tide count of 148 birds and a peak high tide count of 247 birds.
- Ringed plover (*Charadrius hiaticula*). Widely recorded, with records from diurnal surveys in all coastal areas except area 6 (Seaham to Easington Colliery). There was also one record in survey area 9 (Tyne Docks) but not in any other inland survey areas. Records were also made at Hartlepool Marina during nocturnal surveys, but not in any other areas. The highest low tide count came from survey area 8 (Crimdon to Hartlepool - 32 birds in November) whilst the highest high tide count came from survey area 5 (Hendon to Seaham - 65 birds in January).

Survey area summaries

Outlined below are summaries of bird records from each survey area in turn. Maps showing peak counts of the four SPA/SSSI notified species (turnstone, purple sandpiper, sanderling and knot) can be found in the appendix for each survey area.

Survey area 1 - South Shields to Marsden

Survey area 1 covered the coast between Herd Groyne Lighthouse, South Shields (NZ 36933 68310), to the north end of Marsden Sands (NZ 3975 65609). Three of the four SPA/SSSI species were recorded in survey area 1 - turnstone, purple sandpiper and sanderling, with no records of knot in this area during the 2019/20 winter. In addition, notable numbers of dunlin, oystercatcher, redshank and ringed plover were recorded in this survey area, as well as small numbers of curlew and cormorant.

Table 21. Total counts by month and max count of waders and other target species in survey area 1 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Cormorant	1	0	0	1	1	1
Curlew	1	0	0	0	0	1
Dunlin	0	1	66	90	77	90
Oystercatcher	26	26	49	143	130	143
Purple Sandpiper	10	2	7	17	7	17
Redshank	20	0	8	23	20	23
Ringed Plover	6	0	11	16	10	16
Sanderling	3	1	16	5	14	16
Turnstone	41	11	8	29	25	41

Table 22. Total counts by month and max count of waders and other target species in survey area 1 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	2	0	0	0	0	0	2
Dunlin	0	0	0	36	0	0	36
Oystercatcher	13	132	73	146	87	123	146
Purple Sandpiper	7	4	8	10	7	7	10
Redshank	7	1	8	0	0	0	8
Ringed Plover	15	4	0	16	0	0	16
Sanderling	12	1	48	5	0	0	48
Turnstone	19	29	23	26	18	29	29

Survey area 2 - Marsden to Whitburn

Survey area 2 covered the coast between the north end of Marsden Sands (NZ 39750 65609) and Whitburn (NZ 41416 62403). Three of the four SPA/SSSI species were recorded in survey area 2 - turnstone, purple sandpiper and sanderling, with no records of knot. In addition, notable numbers of curlew, golden plover, oystercatcher and redshank were recorded in this survey area, as well as small numbers of cormorant and ringed plover.

Table 23. Total counts by month and max count of waders and other target species in survey area 2 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Cormorant	1	0	2	3	0	3
Curlew	1	55	0	0	0	55
Oystercatcher	32	38	50	43	46	50
Purple Sandpiper	3	0	2	0	4	4
Redshank	27	0	27	0	15	27
Sanderling	0	0	0	0	1	1
Turnstone	10	59	44	1	4	59

Table 24. Total counts by month and max count of waders and other target species in survey area 2 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	1	2	0	0	1	1	2
Curlew	3	53	10	46	0	0	53
Golden Plover	0	0	1	0	0	0	1
Oystercatcher	50	37	53	50	59	40	59
Purple Sandpiper	1	1	1	1	1	1	1
Redshank	3	2	18	17	6	10	18
Ringed Plover	0	0	0	0	0	2	2
Sanderling	0	0	0	1	0	1	1
Turnstone	28	9	29	22	15	15	29

Survey area 3 - Whitburn to Sunderland

Survey area 3 covered the coast between Whitburn (NZ 41416 62403) and Sunderland (NZ 40802 59694). Three of the four SPA/SSSI species were recorded in survey area 3 - turnstone, purple sandpiper and sanderling, with no records of knot. In addition, notable numbers of curlew, golden plover, oystercatcher, redshank and ringed plover were recorded in this survey area, as well as small numbers of cormorant and lapwing.

Table 25. Total counts by month and max count of waders and other target species in survey area 3 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Curlew	2	6	0	12	0	12
Lapwing	9	0	0	0	0	9
Golden Plover	0	0	0	118	0	118
Oystercatcher	5	0	13	51	10	51
Purple Sandpiper	4	0	1	2	9	9
Redshank	96	0	9	77	11	96
Ringed Plover	60	0	32	0	0	60
Sanderling	31	71	41	0	10	71
Turnstone	31	59	19	40	63	63

Table 26. Total counts by month and max count of waders and other target species in survey area 3 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	0	0	0	4	0	0	4
Curlew	11	73	48	6	80	84	84
Lapwing	0	6	0	0	0	1	6
Oystercatcher	0	0	0	43	100	76	100
Purple Sandpiper	0	2	3	2	0	4	4
Redshank	72	52	69	60	23	62	72
Ringed Plover	13	6	23	2	5	17	23
Sanderling	54	111	118	36	62	48	118
Turnstone	6	28	28	29	51	51	51

Survey area 4 - Sunderland Docks

Survey area 4 covered the Sunderland Docks area at the mouth of the River Wear and the coast between NZ 40802 59694 and NZ 41065 56149. Turnstone, purple sandpiper and sanderling were also all recorded here, with no records of knot. In addition, notable numbers of cormorant, dunlin, oystercatcher, redshank and ringed plover were recorded in this survey area.

Table 27. Total counts by month and max count of waders and other target species in survey area 4 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Cormorant	9	9	16	25	31	31
Dunlin	0	32	0	0	53	53
Oystercatcher	160	163	137	112	247	247
Purple Sandpiper	3	5	2	3	0	5
Redshank	71	81	125	232	175	232
Ringed Plover	0	0	28	0	0	28
Sanderling	0	5	0	0	0	5
Turnstone	67	28	54	12	27	67

Table 28. Total counts by month and max count of waders and other target species in survey area 4 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	19	8	10	38	24	58	58
Oystercatcher	0	46	37	0	148	0	148
Purple Sandpiper	6	6	8	0	0	5	8
Redshank	8	91	8	23	28	87	91
Sanderling	2	0	0	0	0	0	2
Turnstone	18	18	11	4	15	23	23

Survey area 5 - Hendon to Seaham

Survey area 5 covered the coast between Hendon (NZ 41065 56149) and Seaham (NZ 43414 48860). Turnstone and purple sandpiper were the two notified SPA/SSSI species recorded here, with no records of knot or sanderling. In addition, notable numbers of lapwing, golden plover, oystercatcher, redshank and ringed plover were made here as well as small numbers of cormorant, curlew and dunlin.

Table 29. Total counts by month and max count of waders and other target species in survey area 5 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Cormorant	5	1	3	2	0	5
Curlew	10	0	0	0	0	10
Lapwing	15	23	104	1	0	104
Golden Plover	8	0	0	0	29	29
Oystercatcher	120	89	21	50	19	120
Purple Sandpiper	0	0	0	1	2	2
Redshank	31	36	24	56	1	56
Ringed Plover	0	0	0	65	0	65
Turnstone	37	63	22	55	83	83

Table 30. Total counts by month and max count of waders and other target species in survey area 5 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	4	1	1	3	0	5	5
Curlew	0	2	0	0	0	3	3
Dunlin	0	0	0	0	0	4	4
Lapwing	70	0	99	0	0	0	99
Golden Plover	0	0	0	74	0	0	74
Oystercatcher	0	50	2	31	30	5	50
Purple Sandpiper	0	0	12	6	0	9	12
Redshank	43	3	26	10	12	9	43
Ringed Plover	0	0	0	21	0	1	21
Turnstone	31	53	49	47	51	35	53

Survey area 6 - Seaham to Easington Colliery

Survey area 6 covered the coast between Seaham (NZ 43414 48860) and Easington Colliery (NZ 44600 43720). Turnstone, purple sandpiper and sanderling were recorded here, with no records of knot. In addition, notable numbers of oystercatcher were recorded, with small numbers of cormorant, curlew and redshank.

Table 31. Total counts by month and max count of waders and other target species in survey area 6 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Cormorant	1	1	1	3	0	3
Curlew	2	0	0	3	3	3
Oystercatcher	0	0	0	25	0	25
Purple Sandpiper	2	0	0	0	0	2
Redshank	3	0	1	0	0	3
Sanderling	0	0	0	0	3	3
Turnstone	0	5	0	0	0	5

Table 32. Total counts by month and max count of waders and other target species in survey area 6 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	2	2	0	0	1	0	2
Curlew	0	0	0	3	3	3	3
Oystercatcher	0	0	20	36	35	44	44
Redshank	9	1	5	0	0	0	9
Turnstone	12	3	0	0	0	0	12

Survey area 7 - Easington Colliery to Crimdon

Survey area 7 covered the coast between Easington Colliery (NZ 44600 43720) and Crimdon Beach (NZ 47794 38229). Turnstone and sanderling were the only two SPA/SSSI notified species recorded here, with no records of knot or purple sandpiper. In addition, notable numbers of lapwing, oystercatcher, redshank and ringed plover were recorded, with small numbers of cormorant, curlew, shelduck and teal.

Table 33. Total counts by month and max count of waders and other target species in survey area 7 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Cormorant	4	2	2	4	3	4
Lapwing	120	55	95	0	0	120
Oystercatcher	0	0	0	10	10	10
Redshank	6	5	3	13	12	13
Ringed Plover	5	2	15	1	0	15
Sanderling	0	0	2	0	0	2
Shelduck	0	0	2	0	0	2
Teal	0	0	0	0	1	1
Turnstone	4	4	9	2	12	12

Table 34. Total counts by month and max count of waders and other target species in survey area 7 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	4	0	2	3	1	0	4
Curlew	0	0	0	1	3	1	3
Lapwing	0	0	120	100	0	0	120
Oystercatcher	8	5	3	11	12	26	26
Redshank	3	5	11	13	6	42	42
Ringed Plover	12	4	13	0	9	0	13
Sanderling	0	0	0	1	0	0	1
Shelduck	0	0	0	0	2	0	2
Teal	0	0	0	4	0	0	4
Turnstone	26	6	14	4	13	18	26

Survey area 8 - Crimdon to Hartlepool

Survey area 8 was the most southerly survey area, and covered the coast between Crimdon Beach (NZ 47794 38229) and the Hartlepool Headland (NZ 52306 33816). All four SPA/SSSI notified species were recorded here at some point during the winter. In addition, notable numbers of cormorant, curlew, lapwing, oystercatcher, redshank and ringed plover were recorded, with small numbers of bar-tailed godwit and teal also present.

Table 35. Total counts by month and max count of waders and other target species in survey area 8 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Bar-tailed godwit	1	0	0	0	0	1
Cormorant	41	22	26	13	28	41
Curlew	8	0	5	0	4	8
Knot	12	4	1	0	0	12
Lapwing	15	0	0	0	0	15
Oystercatcher	113	65	93	58	85	113
Purple Sandpiper	9	2	4	0	6	9
Redshank	50	31	12	8	21	50
Sanderling	9	5	0	0	6	9
Teal	1	0	0	0	0	1
Turnstone	45	20	41	42	28	45

Table 36. Total counts by month and max count of waders and other target species in survey area 8 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	33	15	11	26	11	22	33
Curlew	0	15	0	0	6	5	15
Knot	18	0	0	0	0	0	18
Oystercatcher	92	123	113	66	134	87	134
Purple Sandpiper	10	8	13	6	2	2	13
Redshank	23	40	22	25	20	13	40
Ringed Plover	0	32	0	0	6	0	32
Sanderling	0	6	0	7	0	2	7
Turnstone	47	44	34	26	34	30	47

Survey area 9 - Tyne Docks

Survey area 9 covered the confluence of the River Don and the River Tyne and the Port of Tyne area (approximate centre point NZ 33948 65467). Turnstone were the only SPA/SSSI notified species recorded here. In addition, notable numbers of redshank and teal were recorded, with small numbers of cormorant, curlew and shelduck also present.

The max high tide counts of turnstone at this site represent between 0.2% (October and November) and 1.4% (January) of the total turnstone population for which the Northumbria Coast SPA is designated as an SPA (1,739 individuals). Similarly, the max low tide counts of turnstone at this site represent between 0% (March) and 3.2% (November) of this population in the SPA designation. Whilst it is likely that some of these birds travel between this survey area and the SPA, we cannot be sure of this in the absence of tracking data.

Table 37. Total counts by month and max count of waders and other target species in survey area 9 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Cormorant	1	2	2	1	0	2
Curlew	2	0	1	0	0	2
Redshank	15	11	45	31	14	45
Shelduck	0	3	1	4	2	4
Teal	7	31	38	61	35	61
Turnstone	3	3	14	25	19	25

Table 38. Total counts by month and max count of waders and other target species in survey area 9 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	3	7	5	2	3	2	7
Curlew	0	0	10	9	10	0	10
Redshank	33	42	31	27	33	66	66
Ringed Plover	0	0	0	0	1	0	1
Shelduck	0	0	0	2	0	8	8
Teal	0	22	33	52	0	4	52
Turnstone	13	56	21	14	39	0	56

Survey area 10 - River Wear West

Survey area 10 covered the River Wear from (NZ 34832 56732) in the west to (NZ 38180 57792) in the east. Turnstone were the only SPA/SSSI notified species recorded here. In addition, notable numbers of cormorant, curlew, redshank, shelduck and teal were recorded.

Table 39. Total counts by month and max count of waders and other target species in survey area 10 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Cormorant	20	6	10	3	2	20
Curlew	0	0	52	12	27	52
Redshank	67	79	227	51	89	227
Shelduck	0	13	8	6	4	13
Teal	0	1	22	15	16	22
Turnstone	6	18	2	0	0	18

Table 40. Total counts by month and max count of waders and other target species in survey area 10 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	14	7	9	4	1	7	14
Curlew	0	0	10	0	0	0	10
Redshank	69	83	19	52	44	64	83
Shelduck	1	9	0	9	18	18	18
Teal	0	26	5	26	35	39	39
Turnstone	12	0	1	0	0	0	12

Survey area 11 - River Wear East

Survey area 11 covered the River Wear from NZ 38180 57792 in the west to the mouth of the River Wear at NZ 40720 58044 in the east. Turnstone were the only SPA/SSSI notified species recorded here. In addition, notable numbers of cormorant, curlew, dunlin, oystercatcher and redshank were recorded here.

Table 41. Total counts by month and max count of waders and other target species in survey area 11 made during **high tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	Max count
Cormorant	20	21	32	20	11	32
Curlew	7	2	6	6	0	7
Dunlin	0	29	0	0	0	29
Oystercatcher	0	136	0	0	0	136
Redshank	233	243	277	99	64	277
Turnstone	0	5	1	0	0	5

Table 42. Total counts by month and max count of waders and other target species in survey area 11 made during **low tide** surveys from October 2019 to February 2020.

Species	October	November	December	January	February	March	Max count
Cormorant	14	16	19	27	35	17	35
Curlew	6	6	6	10	4	7	10
Oystercatcher	0	5	3	2	1	4	5
Redshank	89	200	29	33	36	62	200
Turnstone	0	7	4	16	8	4	16

Survey area 12 - Tyne River

Survey area 12 was conducted on different days than survey areas 1 - 11. It covered three non-contiguous stretches of the south bank of the River Tyne between NZ 30275 65366 in the west and NZ 32917 65826 in the west. Turnstone were the only SPA/SSSI notified species recorded here. In addition, notable numbers of cormorant, curlew and redshank were recorded here, with small numbers of lapwing, shelduck and teal also present.

Table 43. Total counts by month and max count of waders and other target species in survey area 11 made during **high tide** surveys from October 2019 to February 2020.

Species	November	December	January	February	Max count
Cormorant	5	12	2	1	12
Curlew	12	6	0	6	12
Lapwing	0	0	0	2	2
Redshank	21	3	12	12	21
Shelduck	0	2	0	6	6
Teal	1	17	9	12	17
Turnstone	4	5	1	12	12

Table 44. Total counts by month and max count of waders and other target species in survey area 11 made during **low tide** surveys from October 2019 to February 2020.

Species	November	December	January	February	March	Max count
Cormorant	6	2	13	2	5	13
Curlew	2	1	4	2	0	4
Lapwing	0	0	5	5	0	5
Redshank	7	7	5	6	1	7
Shelduck	0	2	2	2	0	2
Teal	1	5	14	12	0	14
Turnstone	0	0	2	7	0	7

Nocturnal surveys

Nocturnal surveys were conducted at five sites along the coast, each visited twice per month (once at high tide, once at low tide) between October 2019 and February 2020, with a repeat visit during March 2020 to one of the sites. An outline of observations made during surveys at these sites are summarised in table 45 (below).

Table 45. Summary of 12 nocturnal surveys conducted at five sites along the Durham coast between October 2019 and March 2020.

Survey area	Site description	Month visited	Tide	Observations
Steetley Pier	Steetley Pier, north of Hartlepool, and beach under pier (NZ 505 356)	October	Low	<ul style="list-style-type: none"> • 2 redshank foraging from beach • 2 oystercatcher roosting on beach • 2 golden plover roosting on beach
			High	<ul style="list-style-type: none"> • No birds seen or heard
Hartlepool Marina	Artificial islands and beach in Hartlepool marina (NZ 519 328)	November	High	<ul style="list-style-type: none"> • 26 redshank roosting on island • 12 oystercatcher roosting on island • 8 ringed plover roosting on island • 15 lapwing roosting on island
			Low	<ul style="list-style-type: none"> • 26 redshank roosting on island • 19 lapwing roosting on island • 6 ringed plover roosting on island • 4 turnstone roosting on island • 3 curlew roosting on jetty • 2 cormorant roosting on walkway
Whitburn Fields	Horse paddock, agricultural field and cliff-top grassland close to Whitburn (NZ 412 629)	December	Low	<ul style="list-style-type: none"> • 1 redshank foraging on grassland
			High	<ul style="list-style-type: none"> • 6 turnstone roosting on grassland • 1 redshank calling from beach
Seaham Business Park	Car park and grassland close to Spectrum Business Park, south of Seaham (NZ 436 478)	January	Low	<ul style="list-style-type: none"> • No birds seen or heard
			High	<ul style="list-style-type: none"> • No birds seen or heard
Blackhall Rocks Fields	Cliff-top grassland and agricultural fields, Station Road, Blackhall Rocks (NZ 470 390)	March	Low	<ul style="list-style-type: none"> • 9 turnstone roosting on grassland • 2 redshank calling from beach
			High	<ul style="list-style-type: none"> • 5 turnstone roosting on grassland • 3 redshank roosting on grassland • 12 lapwing roosting on grassland
			High	<ul style="list-style-type: none"> • No birds seen or heard
			Low	<ul style="list-style-type: none"> • 6 Oystercatcher roosting on grassland • 2 redshank calling in flight overhead

Disturbance surveys

Total across survey area

Disturbance surveys were conducted concurrent to bird surveys, and totalled 816 hours of observation across all survey areas (780 hours during diurnal surveys in areas 1-12, and 36 hours during nocturnal surveys in five survey areas).

During surveys, a total of 1,250 different observations involving 3,219 people were made, which either caused disturbance to birds or were a potential source of disturbance. Of these, 362 (29%) caused disturbance to birds, whilst 83 (7%) elicited no observable response from birds present in the area, and the remaining 805 (64%) constituted 'potential' causes of disturbance (i.e. no birds were present in the area at the time of recording). This equates to a rate of human activity of 1 person per 15 minutes of observation time, and birds being disturbed on average once every 2.3 hours across all survey areas. However, this obviously varied between survey areas, and so sources of potential and actual disturbance, broken down by activity type and bird response, are given in Table 46. Maps providing a visual representation of the location of disturbance events across survey areas are provided in the appendix.

The most commonly observed activity was dog walking, with a total of 565 observations (45% of total), the majority of which (83%) occurred with dogs off the lead. Dog walking (off lead) was also the most common source of disturbance, with 132 observations of a disturbance response amongst birds present (36% of all events).

Of the four SPA/SAC species (turnstone, purple sandpiper, sanderling and knot), turnstones were the most frequently disturbed species across the entire survey area, with 119 recorded disturbance events (Table 47). This likely reflects, in part, the greater number and wider distribution of this species compared to the others.

Table 46. Number of observations of potential/actual disturbance by activity type and bird response.

	Aircraft	Angling	Beach Combing	Bait Digging	Boat	Bird Watching	Dog walking (off lead)	Dog Walking (on lead)	Helicopter	Horse Riding	Jogging	Noise (Background)	Noise (sudden/loud)	Natural Disturbance	Other	Photography	School Group	Sea Kayak	Unknown	Walking	Workers	Total
No response (from birds present)		5	7		8	3	20	9					1	2	7			1	3	14	3	83
Alert (A) (bird raises head and resumes activity)			2		3	4	9	2					1	3	1	1				4		30
Alert (B) (bird moves by foot then resumes activity)			1	3			15	6							1				2	13		41
High Alertness (C) (bird ceases activity and shows agitation)		1					2	1						1					1	1		7
Disturbed (D1) (short flight <50m)		7		2	6	4	59	10			2			8	4	3		4	15	22	3	149
Disturbed (D2) (long flight >50m)		2		1	7	4	20	2			2			4		1		2	3	4	1	53
Disturbed (D3) (birds leave survey area)		5	2		8	5	27	6	1	1	1	1		5	7			2	2	8	1	82
Potential (no birds present)	3	78	98	2	9	2	319	58		2	13			3	14	8	3	5	8	175	5	805
Total	3	98	110	8	41	22	471	94	1	3	18	1	2	26	34	13	3	14	34	241	13	1250

Table 47. Total number of disturbance events for four SPA/SAC species between October 2019 and March 2020 over 816 hours of observation.

	Turnstone	Purple Sandpiper	Sanderling	Knot
Alert (A) (bird raises head and resumes activity)	8	0	1	0
Alert (B) (bird moves by foot then resumes activity)	19	2	3	0
High Alertness (C) (bird ceases activity and shows agitation)	3	0	0	0
Disturbed (D1) (short flight <50m)	50	3	12	0
Disturbed (D2) (long flight >50m)	14	3	3	0
Disturbed (D3) (Birds leave survey area)	25	0	3	0
Total	119	8	22	0

Variation between survey areas

As would be expected, disturbance events, both actual and potential, were not evenly distributed across the survey area, reflecting the distribution of both birds and people as a source of disturbance. Table 48 (below) provides a breakdown of the number of observations of potential and actual disturbance events, which shows a large variation in disturbance rates across survey areas.

Table 48. Number and % of total observations of human activity and actual disturbance events at 12 diurnal survey areas and 5 nocturnal surveys areas between October 2019 and March 2020.

	Survey area	Total observations		Total actual disturbance events*	
		Number	% of total	Number	% of total
Diurnal	1	74	6%	31	9%
	2	69	6%	11	3%
	3	39	3%	32	9%
	4	31	2%	19	5%
	5	491	39%	82	23%
	6	136	11%	9	2%
	7	17	1%	17	5%
	8	164	13%	40	11%
	9	71	6%	43	12%
	10	74	6%	24	7%
	11	77	6%	48	13%
	12	5	0%	4	1%
Nocturnal	Steetley Pier	0	0%	0	0%
	Hartlepool Marina	0	0%	0	0%
	Whitburn Fields	0	0%	0	0%
	Seaham Industrial Estate	0	0%	0	0%
	Blackhall Rocks	2	0%	2	1%
	Total	1250		362	

Survey area 5 (Hendon to Seaham) was the most disturbed area with 39% of all events (including potential and no response events) and 23% of all actual disturbance events. In terms of actual disturbance events, the least disturbed area was survey area 6 (Seaham to Easington Colliery) with just 2% of all actual disturbance events. This is interesting because survey area 6 actually had the third highest level of all human activities, but since bird numbers are fewer here this did not translate into observed disturbance.

Table 49 (below) shows how the 1,250 observations of human activity were distributed between the 12 survey areas (plus 5 nocturnal survey areas) and the types of activity these were made up of. From this table it can be seen that of the 491 (39%) observations made in survey area 5 (Hendon to Seaham), as in the majority of other survey areas, dog walking made up the largest proportion of activities recorded.

Since a single observation was often made up of more than one person present (e.g. groups of people walking) it is also interesting to look at how the total number of people recorded varies across the survey area as an indication of total human activity. Figure 15a shows a heatmap of the number of people engaged in all activity types (dog walking, walking, jogging etc.) recorded during surveys, and provides an indication of where total human activity was greatest. Figure 15b on the other hand, shows a heatmap of events where birds were disturbed by human activity (alert or disturbed into flight).

As would be expected, there is quite a high degree of apparent overlap between total levels of human activity and the occurrence of actual disturbance events. However, while figure 15a shows 'hotspots' of human activity around South Shields, Seaham and Hartlepool (major human population centres with high levels of recreational activity), Figure 15b shows hotspots of actual disturbance around the East River Wear, Sunderland Docks and Hendon areas, as well as to a lesser extent around the Tyne Docks and Whitburn areas. It may be that birds are more likely to be disturbed from these areas, even when total numbers of people are fewer than elsewhere, due to differences in feeding resource quality or lack of alternative 'refuge' areas, meaning that birds are forced to roost and forage in areas frequented by people.

Table 49. Number of observations of potential/actual disturbance by activity type and survey area

Site number	Aircraft	Angling	Beach Combing	Bait Digging	Boat	Bird Watching	Dog walking (off lead)	Dog Walking (on lead)	Helicopter	Horse Riding	Jogging	Noise (Background)	Noise (sudden/loud)	Natural Disturbance	Other	Photography	School Group	Sea Kayak	Unknown	Walking	Workers	Total
1			2				36	3		1	5			1	2	1		3		20		74
2		19	1				28	4								1		1	1	14		69
3				5			18	2	1	1	2			4	1	1		1	1	2		39
4					7	1	6	3			2			1					3	7	1	31
5	2	48	94			2	202	38			1			2	18	3	3		9	65	4	491
6	1	18	2	2		1	59	4			1				1	3			2	42		136
7							14				1					1				1		17
8		7	11			1	68	23		1	1			1	1	2		2		46		164
9					7		13	6					2	13	4	1			12	8	5	71
10				1	6		22	3			5	1			6			2	4	23	1	74
11		6			19	17	5	8						3				5	2	11	1	77
12					2									1						1	1	5
Blackhall Rocks (Nocturnal)															1					1		2
Hartlepool Marina (Nocturnal)																						0
Seaham Industrial Estate (Nocturnal)																						0
Stetley Pier (Nocturnal)																						0
Whitburn Fields (Nocturnal)																						0
Grand Total	3	98	110	8	41	22	471	94	1	3	18	1	2	26	34	13	3	14	34	241	13	1250

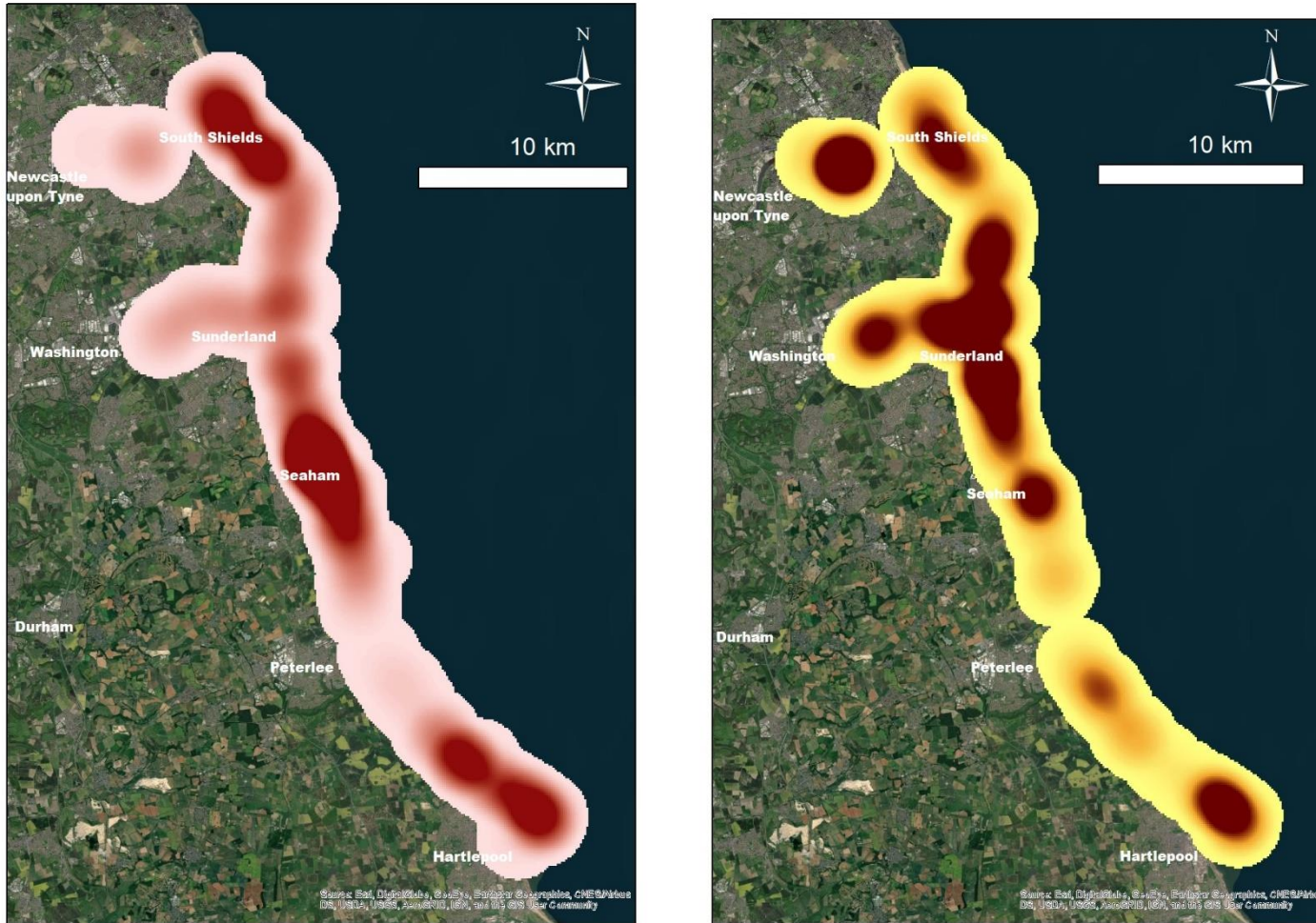


Figure 15. Kernel Density heatmaps of total people recorded (engaged in any activity type) during surveys (left), and of actual disturbance events (alert and disturbed into flight) recorded during surveys (right).

Table 50 shows the number of actual disturbance events (alert and disturbed into flight) for three of the four SPA/SAC species (no disturbance of knot was observed) for each of the 12 diurnal survey areas (no disturbance was observed for these species during nocturnal surveys). Again this highlights the greater level of disturbance of turnstone at survey area 5 (Hendon to Seaham) than any other area.

Table 50. Number of actual disturbance events for turnstone, purple sandpiper and sanderling at the 12 diurnal survey areas. Total hours of observation for these survey areas was 780 hours (66 hours at each sector 1-11, 54 hours at survey area 12).

Survey area	Turnstone	Purple Sandpiper	Sanderling
1	6	2	6
2	6	0	1
3	8	3	13
4	7	0	0
5	56	1	0
6	0	0	0
7	6	0	0
8	18	2	2
9	6	0	0
10	1	0	0
11	3	0	0
12	0	0	0
Total	119	8	22

Since dog walking was the most frequently recorded activity, this has been broken down in Tables 51a and 51b to show the number of people and dogs recorded in each survey area, in each month and during low and high tide surveys. A number of things are apparent from these data, including that dog walkers and dogs were much more numerous during low tide than high tide surveys (2,229 people and 1,040 dogs at low tide vs 987 people and 464 dogs at high tide). It is also apparent that there is large variation between months.

Table 51a. Number of dog walkers and dogs observed in each survey area and in each month during **low tide** surveys

Survey area	October		November		December		January		February		March		Total	
	No. of dog walkers	No. of dogs	No. of dog walkers	No. of dogs	No. of dog walkers	No. of dogs	No. of dog walkers	No. of dogs	No. of dog walkers	No. of dogs	No. of dog walkers	No. of dogs	Total No. of people	Total No. of dogs
1	27	15	37	27	66	53	24	23	38	25	40	18	232	161
2	28	13	23	10	58	11	19	8	41	12	24	9	193	63
3	35	17	11	4	9	2	2	2	0	0	4	2	61	27
4	7	3	0	0	1	1	2	1	46	39	0	0	56	44
5	71	30	178	57	116	48	100	49	234	94	205	71	904	349
6	43	10	32	13	32	9	12	6	41	16	28	8	188	62
7	1	1	0	0	5	8	1	1	0	0	1	0	8	10
8	52	42	78	40	101	64	47	38	105	46	61	42	444	272
9	16	3	4	3	0	0	1	0	6	8	0	0	27	14
10	7	3	0	0	5	4	0	0	16	13	15	3	43	23
11	5	0	47	14	11	0	6	0	3	1	1	0	73	15
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	292	137	410	168	404	200	214	128	530	254	379	153	2229	1040

Table 51b. Number of dog walkers and dogs observed in each survey area and in each month during **high tide** surveys.

Survey area	October		November		December		January		February		Total	
	No. of dog walkers	No. of dogs	No. of dog walkers	No. of dogs	No. of dog walkers	No. of dogs	No. of dog walkers	No. of dogs	No. of dog walkers	No. of dogs	Total No. of people	Total No. of dogs
1	23	6	10	4	67	35	40	19	16	8	156	72
2	8	2	16	7	15	7	16	10	39	9	94	35
3	8	18	11	10	6	7	0	0	1	2	26	37
4	13	0	1	0	3	1	0	0	1	0	18	1
5	23	2	52	14	35	27	98	45	104	34	312	122
6	0	0	12	6	31	14	23	9	9	4	75	33
7	3	4	1	1	4	4	6	4	0	0	14	13
8	15	11	23	11	61	43	71	36	40	22	210	123
9	2	0	1	0	10	10	5	1	0	0	18	11
10	7	1	8	3	9	8	0	0	15	3	39	15
11	7	0	6	0	7	2	0	0	0	0	20	2
12	0	0	5	0	0	0	0	0	0	0	5	0
Total	109	44	146	56	248	158	259	124	225	82	987	464

Variation between weekdays/weekends

Table 52 (below) shows how the number of actual disturbance events (and the rate expressed as number of events per 6hr survey period) varied between weekday (Monday - Friday) and weekends (Saturday and Sunday). This is shown for survey areas 1-11 for which five surveys took place on weekdays and six took place on weekends. Data are not shown for survey area 12 which all took place on weekdays owing to access restrictions.

Overall, across all survey areas, disturbance rates were higher at weekends than during weekdays (3.44 events per six hour survey vs 2.35 events per survey respectively) as may be expected due to increased recreational activity at weekends. However, this was not the case for all survey areas, and the area with the greatest level of disturbance (area 5 - Hendon to Seaham) had a higher rate of disturbance during weekdays than at weekends (8.20 events/survey vs 6.83 events/survey respectively).

Table 52. Number and rate of actual disturbance events (alert and disturbed into flight) of birds during five weekday surveys and six weekend surveys between October 2019 and March 2020.

Survey area	Weekday		Weekend	
	No. disturbance events	Rate (events / 6hr survey)	No. disturbance events	Rate (events / 6hr survey)
1	14	2.80	17	2.83
2	4	0.80	7	1.17
3	10	2.00	22	3.67
4	5	1.00	14	2.33
5	41	8.20	41	6.83
6	5	1.00	4	0.67
7	8	1.60	9	1.50
8	13	2.60	27	4.50
9	11	2.20	32	5.33
10	4	0.80	20	3.33
11	14	2.80	34	5.67
Overall	129	2.35	227	3.44

Discussion and recommended further work

The results of the 2019/20 surveys outlined in this report reveal the widespread distribution of wading birds, including the four species notified under the SPA/SSSI designation, and how these vary considerably between survey areas. The results also reveal the considerable disturbance pressure for wading birds along the coast caused by human activity, and how this varies spatially and temporally. Disturbance along the Northumbria SPA has recently been shown to negatively affect turnstones (Whittingham *et al.* 2020).

Comparison with previous surveys

While it is not possible to compare bird data for all species in each survey area directly with previous surveys without the raw data, it is possible to compare population estimates across larger areas of the coast for some species. Figures 2 and 4 (above) show trends for overwintering turnstone and purple sandpiper from WeBS data, and the declining trend for these two populations (in the UK as a whole), as well as the fluctuation between years, should be considered when comparing data from earlier surveys. However, below we have utilised data from earlier surveys in 2014/15 and 2015/16 to consider changes in turnstone and purple sandpiper populations.

How have the populations of Turnstone and Purple Sandpiper changed across the Northumbria Coast SPA?

The Northumbria Coast SPA was designated in 2000 and now includes four species of qualifying interest. Of these two species occur in the winter (Turnstone and Purple Sandpiper). The SPA runs from the Tweed to Crimdon in County Durham and does not include the entire coastline in between these two rivers but focusses on particular areas including those with rocky shore, which are of particular importance for both Turnstone and Purple Sandpiper.

How have the numbers of these species changed through time and how does that compare with the data we collected in winter 2019/20? The various studies have estimated numbers of each species across different lengths of the SPA coastline. All estimates by Cadwallender in 2011/12, 2012/13 and 2017/18 were not comparable with our counts as they were carried out across the coastline on different days (in contrast to our data which was a snapshot on a given day carried out by 11 surveyors working on the same day at the same time). We were unable to estimate total counts across the coast from the information presented in BSG (2016a) for 2015/16. However, we were able to compare our counts across the coastline with those from other previous surveys (see Table 53).

Although both species have a patchy distribution along the coast, the only way to meaningfully compare between surveys is to take the proportion of coastline surveyed and adjust counts based on these numbers. This is, of course, a simplification of reality as the numbers in one part of the coast are unlikely to directly relate to those in other parts of the SPA but it does give a rough indication of the change in numbers estimated across the SPA. A snapshot in time for the whole SPA in 2019/20 could be more accurately predicted using WEBS data for that year combined with our survey data (see Table 53).

Table 53. Changes in numbers of turnstones and purple sandpipers based on estimates of Northumbria Coast (NC) SPA population from qualifying interests and BTO and contrasted with the maximum recorded in any one survey on part of the Northumbria Coast SPA.

	Original citation for NC SPA in 2000*	Estimate of population in 2014/15 from Arcus report	Estimate of population in 2015/16 from Ecology Consulting	BTO estimate of population in 2018 (data included in citation*)	Estimate of population in our study area in 2019/20
Area covered (length of coastline km)	All SPA (143km)**	South of the Tyne to Seaham (24km)	South of Tyne to Steetly Pier (38km)	All SPA (143km)	South of the Tyne to Crimdon (36km)
Turnstone – Actual Count	1739	367	183	618	229
Turnstone – estimated count for whole SPA	1739	2184 (+126%)	688 (-60%)	618 (-64%***)	910 (-48%)
Purple Sandpiper	787	59	18	242	32
Purple Sandpiper – adjusted count	787	351 (-55%)	68 (-91%)	242 (-69%)	127 (-84%)
Knot – actual count	N/A as not species of qualifying interest	28	22	N/A as not species of qualifying interest	0
Sanderling – actual count	N/A as not species of qualifying interest	197	145	N/A as not species of qualifying interest	166

*<https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK9006131&SiteName=northumbria&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&HasCA=1&NumMarineSeasonality=4&SiteNameDisplay=Northumbria%20Coast%20SPA#SiteInfo>

**Length of coastline was estimated from ARC GIS maps

***Change in numbers are shown in parentheses for adjusted counts (e.g. the BTO 2018 data recorded a 64% decline in Turnstone numbers relative to the original numbers included in the citation in 2000).

Clearly, the populations of turnstone and purple sandpiper have declined substantially since the Northumbria Coast SPA was designated in 2000 but how different are these declines to those experienced across the whole of the UK? Turnstone numbers have declined in the UK by 35%

between 1999/2000 and 2018/19 (WEBs data from 1999/2000, when the SPA was designated to the latest year from which data were available, 2018/19). Similar levels of decline were also found for England as for the UK. The Arcus (2015) survey suggests an increase in numbers of turnstone but that is not in keeping with the national data or from the other survey data which all suggest relatively similar declines. All three estimates are greater than the decline observed across the UK.

Purple Sandpipers have declined in the UK by 36% between 1999/2000 and 2018/19 (WEBs data from 1999/2000). All counts suggest a more severe decline than across the UK as a whole. Again the Arcus (2015) survey found the greatest numbers but these still suggested greater declines than the UK average.

So why have the numbers of turnstone and purple sandpiper declined more in Northumbria Coast SPA than elsewhere in the UK? Previous work along the northeast coast of England (see Whittingham et al. 2020) suggests that offshore refuges play an important role in buffering turnstones from disturbance. South of the Tyne the number of offshore refuges are very limited with the only presence being of small outcrops of rock and Steetly Peer.

Disturbance data

As with bird data, it is difficult to compare disturbance data with earlier surveys without the raw data, however some broad scale comparisons are possible. Firstly, dog walking (off lead) was the most frequently recorded of all events, accounting for 45% of all events. This is exactly the same proportion of events recorded in 2014/15 (45%) and very similar to that in 2015/16 (46%) (BSG 2016a) indicating that the division of human activities remain broadly the same.

Secondly, there is some evidence to suggest that overall disturbance levels were marginally higher in this survey (2019/20) compared to the BSG survey in 2015/16. Here, from South Shields to Seaham we recorded 175 actual disturbance events, while BSG recorded 149 over the same period and stretch of coast (BSG 2016a).

Thirdly, the distribution of disturbance events appears to be similar between this survey and the 2015/16 survey – at least between South Shields and Seaham. Both ours, and BSGs, surveys highlighted that greatest levels of disturbance on this stretch of coast occurred between Whitburn Steel and Seaburn Beach and Roker pier.

It is also apparent that disturbance levels (actual and potential) do not consistently correlate with wader distribution. This can be seen by inspecting the heatmaps of total people and actual disturbance events (figures 15a & 15b) with heatmaps of the four SPA/SSSI notified species. By way of example, the headland area of Hartlepool within survey area 8 contained high densities of wading birds, but low levels of actual disturbance, possibly because the important roosting/foraging areas were on intertidal rocks, largely inaccessible to people. Likewise, Crimdon Beach contained relatively low densities of wading birds, but high levels of people (particularly dog walkers) resulting in low levels of actual disturbance. Whether this is because birds have been displaced by the high disturbance, or these areas are simply less suitable is unclear however. On the other hand, a few areas contained high levels of disturbance and high wader numbers. One area in particular where

this is the case is south of Sunderland around Hendon, which both turnstone and purple sandpiper hotspots in our surveys, and also was the centre of the main disturbance hotspot.

Recommendations for further work

Further work may have the potential to increase our understanding of the use and pressures on use by key birds species of the north-east of England coast. Firstly, a key issue requiring further study is the spatial use of the coast by SPA/SSSI notified species. Darkness surveys here were unable to identify any significant nocturnal wader roosts and identifying the location and extent of use of these areas is necessary if these areas are to be protected from undue pressures. Similarly, movements of groups of waders between areas of the coast is currently not understood. One technique that has the potential to identify these is the use of radio or satellite tracking technology, which can be made to fit species such as turnstone, and would facilitate the capture of data on spatial use of the coast by this species, and others. These data could also aid in decision making processes over new developments or protection of currently used areas.

It may also be useful to understand how disturbance levels along this stretch of the Northumbria coast differ from those elsewhere. This may help to explain why the apparent rate of population decline is greater here than for the UK as a whole. Of course, there may be a number of other causes for this, e.g. food quality and availability.

Furthermore, it may be useful to improve our understanding of the use of offshore refuges, and possibly increase their provision and monitor use. A recently published study conducted by a number of surveyors and project partners (Whittingham *et al.* 2020) provided evidence that coastal areas with nearby offshore refuges contained higher densities of turnstone and these areas also had slower population declines. There was also limited evidence from survey area 8 in this study, that turnstones (and other wading bird species) were making use of artificial offshore refuges within Hartlepool harbour. Understanding how the provision of these refuges could aid in slowing wading bird declines could prove a valuable avenue of further work.

In summary further work on the following may help to inform management to increase the numbers of turnstone, purple sandpipers, knot and sanderling:

1. Wider studies of the distances from offshore refuges on wader densities at sites south of the Tyne (down to Hartlepool) and more broadly across the UK (using WEBs data).
2. Radio tagging of individual birds to determine spatial use and roosting sites.
3. Monitoring the effectiveness of providing undisturbed roosting sites (particularly between the Tyne and Tees) either through offshore islands or protected areas (e.g. perhaps located in parts of harbours).

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Appendix 1 - Recording forms used in this project

Appendix 1A - Bird Recording Form

		Time:							
Sector Number		Wind speed (Beaufort Scale)							
Date		Wind direction							
Start time		Cloud cover (%)							
Finish time		Precipitation							
Observer		Temperature							
Time of low/high tide									

Observation no.	Species	Count	Activity	Time	Comments (including Grid Reference)
1 (e.g)	TT	2	Foraging	14.00	NZ529 344

Appendix 2 - Bird distribution figures

Figures below have been produced for high and low tide in each survey area, and depict the maximum count of each of the four SPA/SSSI notified species (turnstone, purple sandpiper, sanderling and knot). Points are proportional and on the same scale for each species, and show the maximum count over all high/low tide surveys within a 100 metre radius, and therefore depict the areas most used by each species over each tide.

Survey area 1 - South Shields to Marsden

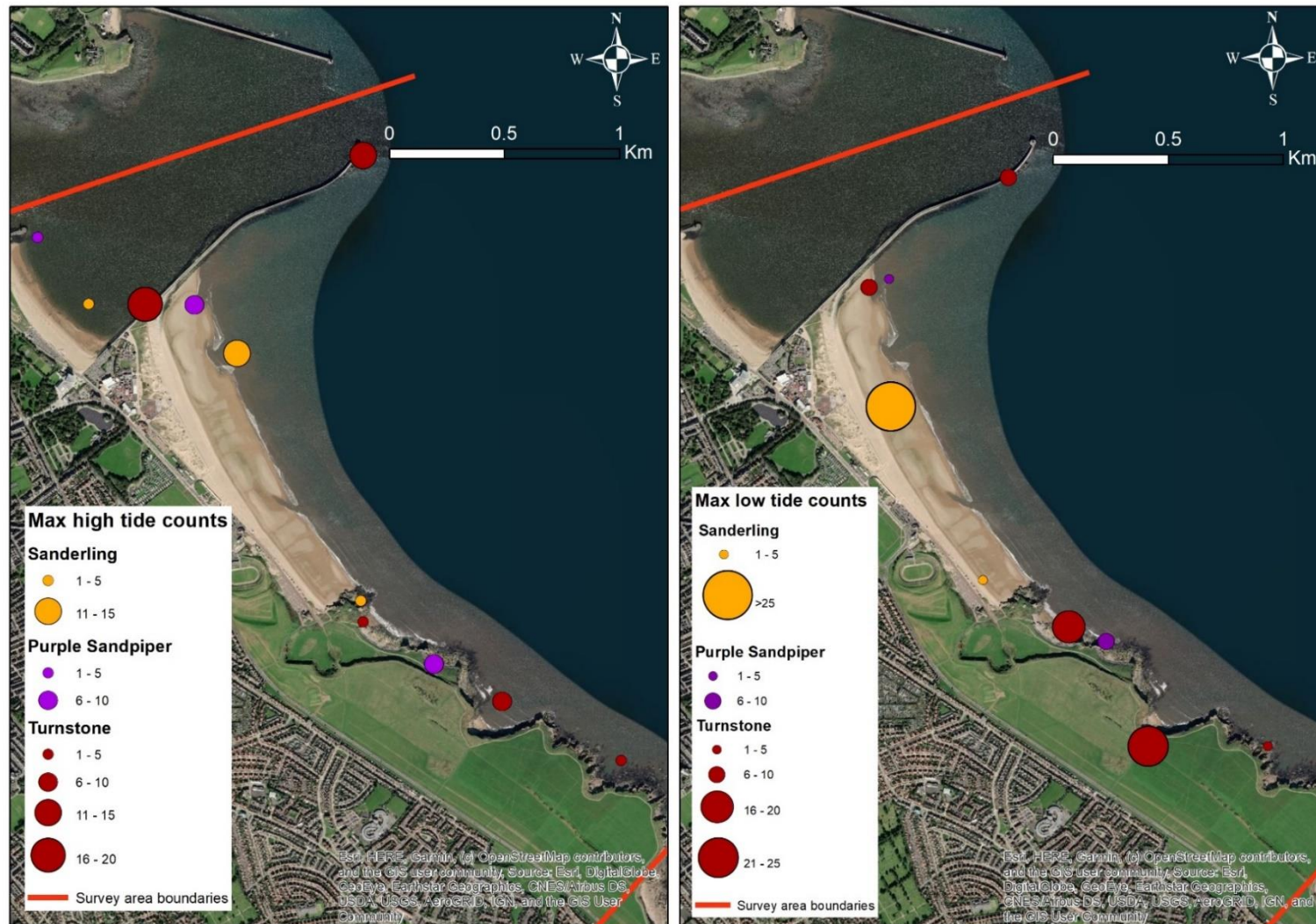


Figure 16. Max counts of four SPA/SSSI notified species in survey area 1 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 2 - Marsden to Whitburn

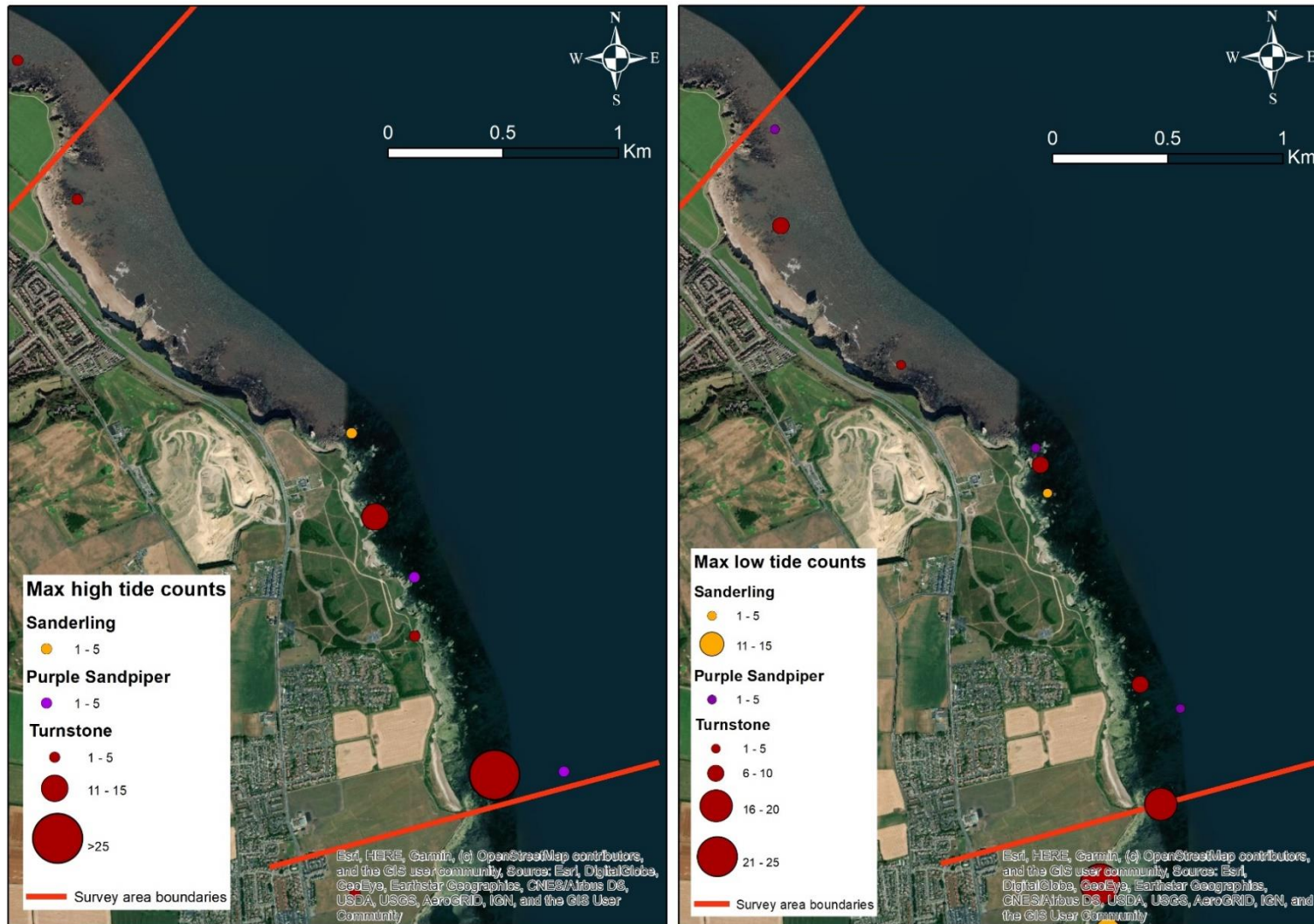


Figure 17. Max counts of four SPA/SSSI notified species in survey area 2 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 3 - Whitburn to Sunderland

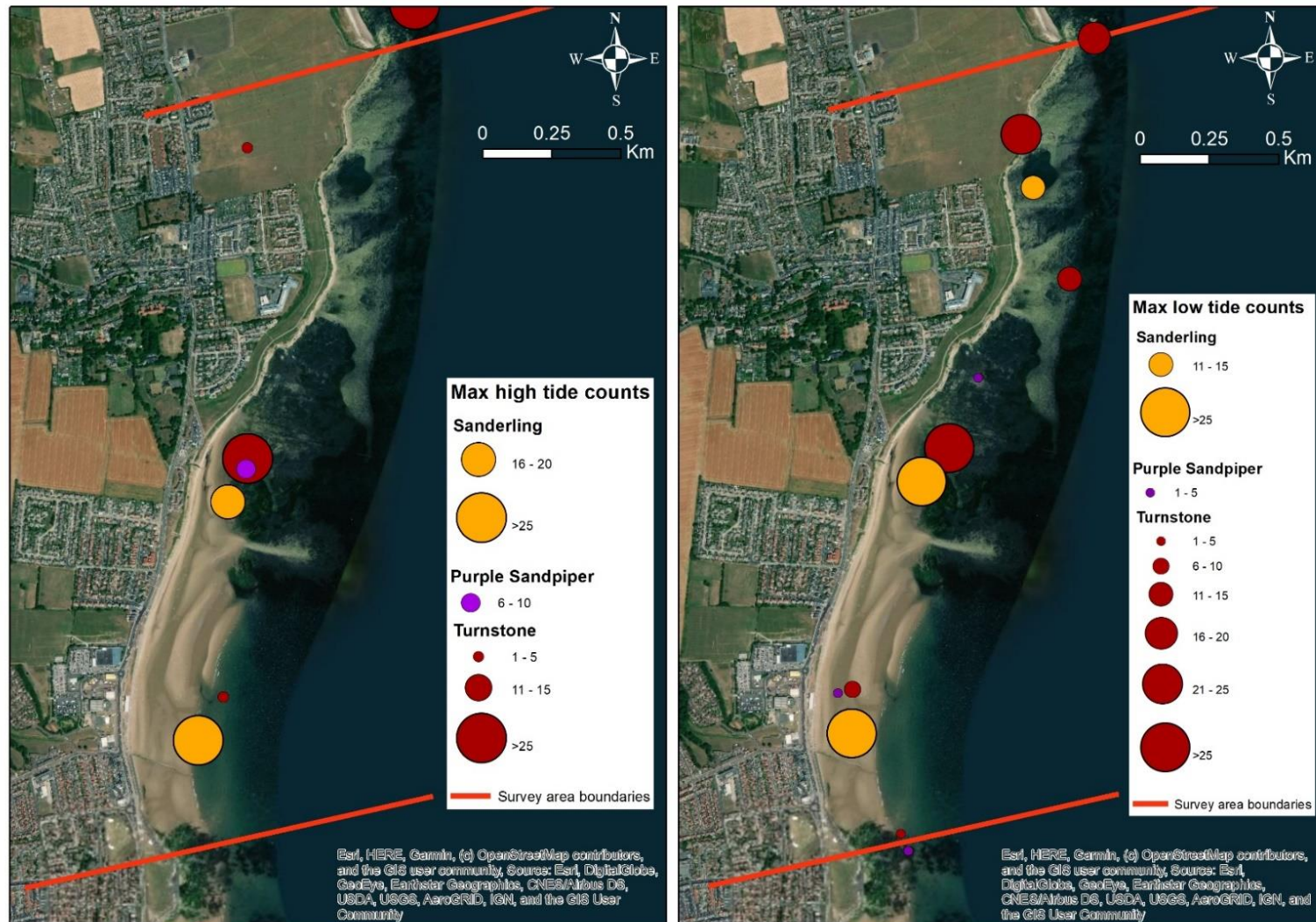


Figure 18. Max counts of four SPA/SSSI notified species in survey area 3 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 4 - Sunderland Docks

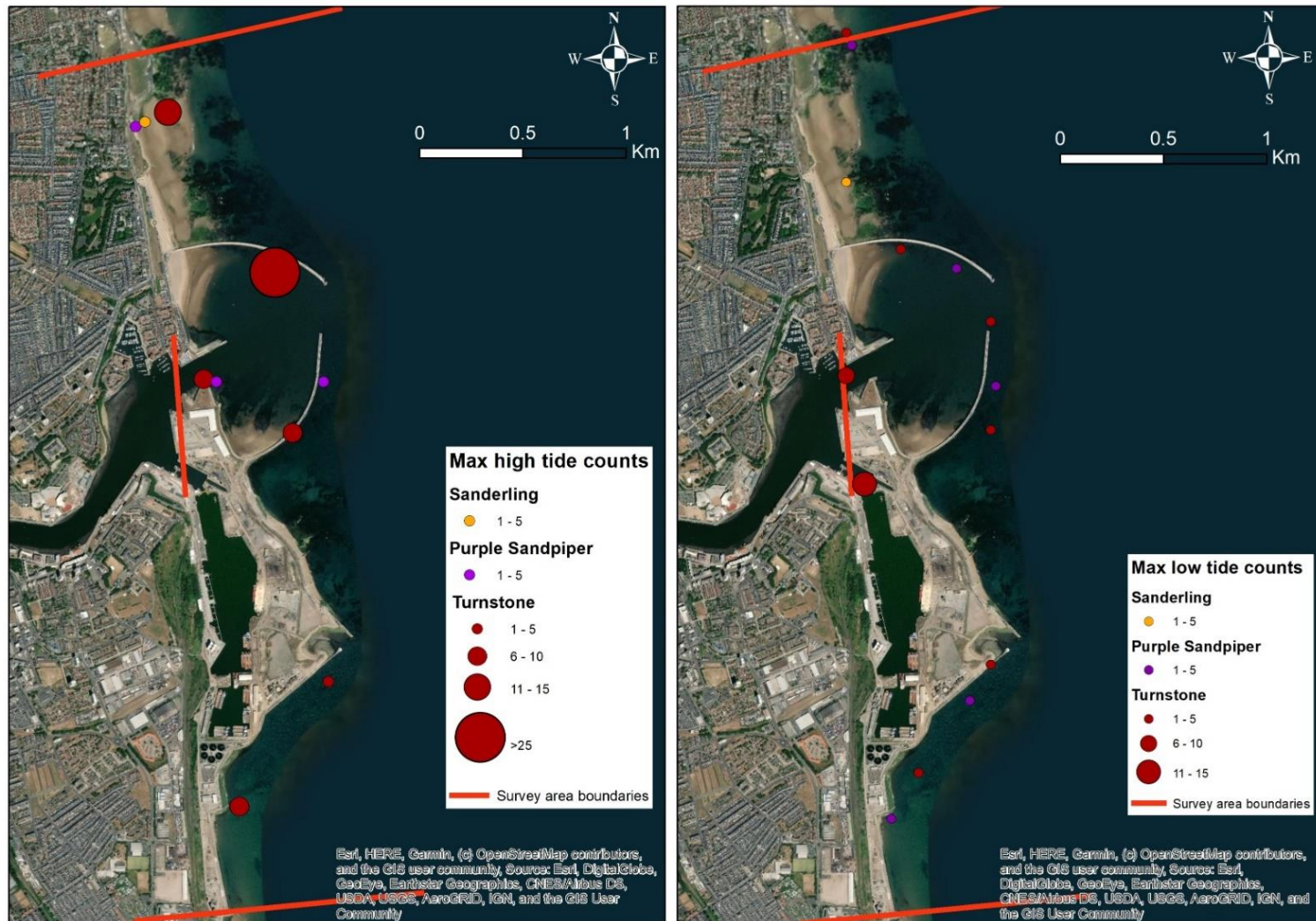


Figure 19. Max counts of four SPA/SSSI notified species in survey area 4 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 5 - Hendon to Seaham

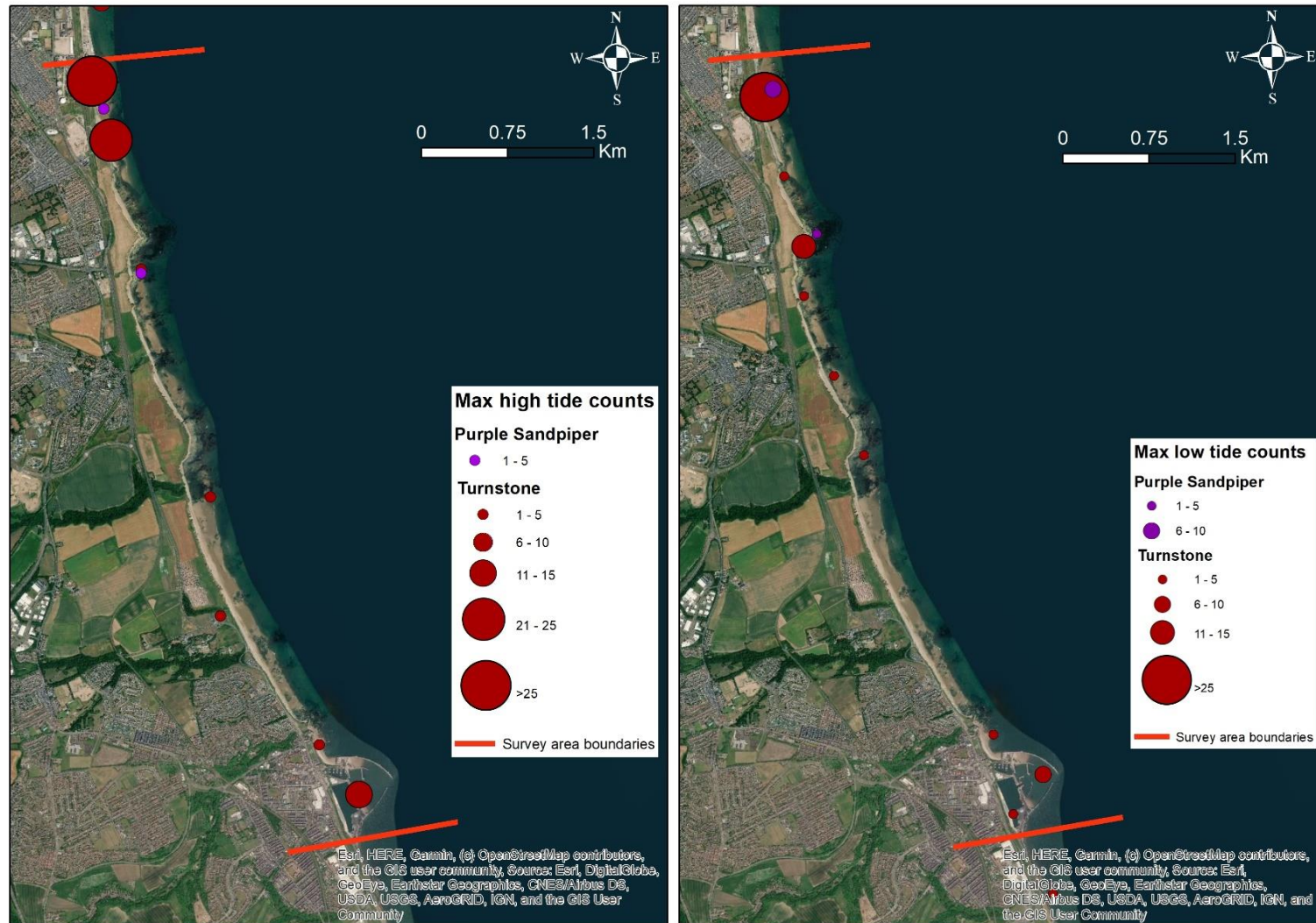


Figure 20. Max counts of four SPA/SSSI notified species in survey area 5 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 6 - Seaham to Easington Colliery

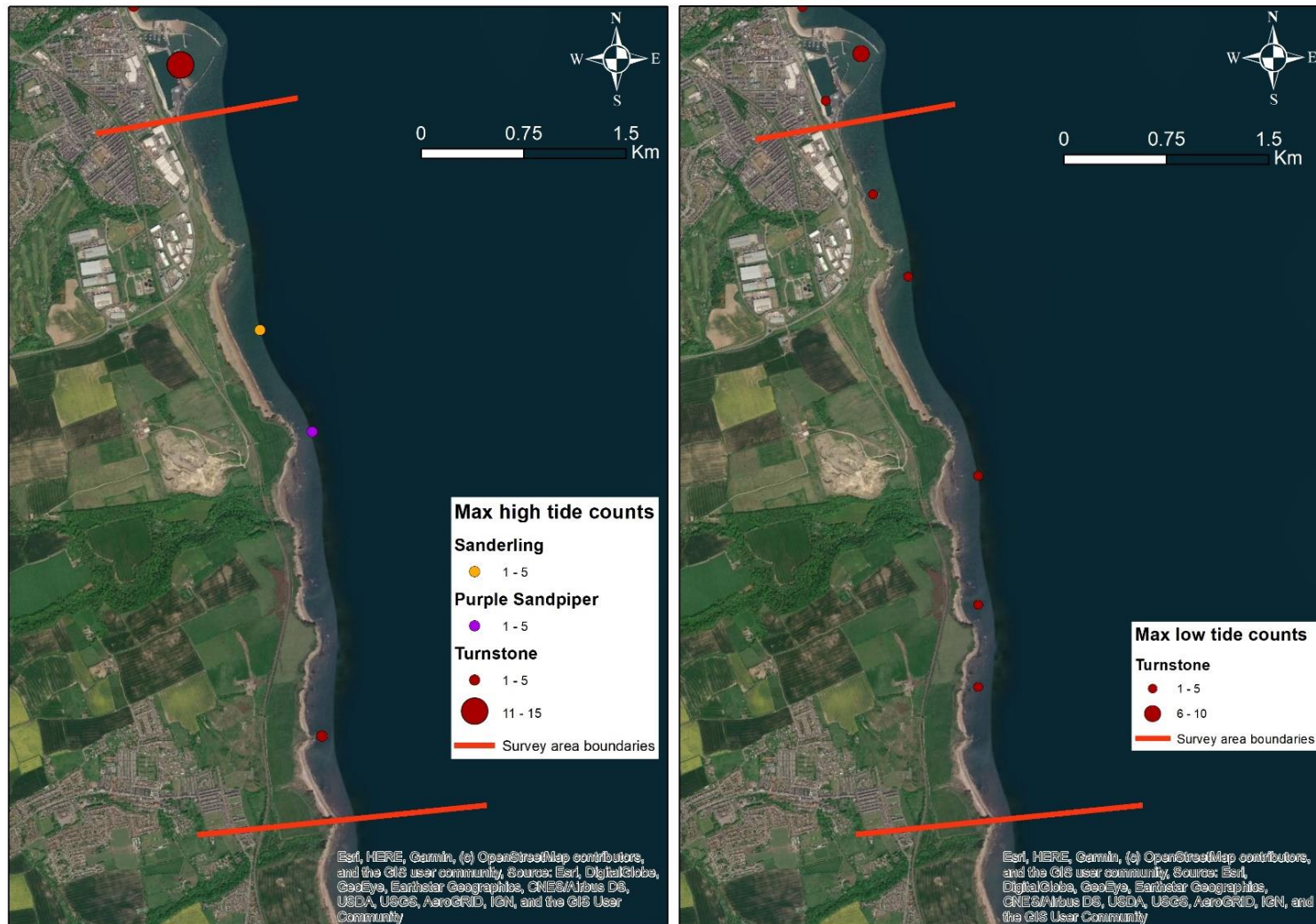


Figure 21. Max counts of four SPA/SSSI notified species in survey area 6 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 7 - Easington Colliery to Crimdon



Figure 22. Max counts of four SPA/SSSI notified species in survey area 7 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 8 - Crimdon to Hartlepool

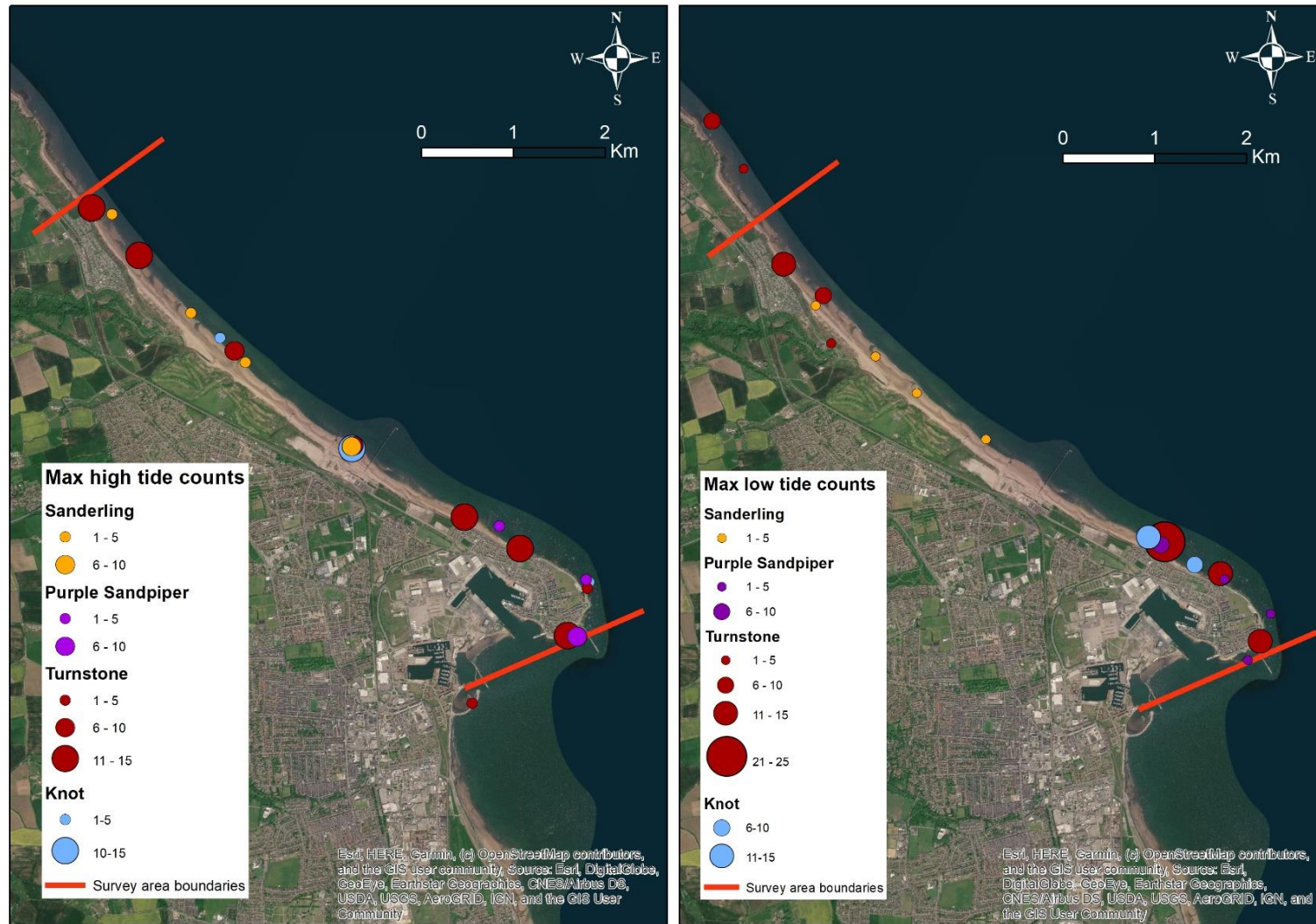


Figure 23. Max counts of four SPA/SSSI notified species in survey area 8 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 9 - Tyne Docks

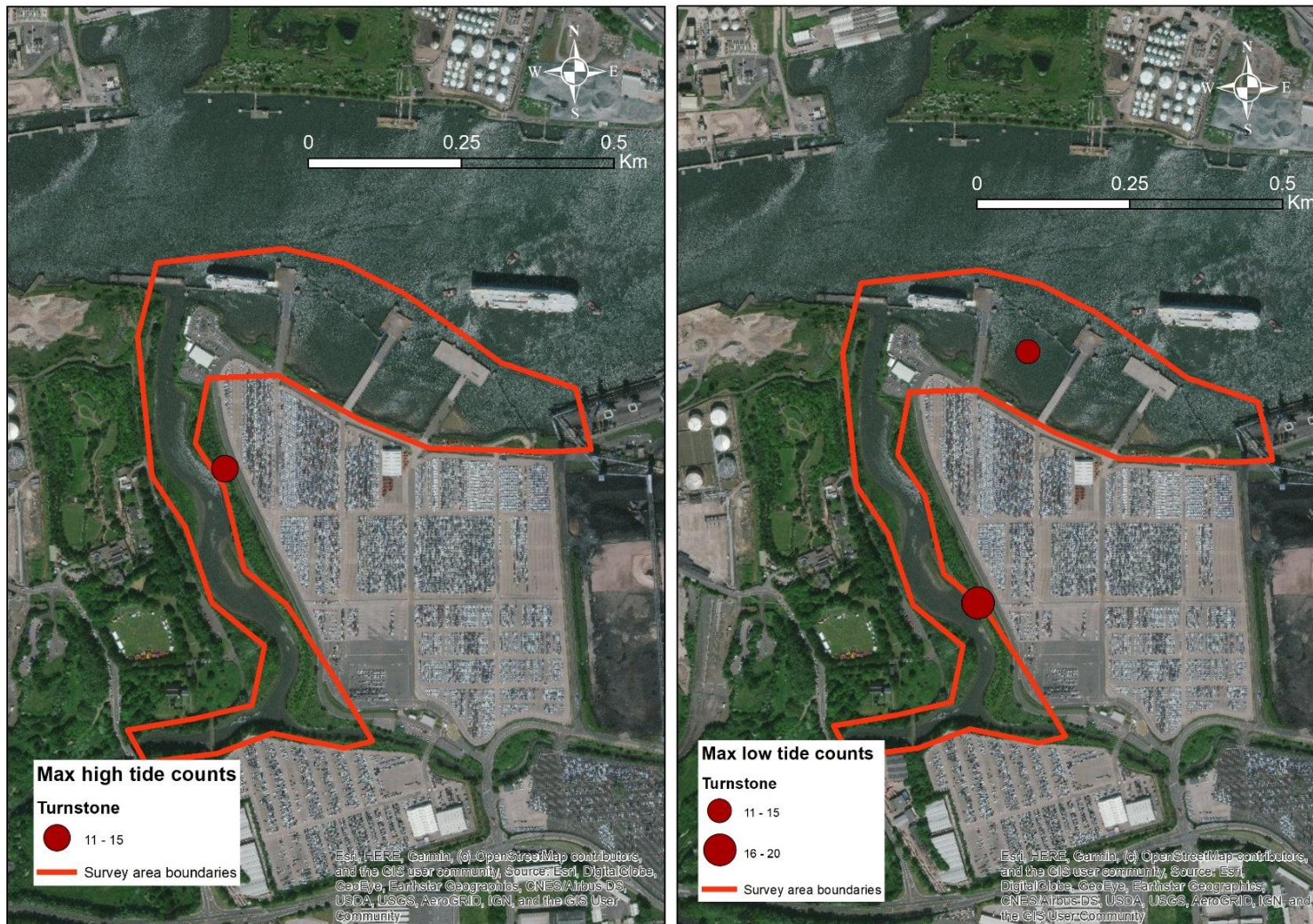


Figure 24. Max counts of four SPA/SSSI notified species in survey area 9 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 10 - River Wear West

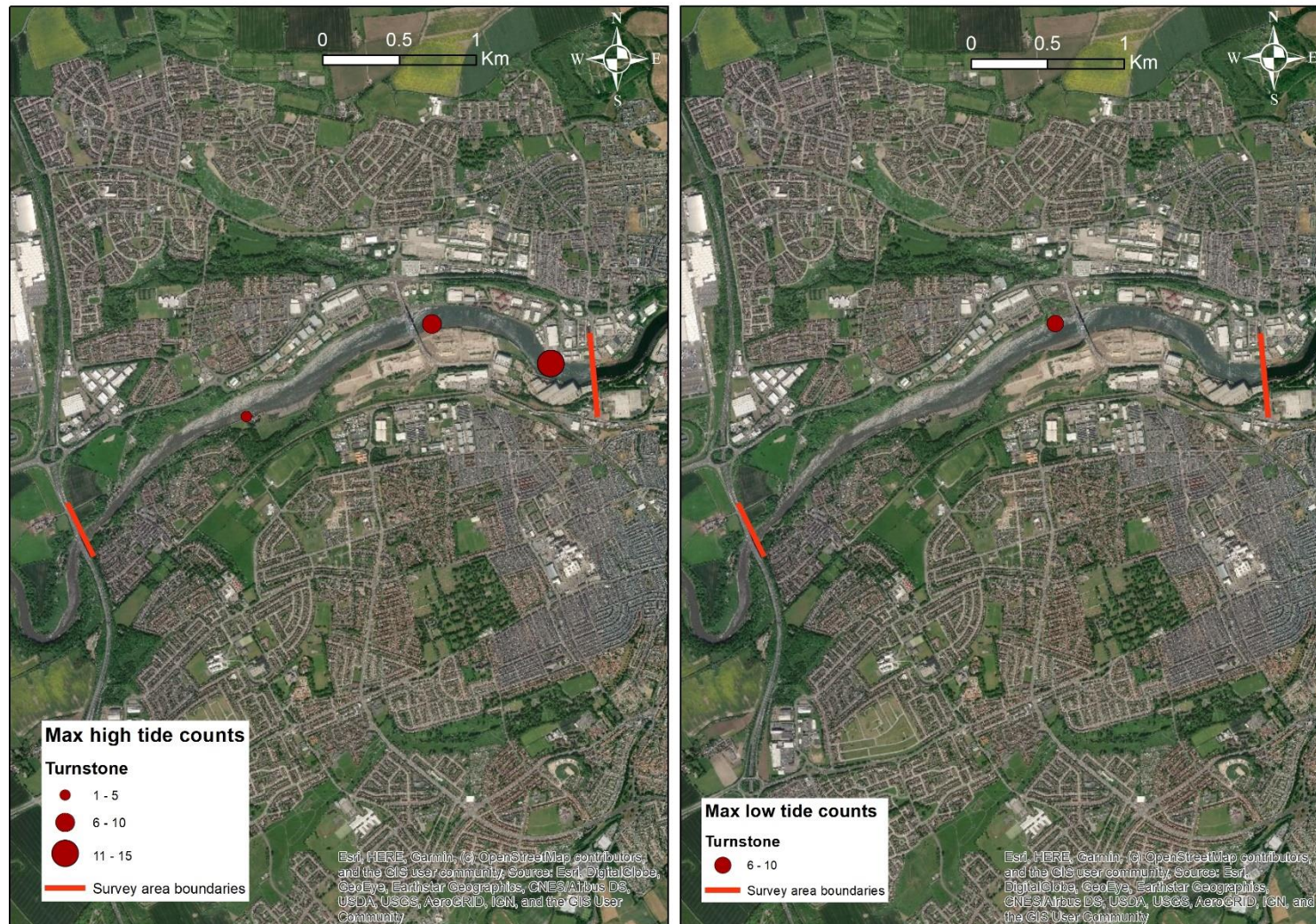


Figure 25. Max counts of four SPA/SSSI notified species in survey area 10 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 11 - River Wear East

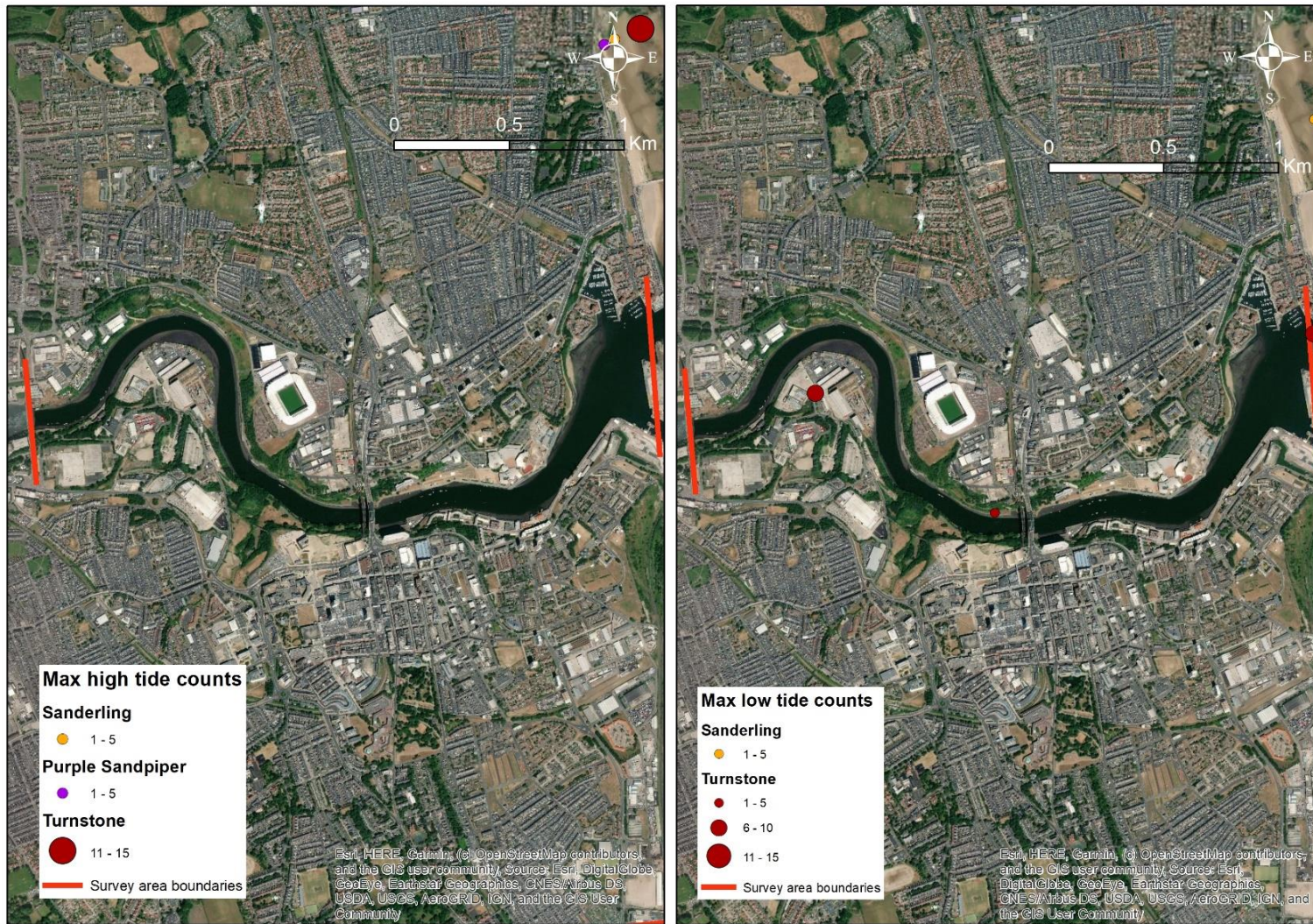


Figure 26. Max counts of four SPA/SSSI notified species in survey area 11 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Survey area 12 - Tyne River



Figure 27. Max counts of four SPA/SSSI notified species in survey area 12 during high tide (left panel) and low tide (right panel) surveys from October 2019 to March 2020.

Appendix 2 - Disturbance figures

Figures below depict the spatial distribution of disturbance events in each survey area, and are labelled by both the cause of disturbance (human activity code) and the species affected. These visual representations may be useful in identifying clusters or 'hotspots' of actual and potential disturbance in each survey area.

Survey area 1 - South Shields to Marsden



Figure 28. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 1. Note: not all events may be visible if numerous events occurred in the same location.

Survey area 2 – Marsden to Whitburn

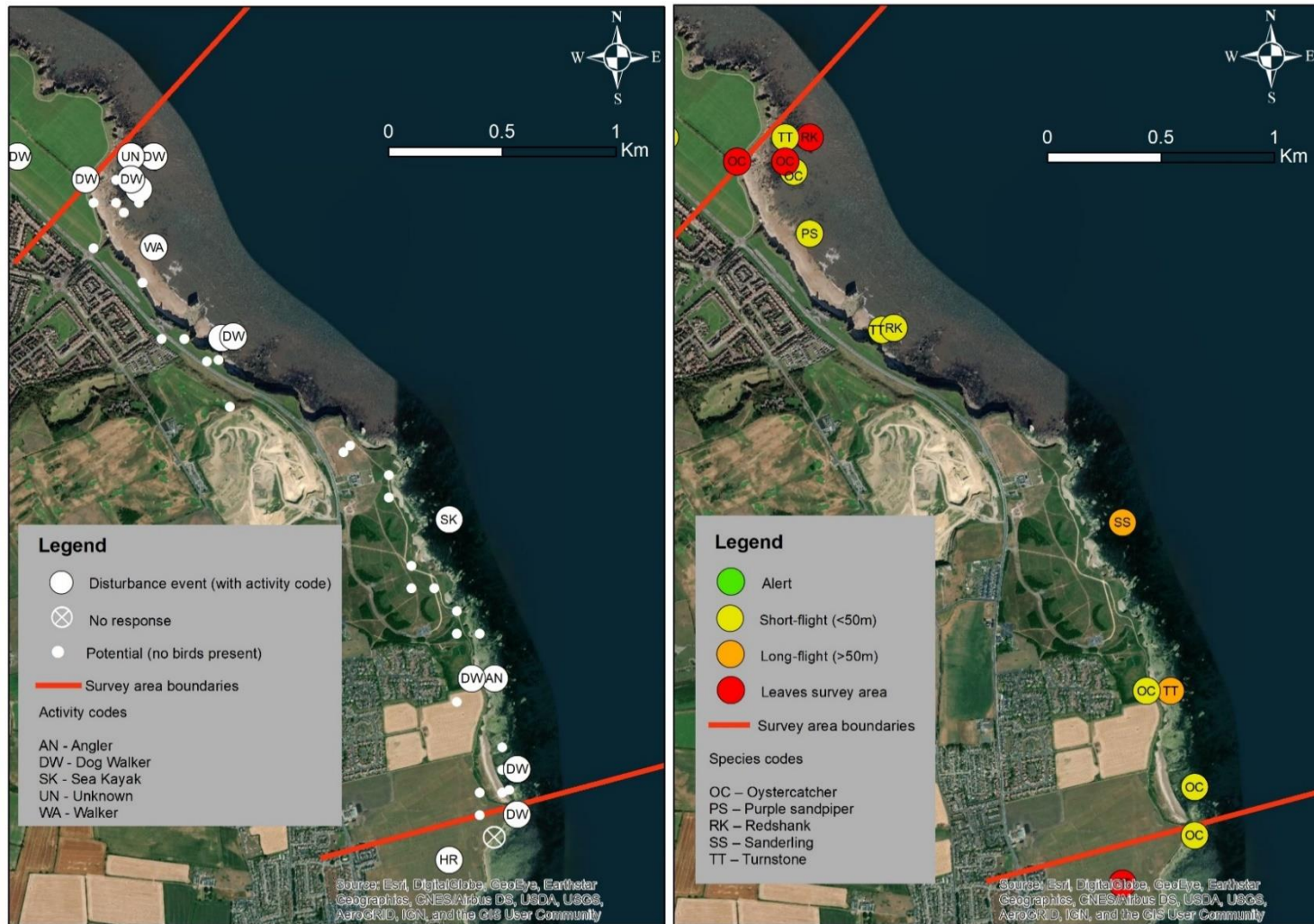


Figure 29. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 2. Note: not all events may be visible if numerous events occurred in the same location.

Survey area 3 – Whitburn to Sunderland

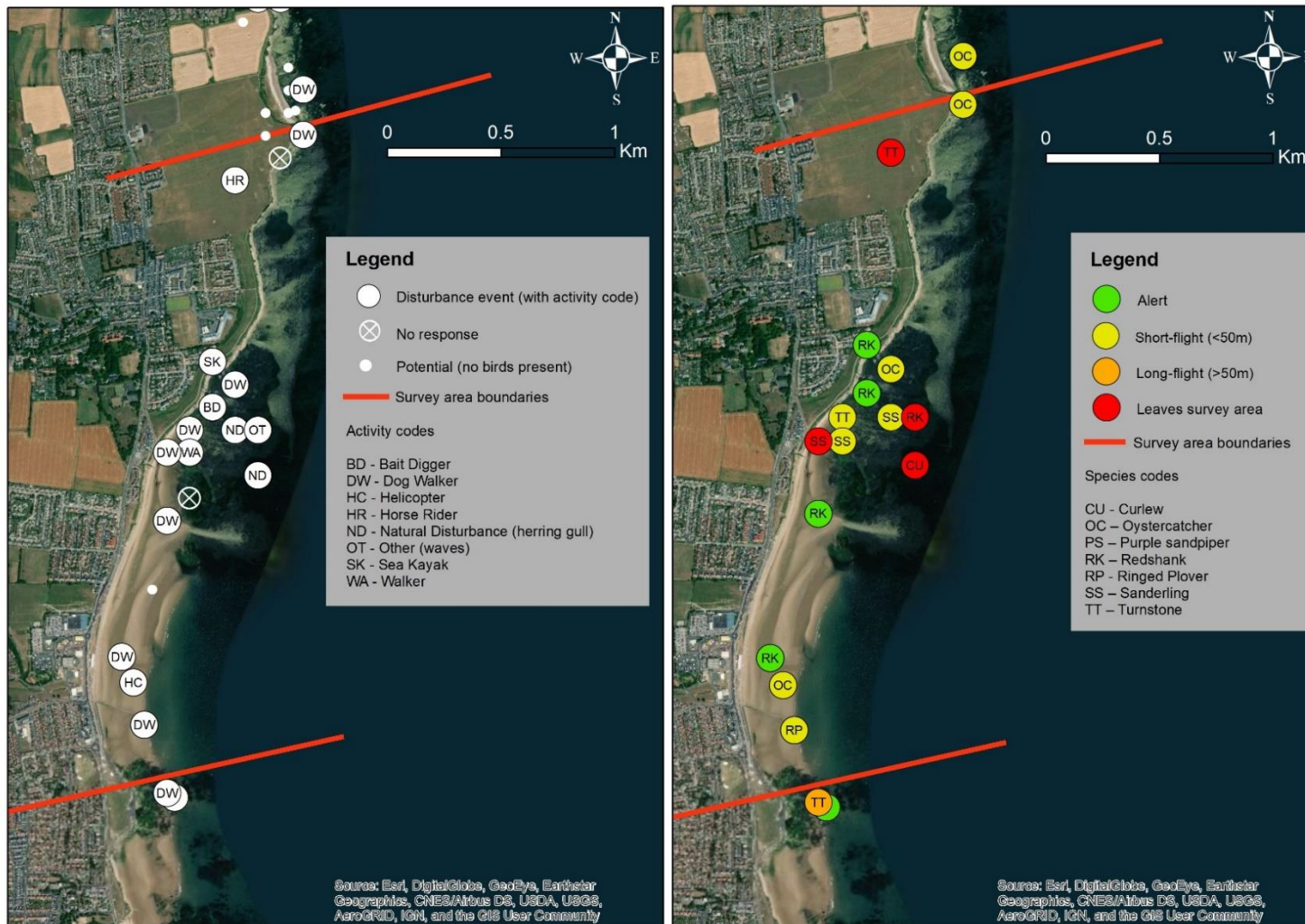


Figure 30. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 3. Note: if numerous events occurred in the same location, not all events may be visible.

Survey area 4 - Sunderland Docks

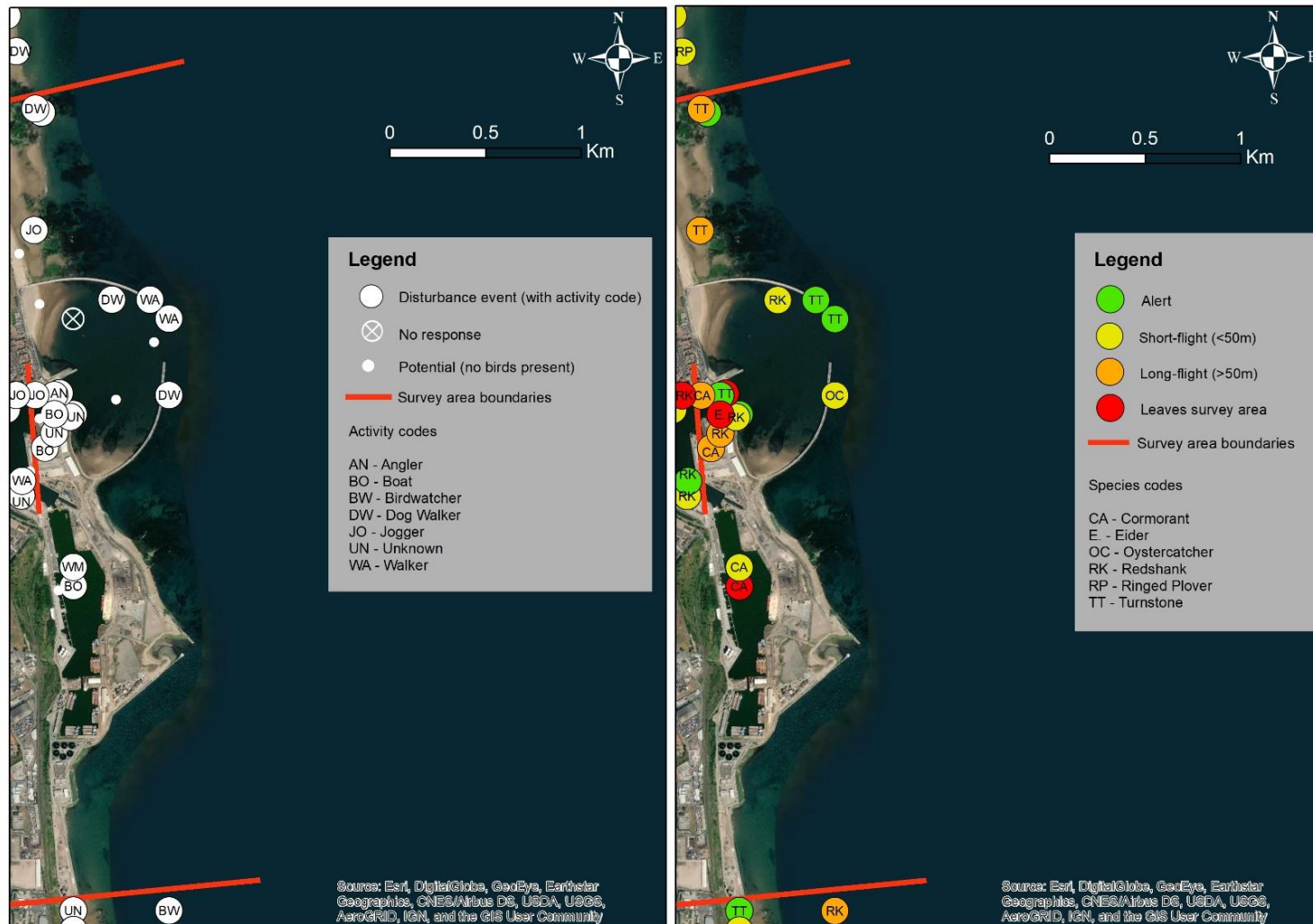


Figure 31. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 4. Note: if numerous events occurred in the same location, not all events may be visible.

Survey area 5 - Hendon to Seaham

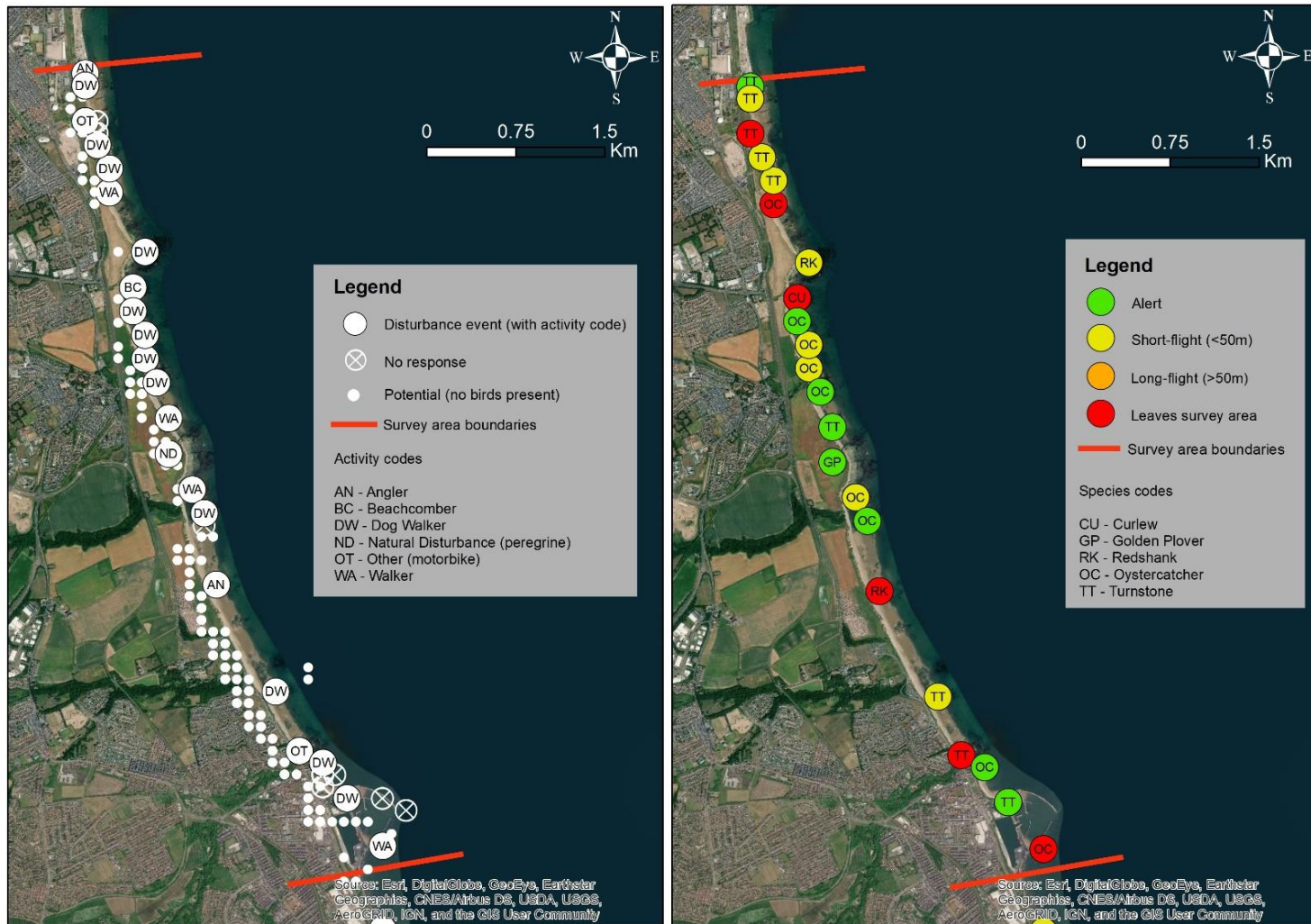


Figure 32. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 5. Note: if numerous events occurred in the same location, not all events may be visible.

Survey area 6 - Seaham to Easington Colliery

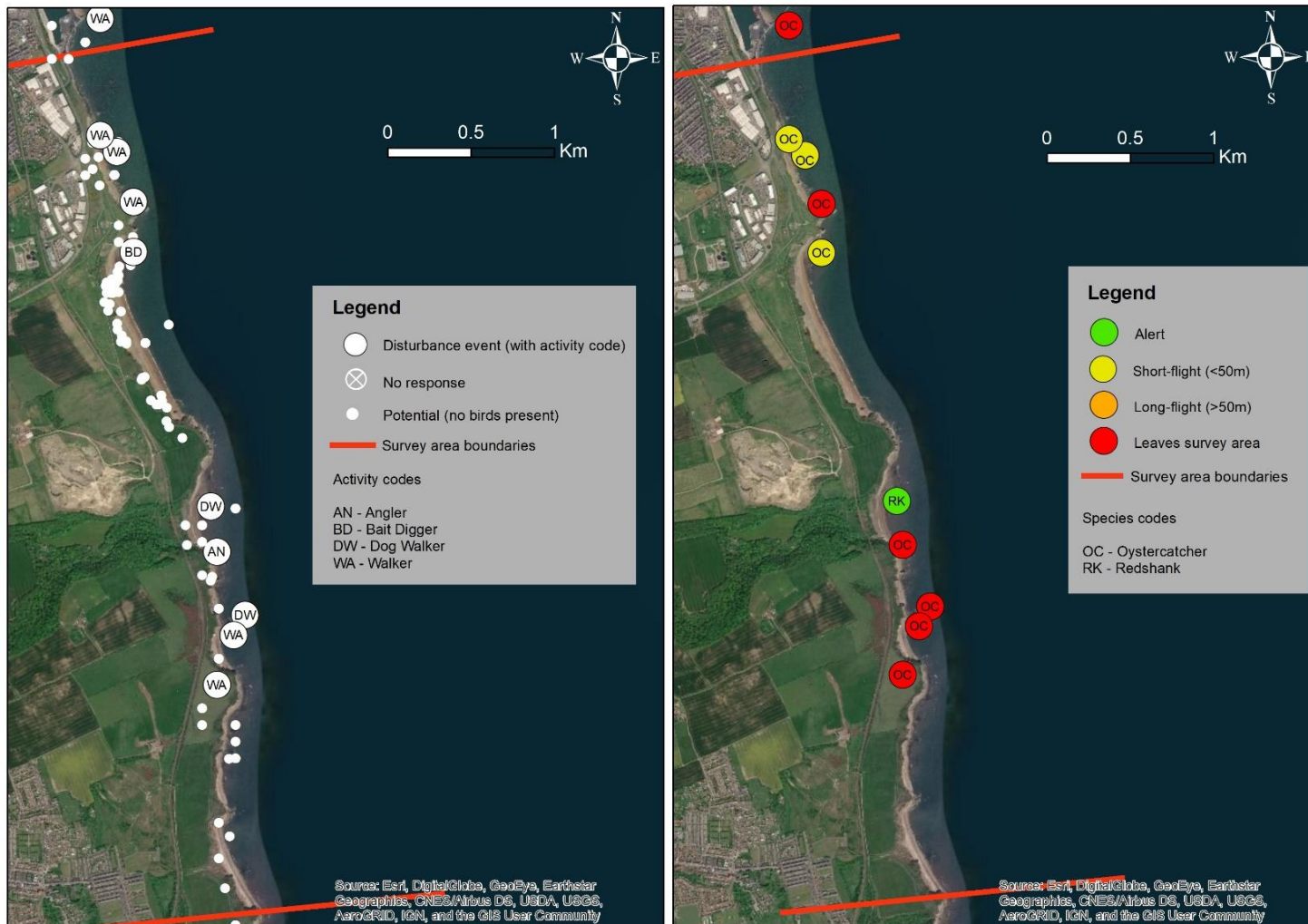


Figure 33. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 6. Note: if numerous events occurred in the same location, not all events may be visible.

Survey area 7 - Easington Colliery to Crimdon

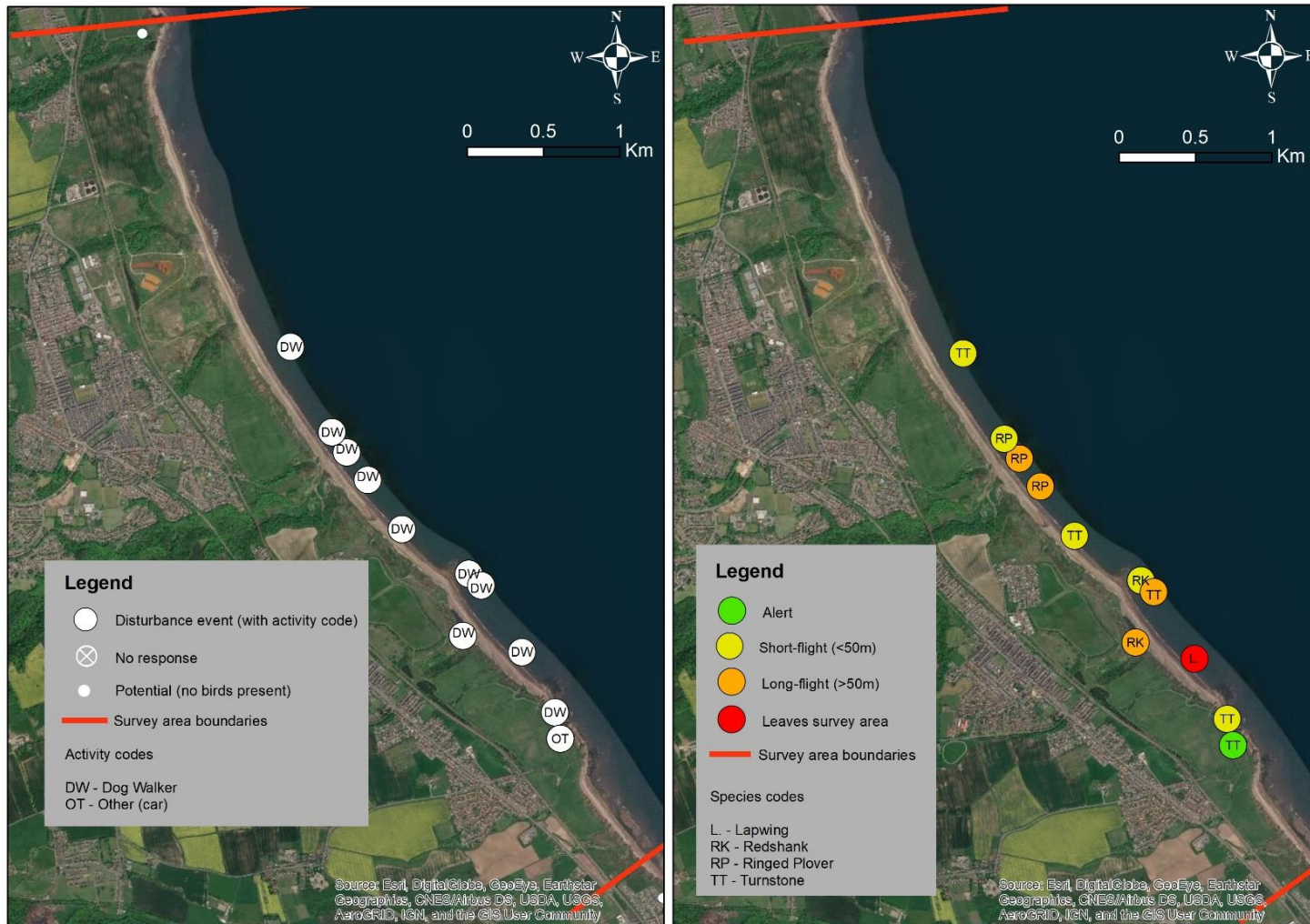


Figure 34. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 7. Note: if numerous events occurred in the same location, not all events may be visible.

Survey area 8 - Crimdon to Hartlepool

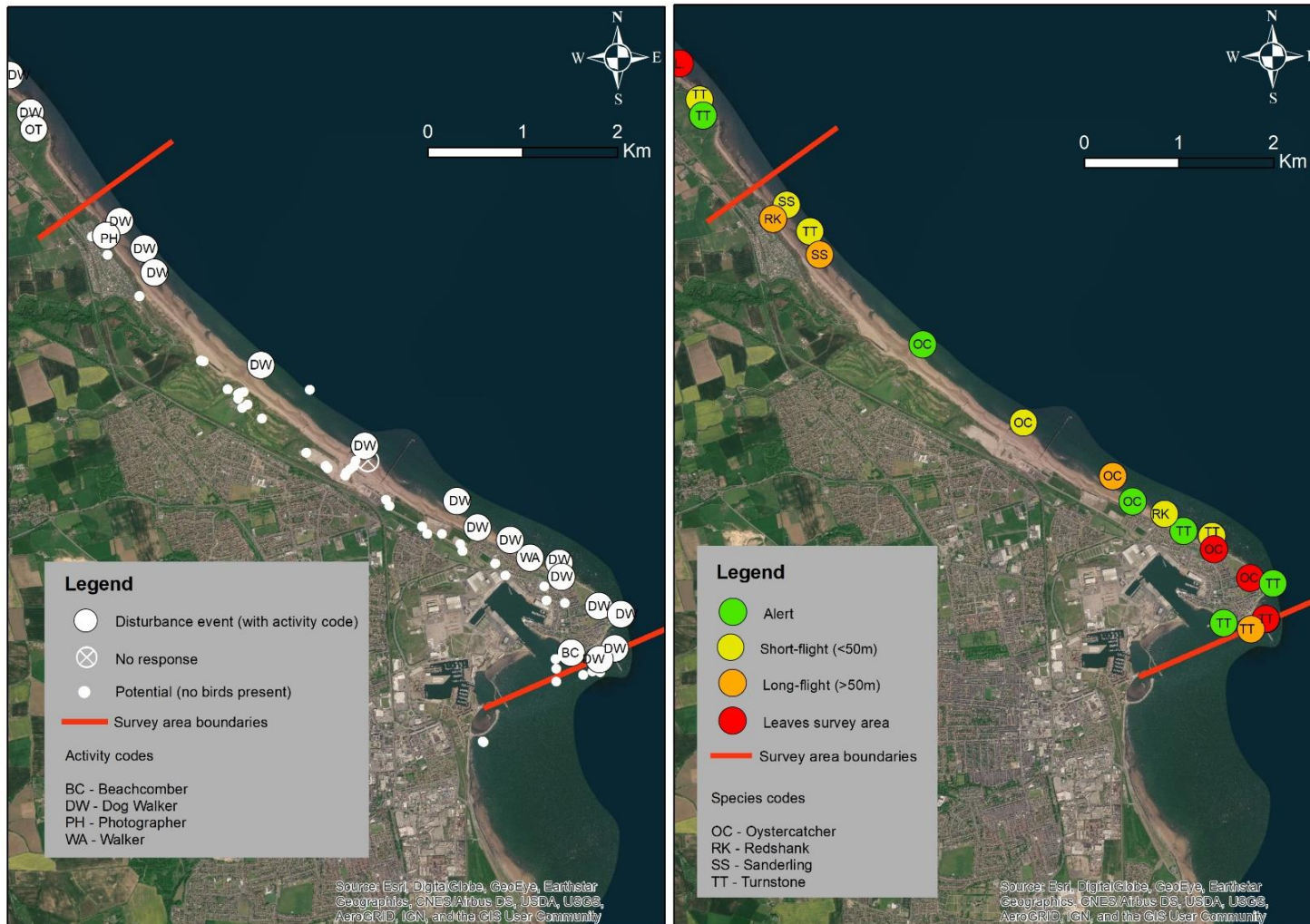


Figure 35. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 8. Note: if numerous events occurred in the same location, not all events may be visible.

Survey area 9 - Tyne Docks

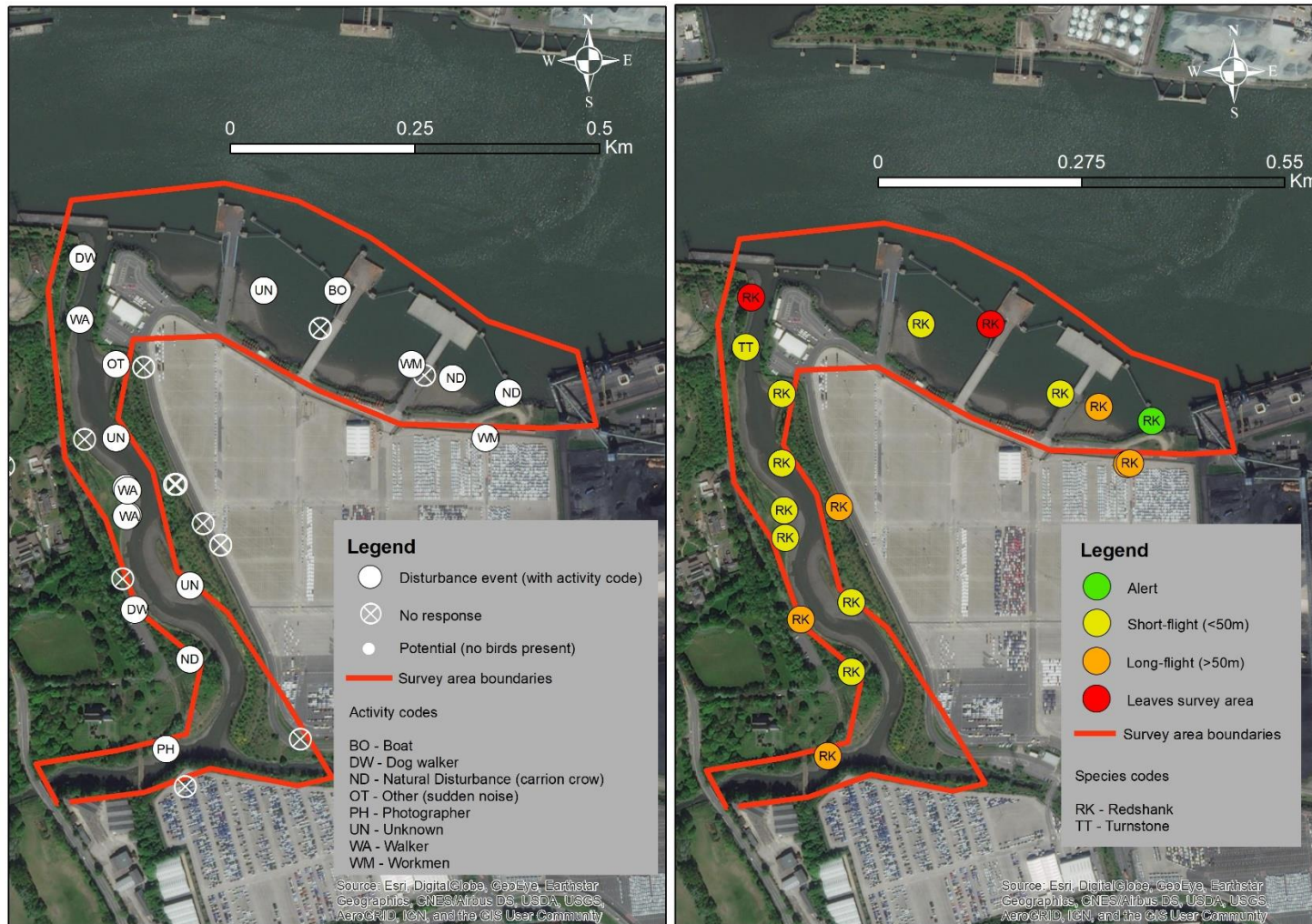


Figure 36. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 9. Note: if numerous events occurred in the same location, not all events may be visible.

Survey area 10 - River Wear West

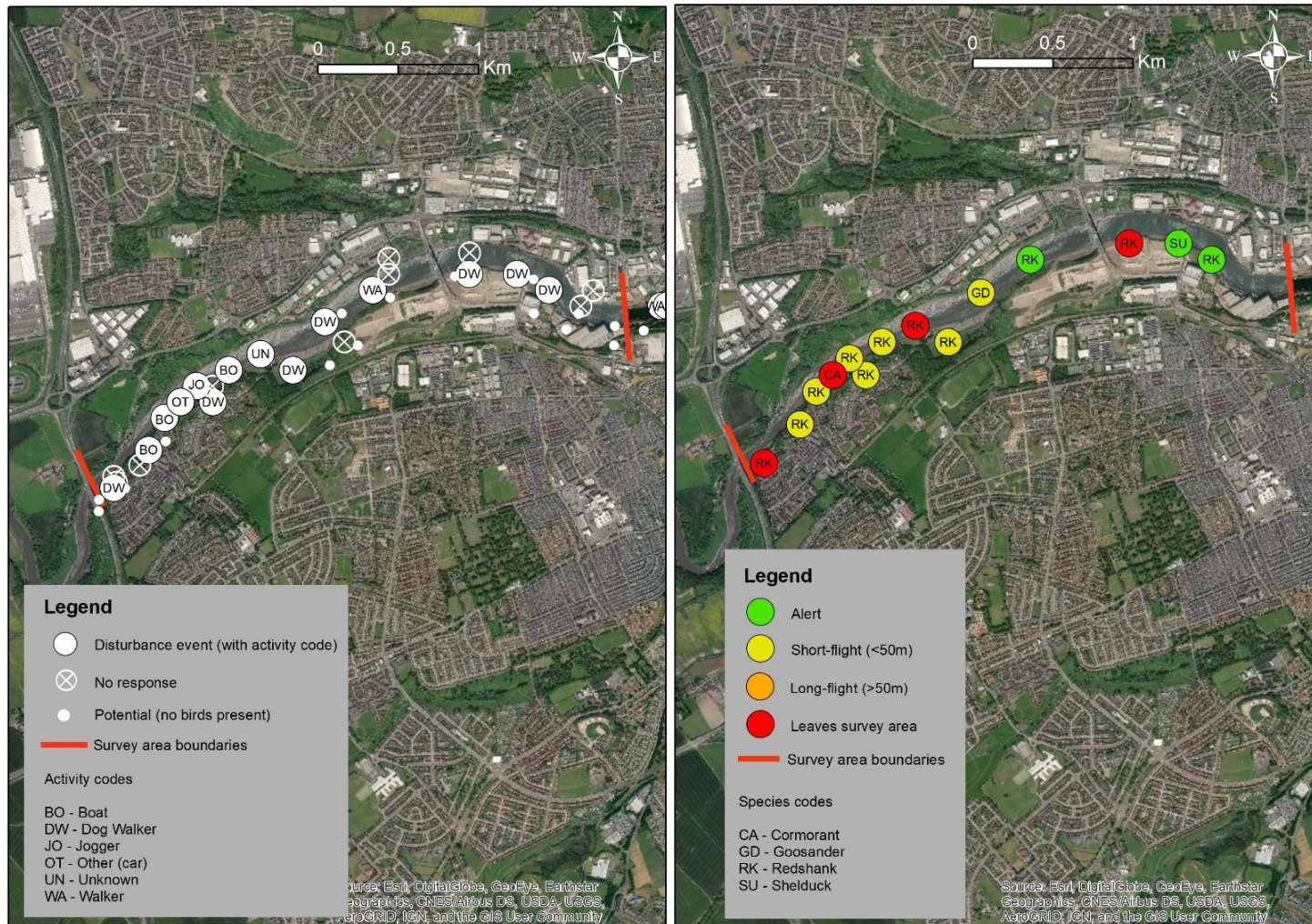


Figure 37. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 10. Note: if numerous events occurred in the same location, not all events may be visible.

Survey area 11 - River Wear East

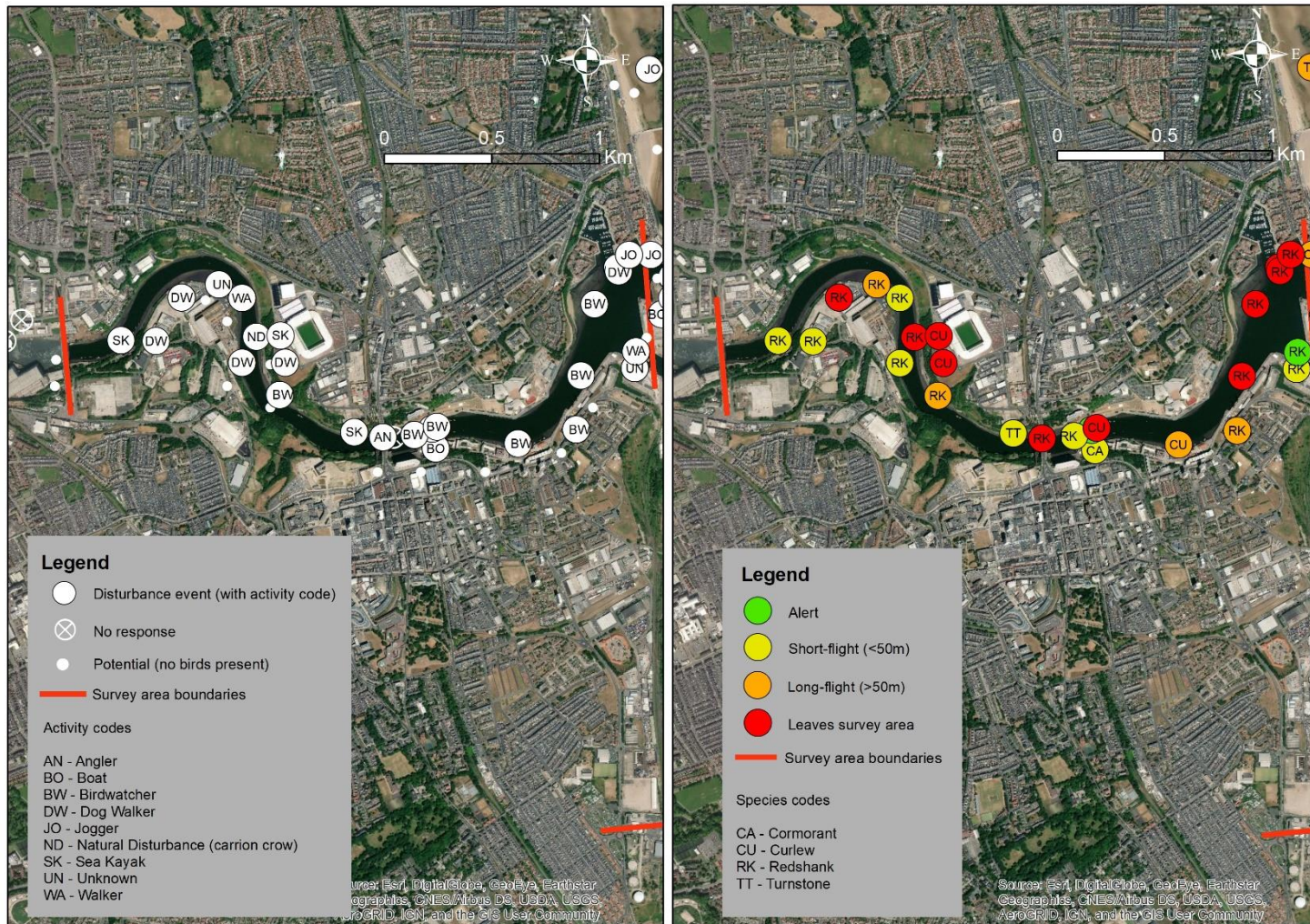


Figure 38. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 11. Note: if numerous events occurred in the same location, not all events may be visible.

Survey area 12 - Tyne River



Figure 39. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in survey area 12. Note: if numerous events occurred in the same location, not all events may be visible.

Dow Chemical site, survey area 12 - Tyne River

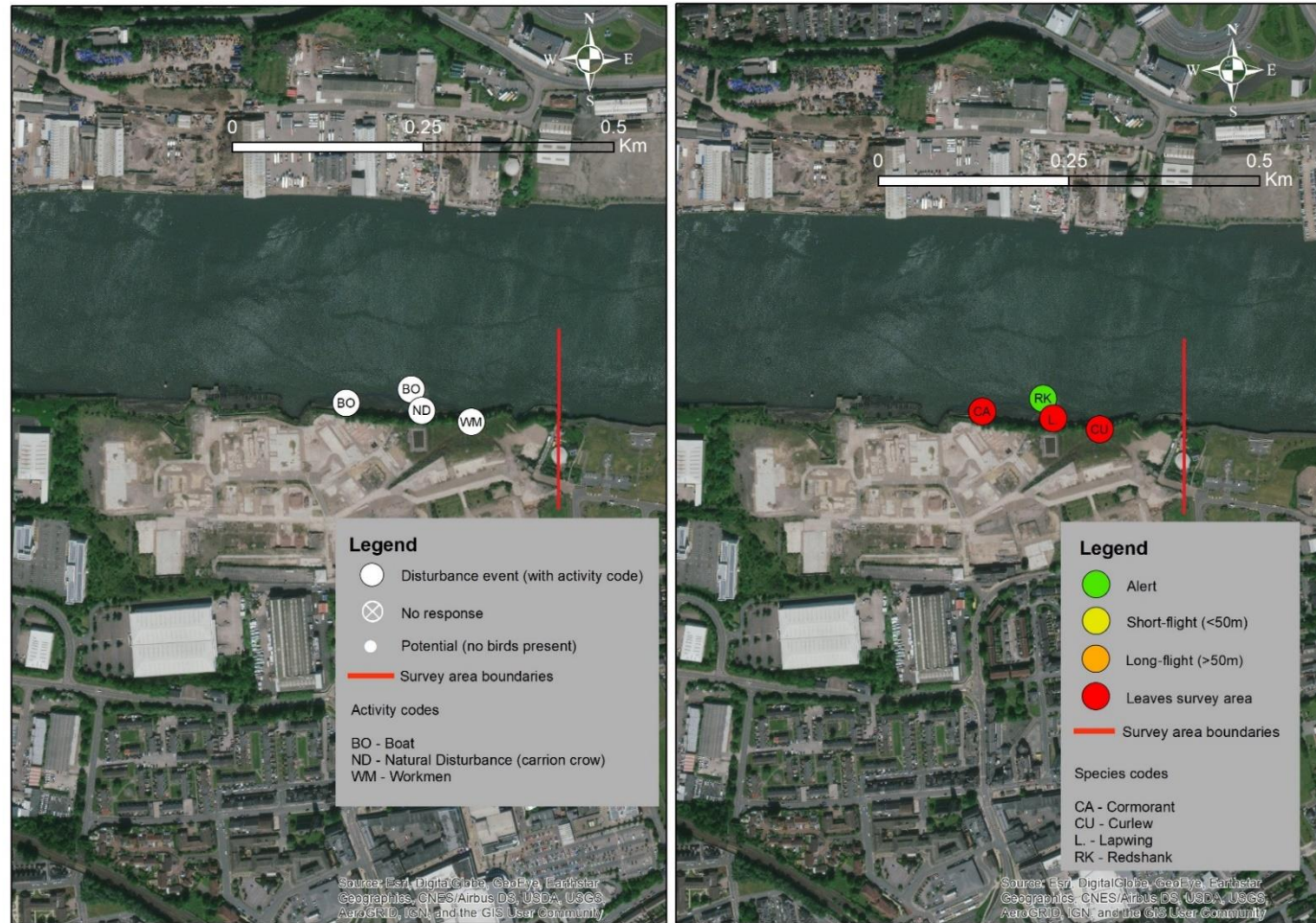


Figure 40. Disturbance events labelled by human activity type (left panel) and by level of disturbance and species affected (right panel) in the Dow Chemical site at the eastern end of survey area 12. Note: if numerous events occurred in the same location, not all events may be visible.